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Installation Work Plan for Environmental Restoration Project

Revision 7

A Department of Energy
Environmental Cleanup Program

DRAFT

Los Alamos
NATIONAL LABORATORY

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EXECUTIVE SUMMARY

Background

In 1989, the US Department of Energy (DOE) created the Office of Environmental Restoration and Waste Management (EM). The goal of this office is to implement the department's policy of ensuring that its past, present, and future operations do not threaten human health, safety, or the environment. The EM Office implements procedures to meet these goals through three associate directorates: Environmental Restoration (ER), Waste Operations, and Technology Development. Among other responsibilities, the EM Office is responsible for assessing, cleaning up, and decommissioning sites at DOE facilities and at sites formerly used by DOE and its predecessors. This Installation Work Plan (IWP) describes how the DOE and the University of California (UC) are conducting the office's 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. The ephemeral and intermittent streams that drain the plateau have created numerous narrow fingerlike mesas, whose tops range in elevation from approximately 7,800 ft on the flank of the Jemez Mountains to about 6,200 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.

Since its inception in 1943, the Laboratory's primary mission has been nuclear weapons research and development. The Laboratory's current central mission is reducing global nuclear danger. This mission supports core competencies that enable the Laboratory to also contribute to defense, civilian, and industrial needs. In turn, the intellectual challenges of civilian and industrial problems strengthen the core competencies for the defense programs. The core competencies include the following: complex experimentation and measurement; theory, modeling, and high-performance computing; analysis and assessment; nuclear weapons science and technology; earth and environmental science; nuclear and advanced materials; bioscience and biotechnology; and nuclear science, plasmas, and beams.

Since the early 1970s, the Laboratory has reported the results of an environmental surveillance program that routinely samples air, water, soil, and foodstuffs throughout the Los Alamos area to determine whether contamination from Laboratory operations is present and, if so, at what levels. The data collected under this program are published annually for distribution to the public and to local, state, and federal agencies. The ER Project at the Laboratory augments the environmental surveillance program by identifying potential threats to human health and the environment from past Laboratory operations and by mitigating them through efficient corrective actions that comply with applicable environmental regulations. Corrective actions include such measures as source containment to prevent contaminant migration, controls on future land use, and excavation and/or treatment of the source to remove hazards to health and the environment.

Statutory Basis of the ER Project

The ER Project at the Laboratory responds 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

The HSWA Module provides a schedule for investigating the SWMUs that the EPA originally selected from potential release sites (PRSs) identified by DOE/UC. DOE/UC have aggregated all PRSs to be taken through the corrective action process in 3 operational focus areas (formerly 24 operable units). These PRSs are addressed in RFI work plans, which provide information on how each site will be investigated. RFI work plans have been completed for all mesa-top PRSs and for Los Alamos Canyon, Pueblo Canyon, Mortandad Canyon, and Pajarito Canyon. The NMED and EPA are continuing their review of the work plans and field investigations in the 3 operational focus areas. The Project has oversight responsibility for decommissioning activities in conjunction with remediation activities for the purpose of coordination of field campaigns.

The current projection for the completion of the RFI/CMS process at the Laboratory is approximately the year 2008, depending on funding levels. This process will address the 2,121 PRSs at the Laboratory in order to meet all applicable environmental regulations. The schedule also addresses the spread of effort over a period compatible with the availability of national resources, including funding.

Current risks from known PRSs are low; however, DOE/UC have implemented a process of evaluating all new data as it becomes available and jointly decides with NMED the priorities of upcoming field work.

Contents of the 1998 IWP

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

Chapter 2 describes the Laboratory and its environmental setting. Chapter 3 contains three major sections: (1) the requirements of the corrective action process, (2) the assessment strategy for conducting corrective action, and (3) the field sampling for conducting characterization and corrective action confirmation. A discussion of the decision process leading to the next phase of investigation or remediation is 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 complies with applicable Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response requirements given in 29 CFR 1926.65 or 29 CFR 1910.120. It establishes generic health and safety requirements, procedures, and emergency actions that apply to all field operations projectwide 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 ER Project's waste management activities. This chapter includes types of wastes anticipated to be generated and waste storage and treatment options.

Chapter 7 contains the ER Project's public involvement plan. It describes the ER Project's approach to public outreach and public involvement in the decision-making process both at the Laboratory and project levels. The Laboratory's current approach to public involvement, which includes working with the Laboratory's Community Relations Office to coordinate the public

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1.0 PROJECT MANAGEMENT PLAN

1.1 Background

In 1989, the US Department of Energy-Headquarters (DOE-HQ) created the Office of Environmental Restoration and Waste Management (EM). The goal of this office is to implement the department's policy of ensuring that its past, present, and future operations do not threaten human or environmental health and safety (DOE 1993, 12602; 12603). The EM Office implements procedures to meet these goals through three associate directorates: Environmental Restoration (ER), Waste Operations, and Technology Development. Among other responsibilities, the EM Office is responsible for assessing, cleaning up, and decommissioning sites at DOE facilities and sites formerly used by DOE and its predecessors. As a facility operated by the DOE, Los Alamos National Laboratory (the Laboratory) is a part of this program.

The Laboratory is administered for the DOE by the University of California (UC). Since its inception in 1943, the Laboratory's primary mission has been nuclear weapons research and development. The Laboratory's current central mission is reducing global nuclear danger. This mission supports core competencies that enable the Laboratory to also contribute to defense, civilian, and industrial needs. In turn, the intellectual challenges of civilian and industrial problems strengthen the core competencies for the defense programs. The core competencies include the following: complex experimentation and measurement; theory, modeling, and high-performance computing; analysis and assessment; nuclear weapons science and technology; earth and environmental science; nuclear and advanced materials; bioscience and biotechnology; and nuclear science, plasmas, and beams.

Many of the processes used in carrying out the Laboratory's past and present missions involve the use of hazardous and radioactive materials. During World War II and for a while thereafter, 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. In that period also, the DOE and the Laboratory began to conduct surveys and to clean up areas where spills and disposal had occurred.

The current investigation being conducted at Los Alamos under DOE's ER Project is intended to definitively determine the presence or absence of hazardous and radioactive constituents and to address any sites where such materials are still found to exist at levels which might have an adverse affect on human health or the environment. The ER Project at the Laboratory is committed to excellence in carrying out its responsibilities for investigating and remediating hazardous waste disposal sites. This Installation Work Plan describes how the DOE/UC are conducting the DOE's ER Project at the Laboratory and complies with the New Mexico Environment Department's (NMED) Outline for Facility-Wide Workplans provided in Section II.B.4.a.(1) of NMED 1998 (57897).

This document consists of seven chapters containing information required by the Laboratory's permit to operate under the Resource Conservation and Recovery Act (RCRA). The Environmental Protection Agency (EPA) is the regulatory agency that issued this permit; however, in January 1996, NMED received corrective action authority. EPA and NMED have since negotiated a work share agreement that delineates each agency's roles and responsibilities. This first chapter describes the ER Project and its management plan. Chapter 2 describes the Laboratory and its environment, and Chapter 3 describes the ER Project's technical approach to

Laboratory sites that are being investigated include SWMUs and areas of concern (sites that contain potentially hazardous substances [such as radionuclides] that are not regulated under RCRA), collectively called potential release sites (PRSs). Under the ER Project's original structure, the PRSs were aggregated into 24 operable units (OUs), based on geographical and other considerations. In 1997, the OUs were regrouped into 3 field management units, called focus areas, as described in Section 1.3. As a result of the corrective action process, all PRSs requiring remediation are remediated by means of accelerated cleanup, corrective measures implementation (CMI) after completion of a CMS, RCRA closure, or other remedial measures, as appropriate. The corrective action process is described further in Section 1.2.1.1.

1.2.1 Statutory and Regulatory Framework

The principal requirements for the ER Project are those derived from RCRA Sections 3004(u) and (v); the CERCLA; the Atomic Energy Act (AEA); and New Mexico state law, primarily the New Mexico Hazardous Waste Act. The ER Project must implement RCRA requirements for assessing and cleaning up sites at active hazardous waste treatment and storage units. Section 3004(u) provides for remediation of all hazardous waste sites at a given facility regulated under RCRA. Section 3004(v) extends this requirement to contaminated properties located beyond but bordering the Laboratory boundary.

Decommissioning is conducted under the authority of the AEA. Hazardous wastes are regulated both by RCRA and the state hazardous waste management regulations; radioactive materials are regulated under the AEA and/or CERCLA. The hazardous waste portion of mixed waste is also subject to RCRA. In addition, the ER Project complies with applicable DOE Directives and Laboratory policies.

The statutes described in the following sections provide the criteria for evaluating the technical performance of the ER Project. Table 1-1 lists the current environmental permits under which the ER Project at the Laboratory operates. The scope and status of permits that address hazardous waste operations at the Laboratory are the responsibility of the Laboratory's Environment, Safety, and Health Division.

TABLE 1-1

CURRENT ENVIRONMENTAL PERMITS APPLICABLE TO THE ER PROJECT

Permit Type	Permitted Activity	Issue Date	Expiration Date	Administering Agency
HSWA Module VIII	Environmental Restoration	Mar. 1990	Mar. 2000	NMED
RCRA Hazardous Waste Facility	Hazardous waste storage and treatment	Nov. 1989	Nov. 1999	NMED

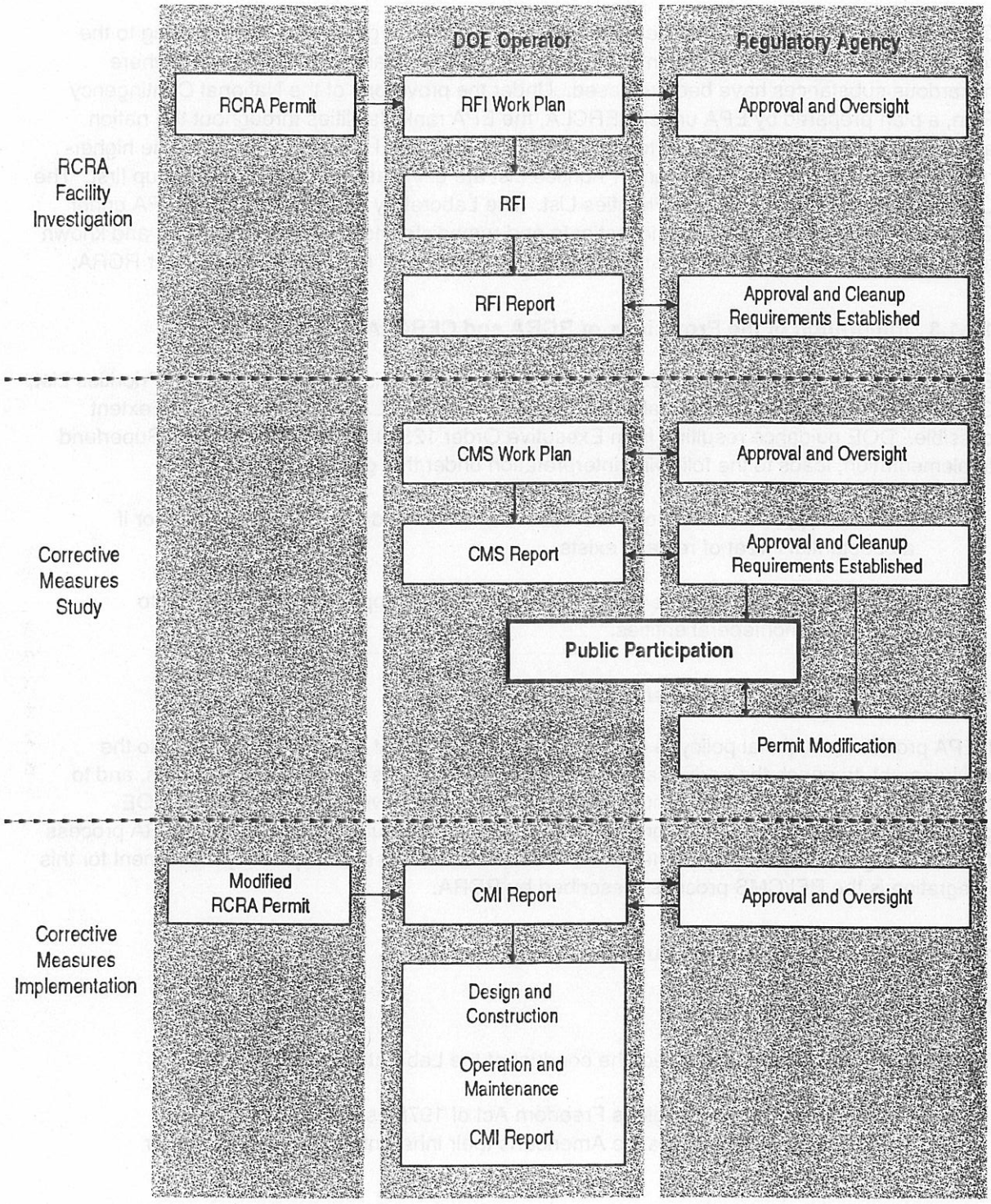


Figure 1-1. Three-step corrective action process.

- 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. Final regulations, which were proposed in 1979 and 1980 and were withdrawn in 1982, have not yet been promulgated. Meanwhile, guidance for implementing the Fish and Wildlife Coordination Act is based on court rulings and past DOE experience.

- 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.

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, Executive Orders, and Secretary of Energy Notices

A number of DOE Orders and Directives, Executive Orders, and Secretary of Energy Notices also apply to the ER Project.

The DOE Orders and Directives and Secretary of Energy Notices that apply to the ER MSA AL-1 Project are detailed in Appendix G of the contract between DOE and UC (http://iosun.lanl.gov:2001/qp/appg.html).

The following Executive Orders (EOs) are applicable to the ER MSA AL-1 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

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;
- establish at the Laboratory through the ER Project a procedural framework and schedules for developing, implementing, coordinating, and monitoring corrective actions that are consistent with CERCLA or 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, EPA, and the public can review, comment on, and participate in the corrective action review process at the Laboratory;

- Remedial Actions,
- Canyons, and
- Material Disposal Areas.

Focus area teams and responsibilities are described in the following sections of this document.

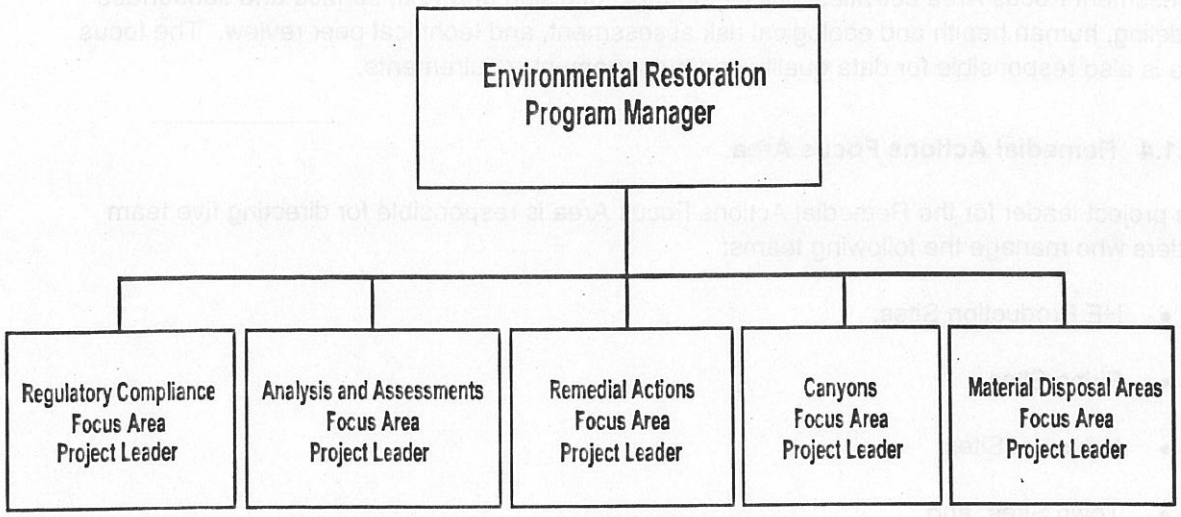


Figure 1-2. Organization of the ER Project Management Team.

1.3.1.2 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:

- Regulatory Integration and Operations,
- ER Policy and Guidance,
- Communication and Outreach, and
- Deliverables Tracking and Consistency.

The project leader and team leaders are responsible for day-to-day interactions with the Administrative Authority, the public, other stakeholders, and various operational managers of the Laboratory.

1.3.1.3 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:

1.3.1.6 Material Disposal Areas Focus Area

The project leader for the Material Disposal Areas (MDAs) Focus Area is responsible for directing three team leaders that manage the following teams:

- TA-21 MDAs
- TA-49 MDAs, and
- TA-50, -51, and -54 MDAs.

Team leaders supervise staff and field teams responsible for the characterization, stabilization, and remediation (if deemed necessary) of MDAs. Teams follow a consistent framework for focusing characterization activities around presumptive remedies.

Corrective action activities implemented by the MDAs Focus Area are arrived at through interactions with the DOE, the public, and the Administrative Authority.

1.3.1.7 Other Key Personnel and Functions in the ER Project

DOE-LAAO Interaction

Representatives of both the DOE and UC interact with the NMED. The representatives strive to work as partners to achieve objectives mutually acceptable to DOE/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 DOE-LAAO ER project managers and the Laboratory focus area project leaders. The teaming occurs during all phases of the ER Project. Figure 1-3 shows the current LAAO organization.

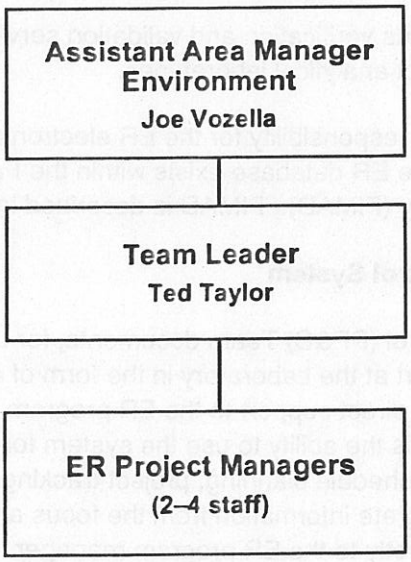


Figure 1-3. Organization of DOE-LAAO.

reporting to the program manager and DOE. The ER PP&C use the system for critical path analysis, what-if scenarios, and load leveling.

Each ER focus area is supported by a cost and schedule analyst. The PP&C team member who supports the ER program manager ensures consistency in level of detail, unit costs, etc. The platform used for baseline development and management consists of Primavera Project Planner for scheduling and establishment of the performance measurement baseline, Excel for performance reporting, and G2 for estimating. Its basic structure is characterized by a risk-based graded approach to system design. In addition, the system as a tool is quite robust and reflects a conscious effort to accomodate different management styles and techniques. The three basic elements consist of baseline development, performance reporting, and change control.

The current financial planning and control system integrates the ER Project's finances with the Laboratory's financial system. As each year's baseline plan is developed, budgets are negotiated between the ER program manager and project leaders. These negotiations allow the project to establish the baseline cost for the next fiscal year on the basis of a proposed budget.

The ER Project has integrated its financial system with the Laboratory's financial management information system to encompass all cost elements needed by the ER Project for cost planning and reporting down to the eighth level of the work breakdown structure. As Laboratory systems are improved (time-accounting improvements, authorization controls for charging to cost accounts, etc.), the ER Project will incorporate these changes into the financial planning and control system.

1.3.3 Reporting Requirements

The development and implementation of reporting requirements for the ER Project are mandated by DOE and NMED through DOE/UC's operational RCRA . Appropriate DOE-LAAO and UC officials, as copermittees, sign the following certification for each deliverable 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.

All reporting data and documentation requirements conform to DOE Order 430.1A, "Life-Cycle Asset Management," and comply with applicable guidance from DOE-HQ, DOE-AL, DOE-LAAO, and internal Laboratory criteria.

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. The major plans and reports are associated with the RFI, accelerated cleanups, CMS, and CMI. In addition, periodic technical progress reports are submitted to DOE and the regulators.

References for Chapter 1

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, ER ID 12602; ER ID 12603)

DOE (US Department of Energy), May 1993. "Executive Order 12580: Superfund Implementation," CERCLA Information Brief EH-231-015/0593. (DOE 1993, ER ID 37500)

DOE (US Department of Energy), June 7, 1993. "Project Control System Guidelines," DOE Notice N4700.6, Washington, DC. (DOE 1993, ER ID 1058)

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, ER ID 1585)

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)

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, ER ID 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-acre site northwest of Santa Fe. The project ultimately acquired an additional 3,120 privately owned acres and 45,666 acres of public land managed by the US Forest Service. In 1943, this land became known as the Los Alamos Site, later Los Alamos Scientific 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) and is currently officially known as Los Alamos National Laboratory. Figure 2-1 shows the location of the Laboratory. A map showing active technical areas at the Laboratory is shown in Figure 2-2, and summaries of the activities at the Laboratory's active technical areas (TAs) are provided in Appendix A.

2.1.2 Geography

Los Alamos National 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). The 43-mi^2 Laboratory site and the communities adjacent to it are situated on 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 7,800 ft on the flank of the Jemez Mountains to about 6,200 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 2-3). The San Ildefonso Pueblo borders Los Alamos County and the Laboratory to the east.

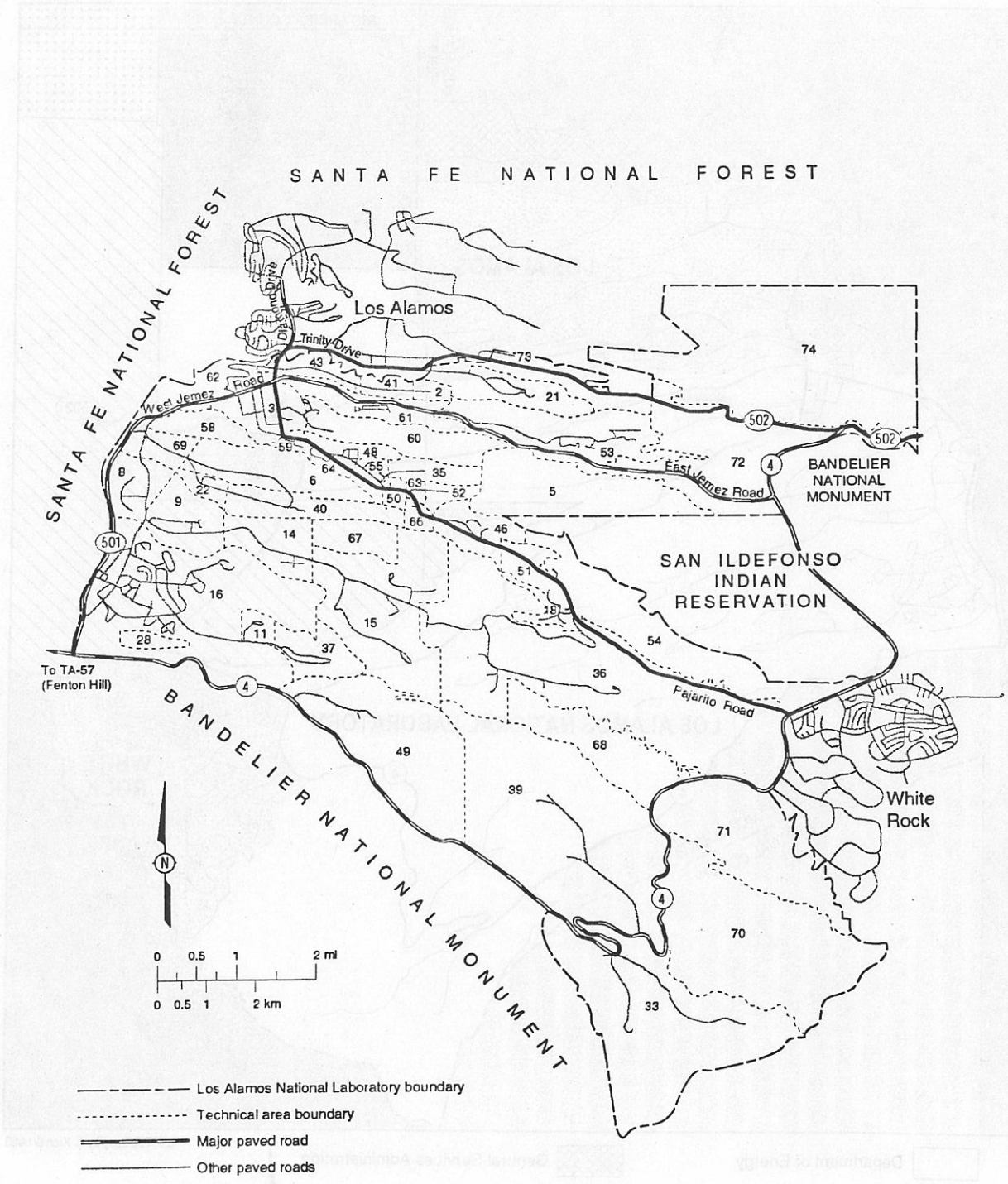


Figure 2-2. Technical areas at Los Alamos National Laboratory.

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.

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 Road 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 Road 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 1992 population of approximately 18,200, based on the 1990 census adjusted to 1992 (Environmental Protection Group 1994, 35363). Two residential areas (Los Alamos and White Rock) and their related commercial areas exist in the county (Figure 2-1). 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 11,400. The White Rock area (including the residential areas of White Rock, La Senda, and Pajarito Acres) has about 6,800 residents. About 40% of the people employed in Los Alamos commute from other counties. Population data from 1990, adjusted to 1992, place about 224,000 persons within a 50-mi radius of Los Alamos (Table 2-1) (Environmental Protection Group 1994, 35363).

Table 2-1

1992 POPULATION WITHIN 80 km OF LOS ALAMOS

	Distance from TA-53 (km)								
Direction	1–2	2–4	4–8	8-15	15–20	20–30	30–40	40–60	60–80
N	1	0	0	0	0	0	1,169	0	378
NNE	0	0	0	582	0	558	1,781	1,850	227
NE	1	0	0	0	326	15,860	1,039	1,170	3,965
ENE	0	0	0	2,031	1,609	2,843	2,827	1,222	2,267
E	0	0	87	26	582	1,199	728	0	1,422
ESE	0	0	0	0	0	306	24,239	1,091	1,511
SE	0	0	6,796	0	0	0	56,036	2,558	8
SSE	0	0	0	0	0	0	446	4,551	99
S	0	0	0	50	0	347	670	7,363	0
SSW	0	0	0	20	0	891	219	8,981	36,507
SW	0	0	0	0	0	0	343	4,532	0
WSW	0	0	0	0	0	343	341	2,775	225
W	0	0	0	0	0	0	0	179	144
WNW	0	1,443	6,572	0	0	0	0	0	3,359
NW	0	526	1,731	0	0	0	0	1,481	0
NNW	0	581	582	0	0	0	0	65	64
1992 Population Distribution	2	2,550	15,768	2,709	2,517	22,347	89,838	37,818	50,176

Note: Total population within 80 km of Los Alamos is 223,725.

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 Ma (Manley 1979, 11714)
2. Tschicoma Formation: 2.53 to 6.7 Ma (Dalrymple et al. 1967, 49924)
3. Puye Formation: 1.7 to 4 Ma (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 Ma (Gardner and Goff 1984, 44021; WoldeGabriel et al. 1996, 54427)
5. Otowi Member of the Bandelier Tuff: 1.61 Ma (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542)
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 Ma) and the overlying Tshirege Member (1.22 Ma) of the Bandelier Tuff
7. Tshirege Member of the Bandelier Tuff: 1.22 Ma (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542)

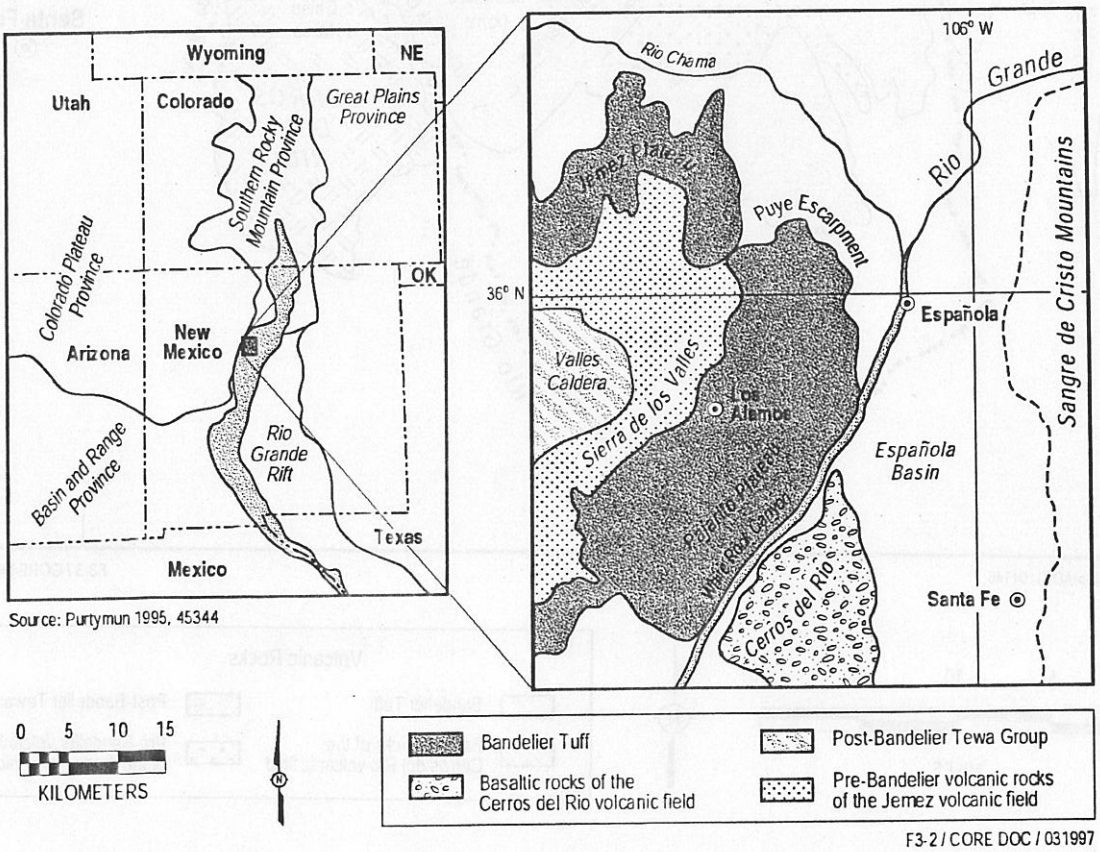


Figure 2-4. Physiographic features of the Pajarito Plateau.

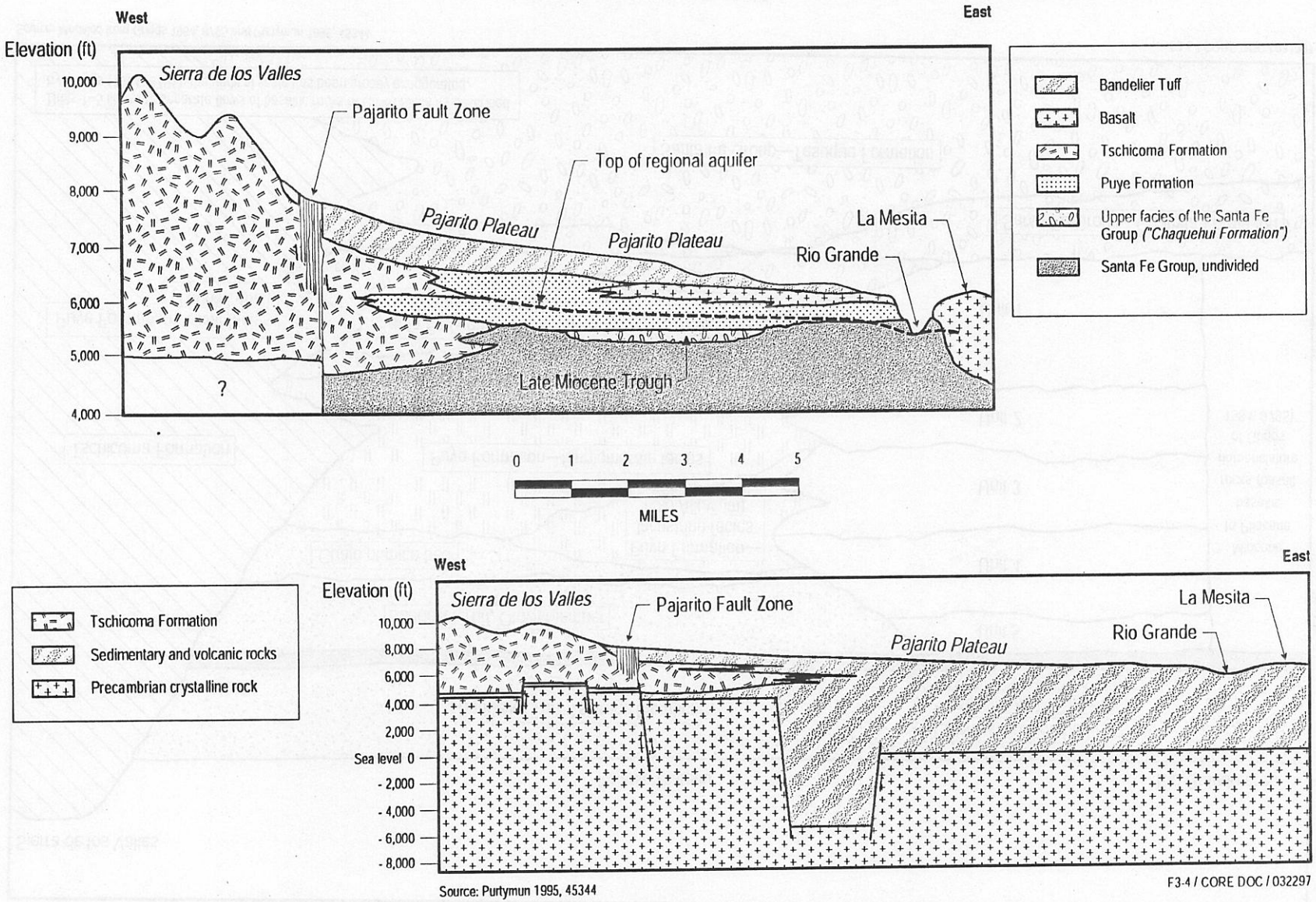
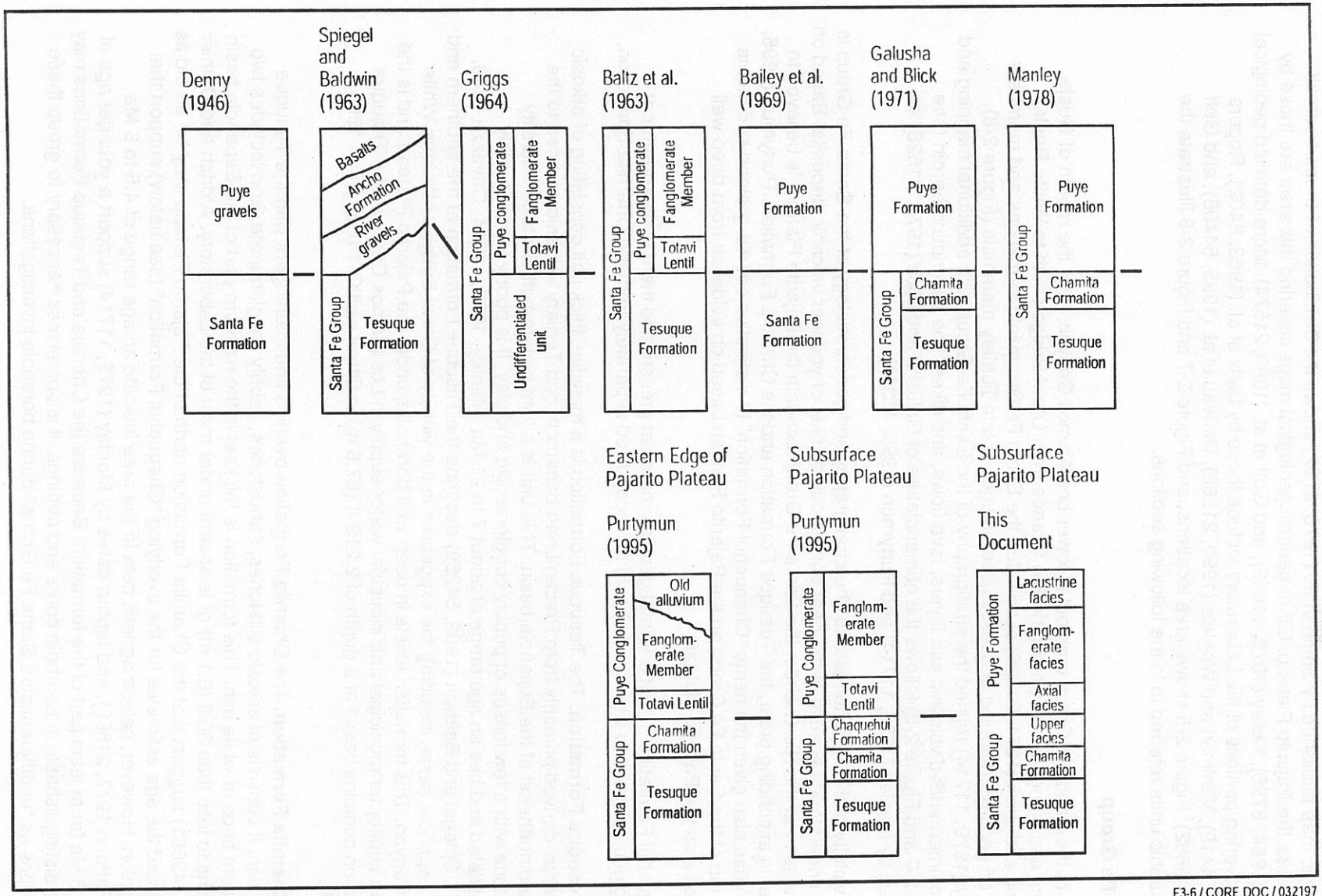


Figure 2-6. Generalized geologic cross sections of the Pajarito Plateau.



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Source: Modified from Purtymun 1995, 45344

Figure 2-8. Stratigraphic relationships and evolution of nomenclature for pre-Bandelier Tuff rocks of the Pajarito Plateau.

The "Chaquehui Formation." Sedimentary deposits referred to as the "Chaquehui Formation" by Purtymun (1995, 45344), and shown as upper facies of the Santa Fe Group on Figure 2-7 and Figure 2-8, 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 "Chaquehui Formation" overlies the Chamita Formation in well boreholes on the Pajarito Plateau. However, because it contains interbedded basalt lava flows dated at 8 to 9 Ma (Laughlin et al. 1993, 54424), it is equivalent in age to older parts of the Chamita Formation. The "Chaquehui Formation" forms 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 "Chaquehui Formation" suggests that these deposits may represent axial deposits of an ancestral Rio Grande within the Chamita Formation.

The 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 2,500 ft (762 m) thick in the Sierra de los Valles. The Tschicoma Formation thins eastward under the Bandelier Tuff on 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 Ma (Dalrymple et al. 1967, 49924). Turbeville et al. (1989, 21587) report an age of 2.53 Ma 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 Ma) and the overlying El Rechuelos Rhyolite (2.0 Ma) (Loeffler et al. 1988, 54409).

The Puye Formation

The Puye Formation is a large apron of alluvial fans which 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; Purtyman 1995, 45344), this formation crops out in canyons north of Los Alamos Canyon. Turbeville et al. (1989, 21587) estimated its areal distribution at 200 km^2 (518 mi^2) and its volume at ~15 km^3 (~3.6 mi^3). Its age is generally placed at between 1.9 and 3.5 Ma, but it may be as young as 1.6 Ma and as old as 6.7 Ma 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

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 2-7). 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 (152 m) 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. The maar deposits resulted from steam explosions that occurred where basalt erupted through an aquifer or standing body of water.

The 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 Ma 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).

The 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

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 degree of welding and glass crystallization that accompanies 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.

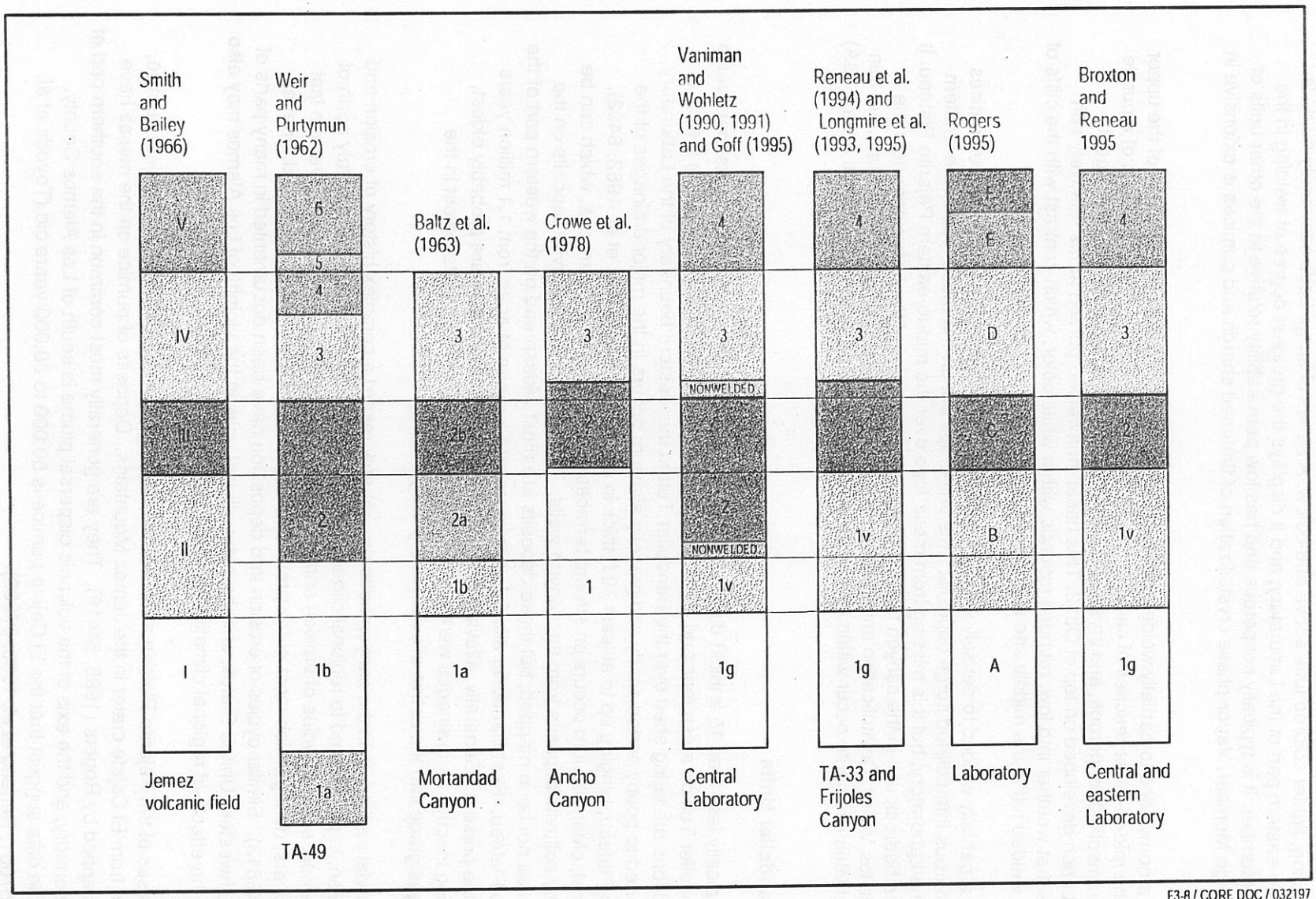
The Tshirege Member can be divided into mappable subunits (Figure 2-9) based on a combination of hydrologic properties and lithologic characteristics. There is a certain amount of confusion due to the inconsistent use of subunit names for the Tshirege Member (Baltz et al. 1963, 8402; Weir and Purtymun 1962, 11890; Crowe et al. 1978, 5720; Vaniman and Wohletz 1990, 21589; Vaniman 1991, 9995; Goff 1995, 49682; Broxton et al. 1995, 50121). Figure 2-10 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 follow paragraphs describe, in ascending order, subunits of the Tshirege Member.

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.

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.

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.



Source: Slightly modified from Broxton and Reneau 1995, 49726

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Figure 2-10. Correlation of rock unit names applied to the Tshirege Member of the Bandelier Tuff.

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 United States 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 2-11). The vertical throw on this fault system is over several hundred feet south and west of the Laboratory but decreases northward 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.

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 years ago and continued without significant hiatus up through about 50,000 years 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 years 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.

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 what their potential is 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 rockfall and landsliding, (3) colluvial transport on sloping portions of canyon walls, and (4) erosion and deposition of sediments by streams in the canyon bottoms. 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

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 2-12 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 and Cañon de Valle does not reach the western boundary (Stoker 1993, 56021) (see Figure 2-12).

Springs on DOE property near the western Laboratory boundary occur in Pajarito Canyon and Cañon de Valle. Perennial flow has been noted 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.

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 Road 4 as part of the environmental surveillance program. By 1993, flow extended to the Rio Grande (Stoker 1993, 56021). Effluent discharged into Cañada del Buey 2 mi up from the confluence with Mortandad Canyon from the Los Alamos County-operated sanitary wastewater treatment plant in White Rock regularly extends to the Rio Grande (Stoker 1993, 56021). 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 of 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

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 main 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 2-13.

The Laboratory has formulated a comprehensive groundwater protection plan (LANL 1995, 50124) for an enhanced set of characterization and monitoring activities. The Hydrogeologic Workplan (LANL 1998, 59599) details the implementation of extensive groundwater characterization across the Pajarito Plateau within an area potentially affected by Laboratory operations. The locations of the characterization wells and their proposed drilling and sampling plans address many areas of concern, 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 Environmental Restoration 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 ranges in thickness to as much as 100 ft. 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/s for a sand to 10^{-4} cm/s 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 limit 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).

The water quality in the alluvial perched groundwaters is variable, depending on the location and history of effluent discharges. In Mortandad Canyon, for example, plutonium concentrations fluctuate up and down in response to variations in treatment plant effluent and storm runoff water, which cause some dilution of the shallow alluvial perched groundwater. Tritium concentrations have fluctuated almost in direct response to the average annual concentration of tritium in the TA-50 effluent, with a lag time of about one year (Environmental Protection Group 1992, 7004).

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).

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 bottoms 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

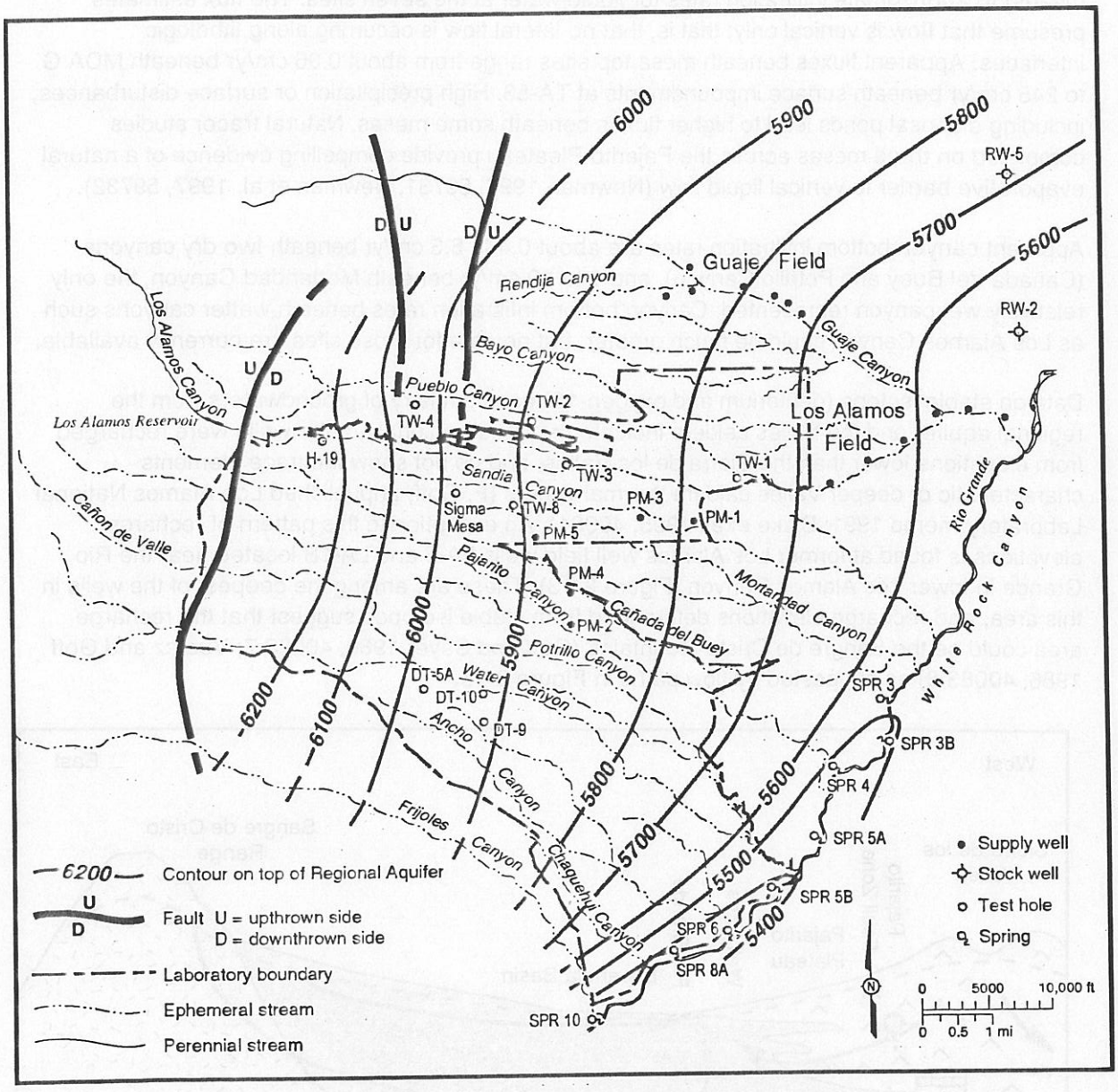
above the contact between the Otowi Member and the Puye Formation. Samples of water from that well contained about 6,000 pCi/L tritium in 1993, but concentrations had decreased to <1,000 pCi/L by 1996.

Six zones of saturation were encountered during the drilling of R-9 in Los Alamos Canyon at the eastern Laboratory boundary (Broxton, et al., 1998, 59158.3). Two perched groundwater zones were encountered in Cerros del Rio basalt at depths of 180 and 275 ft. The upper zone was confined, and the water rose in the hole to 137 ft after the top of the zone was penetrated. The saturated thickness of the upper zone is approximately 45 ft. This zone contains 347 pCi/L tritium (analysis by low-level electrolytic enrichment), which is similar to tritium activities detected in alluvial groundwater within upper Los Alamos Canyon. The second perched zone occurs at the base of the Cerros del Rio basalt and is approximately 7 ft thick. This zone contains 106 pCi/L tritium (low-level electrolytic enrichment) and 48.4 parts per billion (ppb) dissolved uranium. Thin zones of saturation were also encountered in the Puye Formation at depths of 579, 615, and 624 ft. These zones, which are of uncertain origin, occur in transmissive zones intercalated in clay-rich tuffaceous sedimentary deposits. These three zones are confined and appear to be hydraulically connected because water levels rose to a depth of 524 ft after the tops of each of the zones were penetrated. Tritium activities in groundwater of the Puye Formation range from 2.71 to 30.3 pCi/L. The deepest groundwater zone was encountered at a depth of 688 ft near the top of basalt in the Santa Fe Group. This deep groundwater is unconfined, and it is almost certainly associated with the regional aquifer. It has a tritium activity of 14.43 pCi/L.

In R-12, located in Sandia Canyon at the eastern Laboratory boundary, perched groundwater system was encountered from depths of 443 to 519 ft in the lower part of the Cerros del Rio basalt and in underlying old alluvium (Broxton et al., 1998, 59665.4). Groundwater in this zone was confined and the water level stabilized at a depth of 424 ft after the top of the zone was penetrated. The confining layer at the top of this zone apparently is massive basalt, and the lower perching layer is a clay-rich lacustrine deposit. The saturated thickness of this groundwater body is approximately 75 ft, making it one of the thickest intermediate-depth perched groundwater bodies yet identified on the Pajarito Plateau. Groundwater from the depths of 443 and 495 ft was found to contain 249.3 to 254.7 pCi/L tritium (analysis by low-level electrolytic enrichment), 31.5 to 33.4 parts per million (ppm) chloride, <0.02 to 0.26 ppm ammonium, 4.9 to 5.5 ppm nitrate, and 2.46 to 2.51 ppb uranium. Groundwater from the depth of 464 ft was found to contain 208.1 pCi/L tritium, 200 ppm chloride, 13.5 ppm ammonium, 0.21 ppm nitrate, and 2.04 ppb uranium.

Some perched water occurs in volcanics on the flanks of the Jemez Mountains offsite 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 years, 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 (unpublished data). Some of these springs are located within canyon bottom alluvium where groundwater return flow to the dry stream channel occurs and 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 may have its source from nearby outfalls. The ER Project and NMED DOE Oversight Bureau (unpublished data) have discovered high-explosives residuals in samples from some of these springs.



Source: Modified from Purtymun 1984, 6513

Figure 2-14. 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 which had sufficient data. These seven boreholes represent mesa top and canyon bottom 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 Material Disposal Area 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

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).

The above cited studies regarding sources of recharge are inconclusive and require further investigation. The work being done for the Hydrogeologic Workplan will address recharge issues as part of the characterization of the groundwater system beneath the Pajarito Plateau.

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.

The interpretation of ten carbon-14 analyses indicates that the minimum age of water in the regional aquifer ranges from about 1,000 years under the western portion of the Pajarito Plateau, increasing as it moves eastward, to about 30,000 years 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 2-15). 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 2-16), 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 years. These travel times are far shorter than the 22,000 to 27,000 year difference in the carbon-14 ages for these wells (Rogers et al. 1996, 54714).

Several measurements of tritium by extremely low-detection-limit analytical methods appear to show the presence of some recent recharge (within the last 40 years) in groundwater samples taken from seven locations in the regional aquifer at locations near Los Alamos (Environmental Protection Group 1994, 35363; 1995, 50276; Broxton et al. 1998, 59158.3; Broxton et al. 1998, 59665.4). Another thirty wells show no apparent influence of recent recharge on the regional

2.2.3 Ecology

The Pajarito Plateau is a biologically diverse area. This diversity is due partly to the dramatic 5,000-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 5,600 to 6,200 ft. The piñon-juniper cover type, generally in the 6,200- to 6,900-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 6,900- to 7,500-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 7,500 to 9,500 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 9,500 to 10,500 ft. Twenty-seven wetlands and several riparian areas enrich the diversity of plant 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.

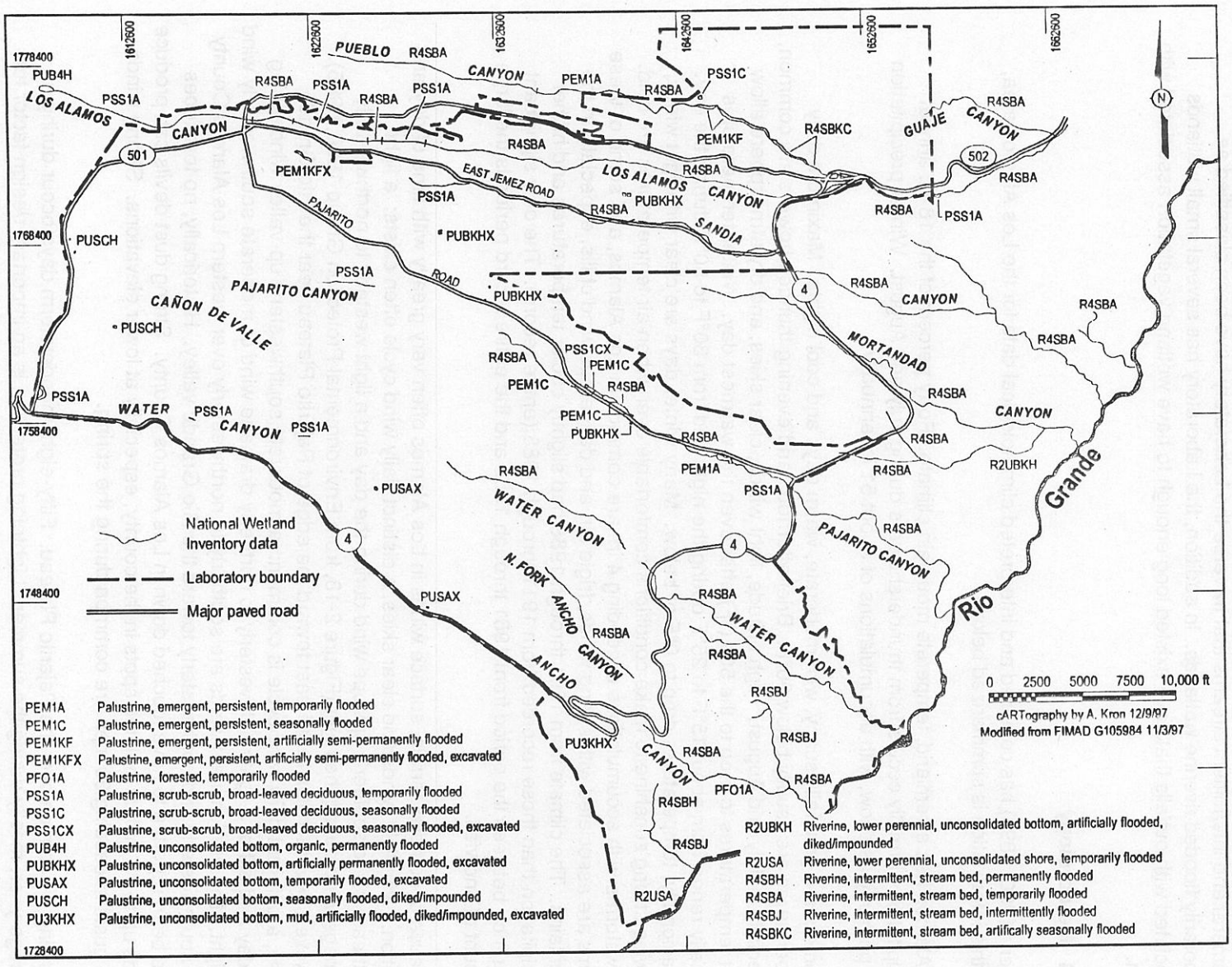
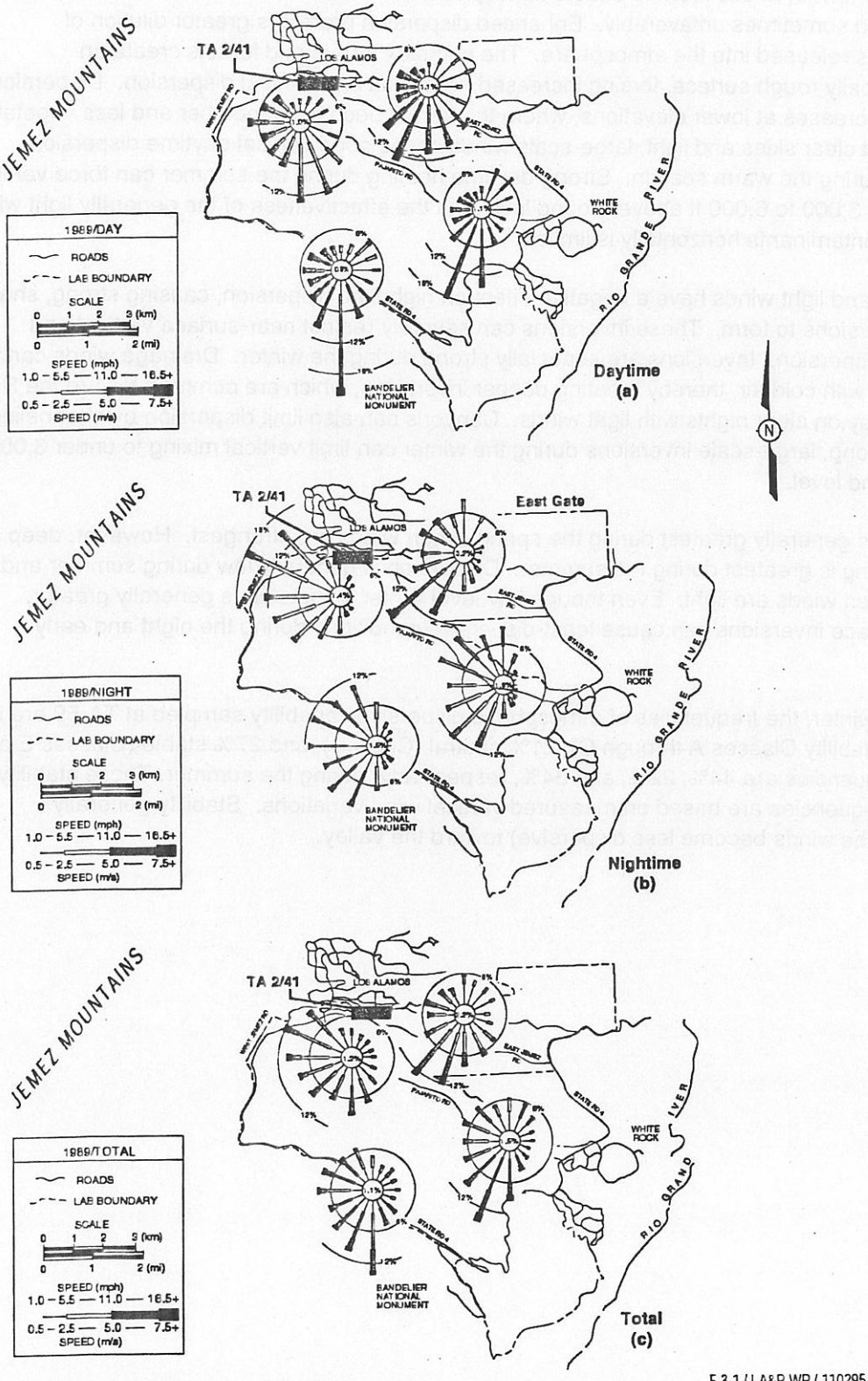


Figure 2-17. Map of wetlands.*

*Figure 2-12 shows perennial and intermittent streams.



Source: Environmental Protection Group 1990, 6995

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Figure 2-18. Wind roses at Laboratory stations during 1989.

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3.0 QUALITY ASSURANCE PROJECT PLAN

3.1 Background

The Environmental Restoration (ER) Project's approach to implementing the corrective action process at Los Alamos National Laboratory (the Laboratory) is to use a modified version of the US Department of Energy's (DOE's) streamlined approach (DOE 1996, 59598). This approach incorporates elements of data quality objectives (DQOs), risk assessment, and the US Environmental Protection Agency's (EPA's) Superfund Accelerated Cleanup Model to facilitate the rapid cleanup of potential release sites (EPA 1993, 45358). In addition, the Laboratory's corrective action approach is in keeping and consistent with EPA regulations and guidance and the guidance provided by the Hazardous and Radioactive Material Bureau in "New Mexico Environment Department RCRA Permits Management Program Document Requirement Guide" (NMED 1998, 57897).

The following terms specific to ER Project decision processes and risk assessment are used frequently in this chapter.

background level Naturally occurring concentrations of an inorganic chemical (including naturally occurring radionuclides and radionuclides from global fallout) in soil, sediment, and tuff.

background value (BV) The upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. When a UTL cannot be calculated, either the detection limit or the maximum reported value is used as a BV; BVs are used as simple threshold numbers to identify potentially contaminated site sample results that are greater than background levels. All inorganic chemicals and radionuclides have BVs.

chemical Any naturally occurring or man-made substance characterized by a definite molecular composition, including molecules that contain radionuclides.

chemical of potential concern (COPC) Chemical detected at a site that has the potential to adversely affect human and/or ecological receptors due to its concentration, distribution, and mechanism of toxicity. A chemical remains a potential concern until exposure pathways and receptors are evaluated in a site-specific risk assessment.

chemical of potential ecological concern (COPEC) Chemical detected at a site that has the potential to adversely affect ecological receptors due to its concentration, distribution, and mechanism of toxicity. A chemical is identified as a COPEC if it does not pass an ecological screening process.

cleanup level Media-specific target concentrations that reflect a potential risk of contamination and that must be met by a selected corrective action. Cleanup levels are established 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.

ecological screening level (ESL) An organism's exposure-response threshold for a given chemical; the concentration of a substance in a particular medium that corresponds to a hazard quotient (HQ) of 1.0 for a given organism and below which no risk is indicated.

these work plans are available in the Laboratory's Public Reading Room and other information repositories.

3.1.2 Notification of New Solid Waste Management Units and Releases

If a new site is identified during the RFI process, environmental surveillance, audits, or other activities, the Laboratory must notify NMED of a proposed new SWMU within fifteen (15) calendar days of its discovery. This notification identifies the new SWMU; the Laboratory then must propose a schedule for corrective action. Guidance is provided in Quality Procedure (QP) "Identification, Documentation, and Reporting of Newly Discovered Potential Release Sites for the Environmental Restoration Program" (LANL-ER-QP-5.8), in accordance with Module VIII, Section G, Part 1, p. 15 of the Laboratory's Hazardous Waste Facility Permit.

Discovery of new releases of hazardous waste or constituents from SWMUs must be reported to NMED within twenty-four (24) hours of discovery. This procedure is described in detail in LANL-ER-QP-5.9, "Reporting of Newly Identified Releases from Solid Waste Management Units," to meet the requirements of Module VIII, Section H, p. 17 of the Laboratory's Hazardous Waste Facility Permit.

3.1.3 RCRA Corrective Action Process

The RCRA corrective action process for the ER Project has three main phases: the RFI, the corrective measures study (CMS), and corrective measures implementation (CMI). The ER Project also considers accelerated cleanup, when appropriate. The requirements for each of these phases are described briefly below.

3.1.3.1 RFI Requirements

The RFI entails preparing a work plan, which must be completed and approved by the Administrative Authority before sampling begins (unless DOE/University of California [UC] decide to proceed at risk), to determine whether a release to the environment has occurred. Specific RFI requirements are described in detail in Module VIII, Task II, of the Laboratory's Hazardous Waste Facility Permit, and EPA provides specific guidance in Volume I of the interim final RFI guidance (EPA 1989, 08794).

Each RFI work plan describes the overall approach, technical and analytical approaches and methods, quality assurance (QA) procedures, and data management procedures. In addition, Module VIII of the Laboratory's Hazardous Waste Facility Permit specifically requires the concurrent development of five companion plans as part of the RFI work plan (the Project Management Plan, the Quality Assurance Project Plan, the Records Management Project Plan, the Health and Safety Project Plan, and the Public Involvement Project Plan); however, it allows the Laboratory to deviate from specific requirements as long as the work plan covers the essential elements discussed above.

The ER Project adheres to Section 2, Volume I, of EPA's RFI guidance document (EPA 1989, 08794) to the extent practicable. DOE/UC RFIs are also consistent with the substantive requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). During the RFI, the ER Project's strategy is to assess sites, using a logical and efficient sampling program that moves from analyzing existing qualitative and/or quantitative data

4. A release from the SWMU/AOC to the environment has occurred, but the SWMU/AOC was characterized and/or remediated under another authority (such as the NMED's Underground Storage Tank or Ground Water Quality Bureaus), which adequately addressed RCRA corrective action, and documentation (such as a closure letter) is available.

5. The SWMU/AOC has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

A determination of NFA will 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, Parts 2 and 3, p. 33 of Section K, "Determination of No Further Action," of the Laboratory's Hazardous Waste Facility Permit.

3.1.3.2 Accelerated Cleanup

The ER Project approach to accelerated cleanup is consistent with the accelerated corrective action approach detailed in Section III.C.2 of the NMED RCRA permits management guidance document (NMED 1998, 57897). The ER Project uses the accelerated cleanup approach when conditions warrant early action or when sites can be remediated rapidly and cost-effectively. The following criteria are used to evaluate candidate sites for the accelerated cleanup process:

- Cleanup levels are based on NMED-approved background concentrations, promulgated standards, or risk-based levels developed in accordance with an NMED-approved risk assessment protocol.

- The potential remedy is obvious and can be readily applied.

- Acceptable knowledge (e.g., adequate previous sampling data and/or other existing information) is available to adequately identify chemicals of potential concern (COPCs).

- Adequate treatment, storage, and disposal capacity is available for all expected waste types.

- The nature, rate, and extent of contamination have been determined.

Cleanups fall into the following two categories:

- those that require minimal review and involvement from the Administrative Authority prior to initiation (i.e., voluntary corrective actions [VCAs]),and

- those that, because of their complexity, location, or site type, require more involvement from the NMED (i.e., voluntary corrective measure s [VCMs]), such as NMED review and approval of an accelerated cleanup plan or NMED personnel present to observe cleanup or to split samples).

3.1.3.3.1 Corrective Measures Study Plan

The first step in the process of selecting alternatives to remedial action is to prepare a CMS plan, which is specific to a PRS or PRS aggregate. CMS plans must be consistent with the scope of work for a CMS, presented in Module VIII, Section R, pp. 56–57 of the Laboratory's Hazardous Waste Facility Permit, and with proposed Subpart S, as applicable.

The CMS is used to identify and develop a scheme for evaluating alternatives for final PRS remediation. A CMS plan must provide sufficient information for the Administrative Authority to adequately review the methods for evaluating potential cleanup alternatives. Each PRS-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,
- definition of the overall objectives of the study,
- description of the specific remedial alternatives to be studied,
- plan for conducting treatability (bench- or pilot-scale) studies, if appropriate, to determine the suitability of alternatives for site restoration,
- plan for evaluating remedial alternatives to ensure compliance with the standards for remedies specified in EPA guidance,
- schedule for conducting the CMS, and
- proposed format for presenting the results (CMS report).

In addition to these requirements, DOE/UC integrate RCRA and National Environmental Policy Act compliance through the CMS process. CMS plans can trigger a determination of the need for an environmental assessment; in such cases, CMS reports can serve that function. If a full environmental impact statement is required, the CMS report serves as a support document for that effort.

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, DOE/UC must initiate the studies within fifteen (15) calendar days. DOE/UC conduct 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,

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, DOE/UC may perform immediate risk-reduction activities and consider implementing existing technologies.

3.1.3.3.2 Corrective Measures Study

Before DOE/UC propose and NMED selects a remedy for a PRS, NMED evaluates the proposed alternative to determine whether it meets EPA guidance (EPA 1988, 0295). Because conditions vary from PRS to PRS, decision factors for each proposed remedy may be weighed differently at different PRSs.

3.1.3.3.2.1 Standards for Remedies

The CMS generates data sufficient to evaluate potential remedies based on their ability to meet the following standards:

- protection of human health and the environment,
- attainment of established cleanup levels,
- control of the source of release, and
- compliance with waste management requirements.

These standards are broad and include the major technical requirements for controlling sources, conducting waste management activities, and cleaning up the environment. The Laboratory will comply with media cleanup levels to the extent practicable. In all cases, the Laboratory's overriding concern is protecting human health and the environment.

3.1.3.3.2.2 Media Cleanup Levels

Media cleanup levels include regulatory and risk-based levels that protect human health and the environment and applicable standards that are protective of surface water and groundwater resources. Because existing regulatory levels primarily address drinking water, DOE/UC use health-based risk assessments to determine the effort needed to clean up contaminated media. Technical, regulatory, and other factors are considered on a site-specific basis in determining corrective measures, including media cleanup levels. Technical factors that are considered include but are not limited to contaminant toxicity, proximity of human or ecological receptors, and known or anticipated environmental transport pathways. Regulatory factors influencing the determination of cleanup levels include but are not limited to the nature of contaminants present, the history of the PRS, and the effectiveness of the proposed treatment. Other factors influencing the determination of cleanup levels include but are not limited to land ownership and future land use.

Human health risk-based determinations are consistent with the RCRA corrective action process described in proposed Subpart S (Proposed Rule, Title 40, 264, 265, 270, and 271, "Corrective

> "In short, consideration of the environmental effects of the remedy itself might result in a decision to allow contaminants to remain on site at levels higher than the threshold for effects on the assessment endpoint. Thus, selection of the most appropriate ecologically based remedy can result in residual contamination that presents some risk."

DOE/UC have not yet developed risk-based cleanup concentrations for ecological receptors. The 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 cleanup levels that are protective of ecological resources. It also may be necessary to conduct further investigations in support of a risk assessment to develop cleanup levels.

Cleanup levels may be raised or lowered, depending on site-specific conditions. Such conditions may include a determination that concentrations of some contaminants must be lowered to protect sensitive human and/or ecological populations. Similarly, higher concentrations may be allowed by the Administrative Authority because approved localized background or approved Laboratory-wide background levels are elevated above the approved cleanup levels for residential and industrial exposure scenarios. Additionally, the concentrations permitted in groundwater may exceed drinking-water standards if it is established that such use is not appropriate. The groundwater concentrations permitted will be protective of the appropriate use based on the New Mexico Water Quality Control Commission regulations for groundwater (e.g., human health, domestic water supply, and irrigation). In all instances where the cleanup levels and/or standards have been modified to reflect site-specific conditions, they will remain protective of human health and the environment, including ecological receptors, surface water, and groundwater resources. Other circumstances include determinations that the measures taken to meet specific cleanup levels would themselves cause more harm to human health or to the ecosystem than taking no action. In addition, the technical feasibility of remediation at each site will be taken into account.

DOE/UC will propose for NMED approval the specifics for compliance with established standards. This proposal will address the point of compliance, monitoring and sampling locations, analytical parameters and methods, statistical analyses, and the period required for monitoring restored sites.

Some sites at the Laboratory may require remediation, including soil excavation or some other method that physically removes the contaminant from the environment to appropriate and approved cleanup levels. However, there are sites at the Laboratory from which it would be impractical to physically remove all contaminants. Thus, the definition of cleanup must include remedies that involve controlling contaminant migration from a source.

Cleanup is considered any measure taken to ensure protection of human health and the environment, not necessarily the total removal of a contaminant. It may not be necessary to clean up areas of widespread, very low level contamination. The low levels of risk to human health and the environment resulting from low-level contamination would not be significantly reduced by cleanup because contaminant concentrations may be close to background levels. Thus, cleanup is approached on a case-by-case basis; DOE/UC are responsible for demonstrating to NMED that remediation would not provide a significant reduction in risk.

The RFI determines site stabilization efforts and the implementation of institutional controls. However, DOE/UC may propose site stabilization and institutional controls as a conditional remedy for some of the large material disposal areas (MDAs) from which no environmental transport is likely. Remediating these MDAs could be complex and unnecessarily risky. Furthermore, MDA contaminant concentrations that qualify for conditional remedies do not currently threaten human health or the environment, and institutional controls, which provide long-term access control and prevent potential exposure of Laboratory workers, could be viable options at these sites. Therefore, DOE/UC believe that a conditional remedy for these sites will optimally protect human health and the environment. Long-term monitoring will be conducted as necessary. When the results of the RFI support a single obvious remedy, which could include extensive pilot testing, a formal CMS is not needed; however, the proposed remedy must be presented to NMED either as part of an RFI report or in a separate plan. Based on the results of RFIs that support the use of conditional remedies, DOE/UC may request that the permit be modified. Upon NMED approval, DOE/UC prepare a CMI plan that contains information adequate to design and implement the remedy, maintenance plans, schedule, QA program, progress reports, and proposal for determining a complete and final remedy.

DOE/UC intend to propose in-place stabilization with long-term monitoring and institutional controls as a remedial alternative for some PRSs. To ensure compliance, sensitive and dependable instruments will be required for long-term monitoring. DOE/UC have initiated several efforts to develop appropriate equipment such as polymer film field sensors, optical fiber-flow optrode, fieldable Raman with fiber optics, and tritium plume detectors.

DOE/UC also realize that conditional remedies may not be final remedies. The remedy decision is reviewed after a period of implementation to compare the performance of the conditional remedy with established remedy standards. The conditional remedy may be declared the final remedy at that time or NMED may require further corrective action to supplement or replace the conditional remedy. Final selection of the remedy and termination of the permit must comply with the procedures described below.

3.1.3.3.3 Corrective Measures Study Final Report

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. 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 as described in Module VIII.

The primary purpose of the CMS report is to enable DOE/UC 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;

- schedule and major milestones for remedy implementation, including submission of the CMI plan; and
- reports and documentation to be submitted by DOE/UC during remedy implementation.

3.1.3.4 Requirements for Corrective Measures Implementation

DOE/UC will prepare CMI plans after approval of the CMS plan and upon NMED request. The Laboratory's approach to CMI is addressed in subsequent sections of this IWP.

Table 3-2 crosswalks IWP discussions of CMI requirements to corresponding sections in Subpart S.

TABLE 3-2

CROSSWALK OF CMI REQUIREMENTS

IWP		Subpart S	
3.1.3.4	Requirements for Corrective Measures Implementation	VI., H.	Implementation of Remedy
3.1.3.4.1	Remedy Design	VI., H., 1.	Remedy Design
3.1.3.4.2	Corrective Measures Progress Reports	VI., H., 2.	Progress Reports
3.1.3.4.3	Review of Remedy Implementation	VI., H., 3.	Review of Remedy Implementation
3.1.3.4.4	Completion of Remedies	VI., H., 4	Completion of Remedies

The standard outline for DOE/UC 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.

3.1.3.4.3 Review of Remedy Implementation

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.

3.1.3.4.4 Completion of Remedies

CMI plans contain the criteria used to demonstrate completion of remedies. Upon completion of a remedy, DOE/UC submit a request for termination of the schedule of compliance for the corrective action. The request contains a certification that DOE/UC have met all criteria established for this purpose. The request to NMED will include verification that

- all media cleanup levels have been achieved,
- actions required for source control have been satisfied, and
- procedures for final disposition of equipment and materials associated with the remedial action have been followed.

NMED then reviews the request, along with public comments, to determine whether a remedy has been completed in accordance with the requirements of Module VIII of the Laboratory's Hazardous Waste Facility Permit and CMI plan. After such determination, NMED modifies Module VIII to terminate the schedule of compliance for the corrective action.

3.1.3.5 Special Situations in the Corrective Action Process

3.1.3.5.1 Interim Measures

Section J, Part 2, p. 32, of Module VIII of the Laboratory's Hazardous Waste Facility Permit lists nine (9) factors that may be considered in determining the need for interim measures. If NMED determines that a release or potential release of hazardous waste or constituents poses an imminent threat to human health or the environment, it can mandate that DOE/UC implement interim remedial measures to mitigate the risk. NMED can also specify a schedule (by modifying Module VIII) for implementing the interim measure and can require the Laboratory to prepare and submit a plan for approval before action is initiated. No interim measures have been taken to date because no imminent threats to human health or the environment have been identified. However, in the event that NMED requires an interim measure in the future, DOE/UC will modify any plan already in place or submit a plan for newly identified interim measures. At that time, DOE/UC may request that NMED modify the schedule of compliance for the corrective action.

In determining the need for interim measures based on health risks, at least the following factors should be considered:

- NMED concerns,
- human and environmental risk,
- regulatory compliance requirements,
- public interest/involvement, and
- the ER Project mission.

Based on these criteria, DOE/UC generate a draft work schedule for the current fiscal year and shares it with NMED. Upon NMED concurrence or agreed-upon modifications, DOE/UC submit the work schedule, included in this document as Appendix D of the IWP.

3.2 Assessment Strategy

The Laboratory ER Project approach to planning, collecting, and evaluating data for environmental restoration is based on the EPA DQO process (EPA 1994, 44324) and on EPA and NMED guidance for risk-based decision making (EPA 1989, 08021; EPA 1997, 59370; EPA 1998, 59600); NMED 1998, 57761). This approach recognizes that focusing characterization of a site on the data needs required to support a series of well-defined decision criteria streamlines the decision-making process.

The Laboratory's corrective action approach uses the decision framework illustrated in Figure 3-1. Decision points in the general framework depend on a number of risk-based technical assumptions that are detailed in Section 3.2.2 below.

3.2.1 Corrective Action Process Decisions

Decision-Oriented Approach

To implement the RCRA corrective action process, the ER Project follows a decision-oriented approach based on the EPA DQO process (EPA 1994, 44324). The DQO process

- focuses data collection to support risk-management decisions;
- identifies acceptable levels of uncertainty before data are collected, ensuring data usability before data-collection resources are expended; and
- streamlines the corrective action process by identifying data that have the most value in terms of assessing present and potential future impacts of contamination on human health and the environment.

Once these assessments are made, corrective actions can be proposed to minimize risk.

Several decision points during the RFI and CMS processes demarcate progress during the RCRA corrective action process. Many of these decisions require collecting and assimilating environmental data. The Laboratory's technical approach to corrective action begins with decision criteria that are sufficiently explicit to guide the design of field investigations and the evaluation of the resulting data. Decisions required during the RFI include determining whether

- contaminants have been released to the environment and, if so, to what extent (the site-screening decision),
- corrective action is required for the site (a risk-based decision that may be made before or after a CMS has been initiated), and
- accelerated cleanup is possible or whether a formal CMS is required to evaluate, select, and design an appropriate corrective action.

The first step in this decision-oriented approach is to develop a site conceptual model and technical approach based on existing information. Depending on the complexity of the site and the quality of existing information, the site may be proposed for NFA. The remaining sites fall into the following categories:

- sites where accelerated cleanup (Section 3.1.3.2 of this document) under a VCA/VCM is possible, and
- sites where CMS and CMI are expected, and
- sites for which existing information is not adequate to support a decision about potential outcomes that include proposal for NFA, accelerated cleanup, or CMS/CMI; therefore, further investigation is required.

If initial review of historical information identifies a site as a possible candidate for an accelerated cleanup, CMS, or CMI, an initial investigation is conducted to collect data supporting one of these activities. For many sites, existing information is not adequate to make this decision. The initial investigation then involves collecting data to support a screening assessment or risk management decision. For sites that are likely candidates for proposing NFA, the screening investigation focuses on confirming or denying the existence of a release to the environment. A risk-based investigation focuses on assessing risk to human health and the environment.

Designs for data collection to support screening decisions generally use biased sampling to determine the presence of chemicals at levels of potential concern. Samples taken from areas deemed most likely affected by historical activities are analyzed for a broad range of potential contaminants. The most frequent criterion used for the screening decision is the presence of chemicals in environmental media above human health SALs or ecological screening levels (ESLs).

Additional information for the initial analysis is obtained by maximizing the use of field screening instruments. When appropriate, sampling designs make extensive use of field screening techniques such as geophysics, remote sensing, and field analytical instruments to focus sampling, ensure the site is adequately investigated, and reduce the number of samples needed for laboratory analysis.

with areas of residential lawn could cause the elimination of the Mexican spotted owl due to a change of habitat. Potential changes in land use must be evaluated in estimating a site's potential ecological risk and remediation goals.

To evaluate risk to human and ecological receptors, risk assessments consider site-specific land-use assumptions and exposure scenarios. These factors also are used to establish preliminary goals and media cleanup standards to estimate the reduction of risk associated with a potential corrective action. Target risk and dose levels to human and ecological receptors are set following Administrative Authority and DOE guidance.

3.2.2 Approach to Data Collection and Evaluation

Site-Screening Decisions

The approach for making site-screening decisions follows NMED's risk-based decision tree (NMED 1998, 57761). Sites having existing information of sufficient quantity and quality to document that the site does not pose a threat to human health or the environment (including identification of surface and groundwater pathways) are proposed for NFA without additional RFI fieldwork (see Figure 3-1).

Sites not having sufficient existing information to propose NFA undergo characterization to determine whether a release has occurred. A SAP that includes a preliminary conceptual model is developed for the site. Using information about processes previously used at that site, investigators focus on sampling and analysis of chemicals associated with those processes. When information on historical processes indicates that certain contaminants were never handled at a site, analyses for those chemicals are not performed. Sampling plans for site-screening decisions may incorporate purely random sampling approaches. Directed sampling based on professional judgment and/or the results of field surveys also may be used. Results from field surveys using adequate techniques and instruments may be used to bias the location and number of samples needed for site characterization in order to increase the probability of detecting contaminants rather than using purely random sampling approaches.

To determine whether a release has occurred at a particular PRS, it is necessary to establish whether maximum concentrations or 95% upper confidence limits (UCLs) of the mean for potential contaminants at the PRS are at or above background levels and/or fallout concentrations for that site. Background values and fallout concentrations are described in "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory" (LANL 1998, 58093).

Inorganic and radionuclide COPCs are identified by comparing the maximum concentration or the 95% UCL of the mean of a chemical with background values to determine whether these chemicals are present at levels exceeding background and/or fallout concentrations. Statistical comparisons of site data to background data sets may be conducted to determine if site data are indistinguishable from background. Comparisons with background values are documented in standard operating procedures (SOPs): LANL ER-SOP-15.12, "Performing Background Value Comparisons for Inorganic Chemicals," and LANL ER-SOP-15.13, "Performing Background Value Comparisons for Radionuclides." The statistical methods used in comparing site data with background data are detailed in the LANL ER paper, "Statistical Methods for Background

negligible. 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. 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. In a screening assessment, SALs for noncarcinogens are divided by 10 when two or more noncarcinogenic COPCs are identified. 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.

- 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 field screening and/or laboratory analysis 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 body weight, intake rate, exposure duration, etc. 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.

- The target dose level used for radionuclide SAL calculations is 10 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" [DOE Proposed Rule 10 CFR 834]). Further investigation of sites exceeding 10 mrem/yr is consistent with DOE regulatory guidance.

For most ecological applications, risk-related 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, weights of consumption, and diet) and toxicity information are available. The target dose level used for calculation of radionuclide ESLs is 0.1 rad/day. ESLs for nonradionuclides are derived from literature values for no

quality, and solid waste) also are considered, if relevant. Further action is determined on a case-by-case basis, and may include the following:

- Further evaluation. This process includes more in-depth analysis of available data, if the data are sufficient; the collection and analysis of additional data; or evaluation of the relative impact of a given remedy selection to natural resources. For example, in-depth analysis may result in the modification of exposure assumptions based on site-specific information. Results of these further evaluations could be proposal for NFA, accelerated cleanup, human health and/or ecological baseline risk assessment, or a CMS.

- Risk assessment. If a site fails its screening assessment (i.e., maximum concentrations or 95% UCLs of the mean are above SALs/ESLs) using existing data and information, a human health and/or ecological risk assessment may be conducted to determine if corrective action is required. Additional information and site-specific data may be required for a human health and/or ecological baseline risk assessment if the available data are not adequate to support a risk-management decision.

- Accelerated cleanup. Accelerated cleanup can proceed without further evaluation and/or a human health risk and/or ecological baseline risk assessment under the following conditions:

  - Cleanup levels are based on one of the following criteria: NMED-approved background concentrations, promulgated standards, or risk-based levels developed in accordance with an NMED-approved human health and/or ecological risk-assessment protocol.

  - The potential remedy is obvious and can be readily applied.

  - The remedy is the final resolution needed to prevent releases or future migration of contaminants from the site.

  - Acceptable information (e.g., previous sampling data and/or other existing information) is available to adequately identify and quantify COPCs.

  - Adequate treatment, storage, and disposal capacity is available for all expected waste types.

  - The nature, rate, and extent of contamination have been determined.

  - The remedy selected does not adversely impact the ecosystem, natural resources, worker safety, or public health.

  - Uncertainties can be handled by contingencies in the accelerated cleanup plan, and stopping criteria are defined; confirmatory sampling verifies that the intent of the corrective action has been met; confirmatory sampling and guidelines for stopping criteria are specific to the relevant VCA/VCM plan.

Estimation of risks to human health and the environment must be based on reasonable site-specific land use and exposure assumptions. Risks associated with the use of alluvial aquifers and surface waters (e.g., canyon bottoms with perennial stream flow, permanent alluvial aquifers, and outfalls to canyons) are considered for sites when these waters may be impacted and potential exposures may occur. Currently, individual PRSs may be aggregated to adequately evaluate potential human health and ecological risks from neighboring, contiguous, and related PRSs. An approach for more complex site aggregation will be developed in cooperation with the Administrative Authority.

The groundwater exposure pathway is not considered for most mesa-top sites because the depth to the regional aquifer is about 800 to 1,100 ft. However, potential contaminant migration to groundwater may be modeled at mesa-top sites where deep subsurface contamination is detected and where the potential for transport to groundwater exists. The decision to evaluate groundwater contamination will be determined on a case-by-case basis.

Baseline risk assessments are conducted following EPA's human health and ecological risk assessment guidance documents (EPA 1989, 08021; EPA 1997, 59370; EPA 1998, 59600). Baseline risk assessments may provide a basis for proposal of final actions at sites where COPCs have been identified, as in the following examples:

- If the total carcinogenic and noncarcinogenic risk thresholds are not exceeded for human receptors, the Laboratory may propose the site for human health NFA. Carcinogenic risk thresholds are established on a case-by-case basis within the range of 10^{-4} to 10^{-6} excess cancers per lifetime. The noncarcinogenic risk threshold is equivalent to an HQ of 1.

- 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) or 30 mrem/yr above background (for sites retained under DOE control), DOE/UC may propose the site for human health NFA. 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 1997, 58693) establish the rationale for adopting these dose levels.

- If the total risk thresholds for ecological receptors at a PRS are not exceeded, the Laboratory may propose the site for ecological NFA. Ecological risk thresholds are established on a case-by-case basis and may be based on HQs/HIs greater than 1, the relationship of the stressor level to the magnitude of response, and/or the evaluation of the variability in exposure/effects to receptor populations.

Exposure estimates are based on the distribution of contamination throughout areas or volumes of contaminated media and over time periods that are consistent with land-use assumptions. 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; e.g., a residential exposure unit may be equivalent to an average lot size (500 m^2) and an ecological exposure unit may be equivalent to the home range of an ecological receptor. The 95% UCL of the mean is used for the exposure point concentration in the areas or volumes in which reasonable maximum exposure might take place. Alternative statistics, if appropriate, provide estimates of reasonable maximum

- selecting measurement techniques and methods that are selective, sensitive, and precise enough to distinguish target analyte concentrations from prespecified threshold levels;
- limiting contamination of samples to insignificant levels; and
- maintaining the desired degree of data comparability to allow statistically valid evaluation or pooling of the data.

The result of the DQO planning process is a list of criteria that are expected to increase the likelihood that data of the right type, quantity, and quality are collected to support PRS decisions. These criteria include identifying

- a focused list of environmental variables to be measured or collected (e.g., analytes, concentrations/radioactivities, physicochemical parameters, and exposure model parameters),
- decision or action levels (e.g., SALs and the basis for deriving them),
- geographical boundaries of each PRS or PRS aggregate,
- a geographical area for which the conclusions and decisions will apply,
- temporal considerations that affect the time during which data can be collected, and
- sample matrices of interest.

The ways in which the data collected 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.

3.3.1.1 Data Collection

(a) Sample Location and Frequency

The SAP details the following sample location and frequency information

radioactivity are addressed in LANL-ER-SOP-10.07, "Field Monitoring for Surface and Volume Radioactivity Levels," and LANL-ER-SOP-10.10, "Radiation Scoping Surveys."

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. Requirements for the control of measurement and test equipment are described in LANL-ER-QP-5.2, "Control of Measuring and Test Equipment."

3.3.3 Sampling Equipment and Procedures

3.3.3.1 Sampling Procedures

Samples are collected in accordance with appropriate SOPs. 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-inch depth of entire PRS),
- 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 demanded 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, 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. Sampling and preservation methods recommended in EPA SW-846 Method 5000 (EPA 1997, 57589) are used by the ER Project whenever practicable.

provides hazard status determination, packaging requirements, and shipping/transport requirements for samples.

All analytical services are coordinated through the Field Support Facility (FSF). All samples submitted through the FSF 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.

Nonroutine analytical services are any that are not specified in the ER Project statement of work for analytical services. Nonroutine anaytical services are procured in accordance with LANL-ER-QP-7.1, "Procurement."

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 SAL/ESL concentrations can be detected. SW-846 methods (EPA 1997, 57589) 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 PRS investigation requires the measurement of analyte concentrations less than the lowest concentrations measured by routine analytical methods, the technical team selects an appropriate analytical method that will provide lower detection limits, if practicable.

3.4.1 Site Access and Security

The Laboratory maintains responsibility for all access and security measures required to gain access to the Laboratory. Site security at PRSs 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 monthly by the Hazardous and Solid Waste Group (ESH-19) to the Hazardous and Radioactive Material Bureau. 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 Plans

The development of contingency strategies is necessary for the successful and timely completion of ER operations at the Laboratory. If a problem or interruption occurs during field activities, the appropriate ER Project personnel are notified and consulted before implementation of alternate strategies (depending upon the importance of the problem). In case of major deviation, the Administrative Authority is contacted to discuss the alternative action. Certain reasonably anticipated contingencies are addressed in site-specific health and safety plans. Other reasonably anticipated contingencies are addressed in site-specific SAPs.

3.4.5 Record Keeping

ER Project-wide requirements for documentation and records are detailed in Chapter 4.0 of this document. They also are described in LANL-ER-QP-4.3, "Procedure for LANL ER Records Management," and LANL-ER-QP-4.4, "Distribution of Controlled Documents." 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 Sample Management Office, 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.

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EPA (US Environmental Protection Agency), June 1997. "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments," EPA Interim Final Report, Washington, DC. (EPA 1997, ER ID 59370)

EPA (US Environmental Protection Agency), May 1997. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition," Final (Promulgated) Update III, Washington, DC. (EPA 1997, ER ID 57589).

EPA (US Environmental Protection Agency) Region IX, 1998. "Region IX Preliminary Remediation Goals (PRGs) 1998," http://www.epa.gov/region09.

EPA (US Environmental Protection Agency), April 1998. "Guidelines for Ecological Risk Assessment," EPA Final Report EPA/630/R-95/002F, Washington, DC. (EPA 1998, ER ID 59600)

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, ER IDs 11646, 11647, 11648, 11649)

Kelly, E., G. Gonzales, L. Soholt, M. Hooten, and R. Ryti, 1998. "Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory," Los Alamos National Laboratory Report LA-UR-98-1822, Los Alamos, New Mexico. (Kelly et al. 1998, ER ID 57916)

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work (formerly called requirements document) - Analytical Support," RFP Number 9-XS1-Q4257, Revision 2, Los Alamos National Laboratory Publication, Los Alamos, New Mexico. (ER ID 49738)

LANL (Los Alamos National Laboratory), 1995. "Site Development Plan, Annual Update 1995," Los Alamos National Laboratory Publication, LA-LP-95-113, Los Alamos, New Mexico. (LANL 1995, ER ID 57224)

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

LANL (Los Alamos National Laboratory), 1998. "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)

LANL (Los Alamos National Laboratory), September 1998. "Statistical Methods for Background Comparisons," Interim Final Draft, Los Alamos National Laboratory Report, Los Alamos, New Mexico. (LANL 1998, ER ID 59596)

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)

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 Department of Energy (DOE) and the University of California (UC) by establishing general guidelines for records management, including technical data. Specific actions for managing project records are implemented through quality procedures (QPs), standard operating procedures (SOPs), and management guidance documents. The guidelines have been developed in cooperation with the ER Project's quality assurance staff and the Laboratory's Computing, Information, and Communication (CIC) Division staff.

The Records Management Plan interfaces with other chapters of this Installation Work Plan mandated by the Hazardous and Solid Waste Amendments (HSWA) Module of DOE/UC's permit to operate the Laboratory under the Resource Conservation and Recovery Act (RCRA) (EPA 1994, 44146). This plan contains four 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's Records-Processing Facility (RPF) and Facility for Information Management, Analysis, and Display (FIMAD) are described in Section 4.3. Section 4.4 describes how records management is coordinated with the quality program, project management, and public involvement activities.

4.1.1 Regulatory Mandate

The development and implementation of this plan are mandated by the HSWA Module. General requirements for data management are presented in Task II, Section B, of the HSWA Module, 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 and intended function of the data and documentation submitted to the New Mexico Environment Department (NMED) and the Environmental Protection Agency (EPA). The ER Project's records also include the publicly accessible documentation that make up portions of the administrative record (AR) file as well as parts of the facility operating record.

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 the HSWA Module;
- 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.

4.2.2 Implementation

Transmittal of Records

ER Project participants must transmit their records to the RPF. Records must be transmitted in accordance with LANL-ER-QP-4.3, "LANL ER Records Management," and LANL-ER-QP-4.5, "Transmittal of Records to the Records-Processing Facility." ER records normally are used to make a decision or they document the normal and routine course of conducting ER 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 RCRA facility investigation reports or similar records documenting project decisions.

Participants are required to review their records to determine whether the information represents an ER record as defined in procedures LANL-ER-QP-4.3 and LANL-ER-QP-4.5. 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;
- enters the microfilm roll number and box number globally in the ER 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 and are queriable on bibliographic and indexing information in the RPF's home page on the internal Web site (http://erproject.lanl.gov/rpfdata/new/query.asp).

Use of Approved Procedures

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

- 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.

4.4.3 Public Involvement Program

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.

Public Information Repositories. The Laboratory and ER Project maintain several information repositories for public use in Los Alamos and surrounding communities. These repositories are listed in Section 7.2.2. In general, they contain ER Project plans and reports expected to be of interest to the public, whereas, the RPF contains the backup documentation. Detailed information on the kinds of materials available in the public information repositories may be obtained from the points of contact given in Section 7.2.2.

Sensitive Documents. Documents not subject to public access are those that fall under sensitive categories (such as attorney work product, attorney-client privileged documents, and personal information) and documents that have no direct relevance to making a decision. However, even documents that are unavailable for public review are listed in the AR Electronic Index for the public's information at the Laboratory's Community Relations Office and Reading Room. In the case of legally privileged or otherwise sensitive records, it may be necessary to summarize these records. These actions are taken with the advice and cooperation of the Laboratory's Legal Counsel Office and the Security and Safeguards Division.

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 1998, 58714) 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 projectwide.

This Chapter 5 of the 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, (2) the HASP contains several appendices that are cited in this chapter but have not been included in the IWP, and (3) to meet new requirements and changing project needs, the HASP is continuously updated; the IWP will be updated to reflect changes that occur in the HASP.

In addition to the generic guidance published in this chapter, a site-specific health and safety plan (SSHASP) will be 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 potential release site (PRS) or group of PRSs. 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 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 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 Part 1910 of Title 29 of the Code of Federal Regulations [CFR]). 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.

health and safety responsibilities of the FAPL, or his/her delegate, include

- managing H&S activities of his/her focus area;
- serving as the final authority for resolving H&S issues concerning his/her focus area;
- ensuring that the necessary SSHASPs for his/her focus area are developed and that the comments of the focus area H&S representative and any other appropriate parties have been incorporated;
- ensuring that each individual performing ER work at his/her focus area is qualified in accordance with applicable H&S requirements;
- ensuring that on-site personnel abide by applicable H&S programs, procedures, plans, and applicable regulations;
- having the authority to ban personnel who do not abide by applicable H&S requirements from performing field operations;
- conducting inspections as required by Section 12.1 in the ER HASP; and
- ensuring the submittal of appropriate field project H&S records to the Laboratory's Records-Processing Facility (RPF).

Field Team Manager

The field team manager, who may be either a Laboratory staff member or contractor, reports to the FAPL and is the line manager of one or more field teams. Specific H&S responsibilities of the field team manager, or delegate, include

- coordinating with the FAPL to ensure that provisions of the HASP, SSHASP, and other applicable H&S regulations are implemented for assigned field operations;
- ensuring that all known tasks and personnel have been identified sufficiently in the SSHASP;
- coordinating with the FAPL to ensure that each concerned party has reviewed the SSHASP for accuracy and adequacy in accordance with Section 5.1.2, that review comments are resolved, and that the SSHASP is signed before any field activities are begun;
- coordinating with the FAPL to ensure that only personnel qualified in accordance with applicable H&S requirements are used to perform ER Project work;
- coordinating with the FAPL and the focus area H&S representative to select qualified H&S and health physics personnel;
- coordinating with the FAPL to ensure that the necessary permits have been obtained before commencing field operations;

Other On-site Supervisory Personnel

For field teams involving multiple employers, each employer's on-site supervisory representative is responsible for ensuring that provisions of the HASP, SSHASP, and other applicable H&S requirements are observed by his/her employees during field operations. These supervisors are responsible for cooperating with the field team leader and site safety officer to resolve H&S matters that affect site personnel and/or operations.

(b) Field Teams

Field team members are responsible for performing their work in a safe and healthful manner. They also are responsible for abiding by the requirements of the HASP, SSHASP, 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 may unreasonably compromise the safety or health of an individual or the environment, such a concern should be brought to the attention of an immediate supervisor, the site safety officer, or the field team leader. When an H&S concern is not resolved adequately by field supervisors, the matter should be brought to the attention of the field team manger or focus area H&S representative, and, subsequently, the FAPL if necessary. If adequate resolution still has not been achieved, team members are encouraged to call the Laboratory's ESH Division hotline at 665-5010 or to contact the Los Alamos DOE Area Office at 1(800) 688-5713, where they may file a complaint form. DOE has a policy that employees who report a health and safety problem are protected from reprisal.

5.2.1.2 Health and Safety Personnel

Site Safety Officer

The site safety officer assists the field team leader in seeing that the provisions of the HASP, SSHASP, and other applicable H&S requirements are observed in the field and serves as the primary contact in the field for H&S matters. The site safety officer shall be qualified, on a project-specific basis, to recognize and evaluate hazards and to minimize and mitigate occupational H&S hazards. The site safety officer may perform other duties on the field team, provided that these duties do not compromise the performance of his/her site safety officer duties. The specific responsibilities of the site safety officer are to

- assist with developing the SSHASP;
- verify that on-site personnel have current certification of the applicable training and medical surveillance requirements of Sections 10 and 11 of the HASP and SSHASP (Sections 10 and 11);
- assist the field team leader in effectively implementing the HASP and SSHASP in accordance with applicable federal, state, and local H&S regulatory requirements;
- notify the field team 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 in accordance with applicable H&S requirements;

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," evoked by the Laboratory, Occupational Safety and Health Act (OSHA) uses the terms "competent" and "qualified" to denote specially trained and knowledgeable individuals who are required to perform certain functions. These specific standards are cited as applicable throughout the HASP and SSHASP. Whenever requirements exist in these standards for participation of a competent or qualified person, the person shall be trained and knowledgeable about the particular regulated subject matter in accordance with the health and safety provisions of 29 CFR 1926.32(f) or (m), the applicable regulatory standard.

5.2.1.3 Health Physics Personnel

Health physics personnel include radiological screening personnel, health physics technicians, and radiological control technicians. These field team members are the primary source of information and guidance about radiation protection. They shall ensure compliance with the radiological requirements of the SSHASP and conduct monitoring per the radiological surveillance authorization agreement issued by the Laboratory's Health Physics Operations Group (ESH-1) and the terms of the SSHASP. If non-ESH-1 personnel perform these roles, ESH-1 must preapprove personnel and issue a radiological surveillance authorization agreement before any work is performed.

Radiological Screening Personnel

Radiological screening personnel are responsible for providing health physics monitoring support for the field team. Each radiological screening person is responsible for performing health physics monitoring support in accordance with his/her radiological surveillance authorization agreement. Specific responsibilities include

- performing and documenting radiological surveys,
- performing conditional equipment release 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 ESH-1 when an employee has been contaminated above action levels,
- providing ESH-1 personnel who oversee the ER Project with a daily verbal summary of site radiological conditions and copies of all radiological survey documentation, and
- notifying ESH-1 when action levels defined in the SSHASP have been reached.

- 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;

- reviewing and approving SSHASPs and modification forms for ER work at his/her assigned focus area(s); and

- verifying that field operations associated with his/her focus area(s) are conducted in accordance with applicable H&S programs, plans, and regulatory requirements.

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] of Subpart P, Excavations).

ESH-1 Personnel

ESH-1 will designate ESH-1 personnel to provide radiological control support to the ER Project. In cases requiring immediate involvement by ESH-1 personnel, the field team leader or delegate may request direct ESH-1 participation. Such participation may include site visitation, the frequency of which will depend on the specific operations and radiological conditions occurring at the site. The responsibilities of the ESH-1 representative include

- performing reviews to ensure that the radiological safety program is in compliance with the Laboratory's Radiological Control Manual (LANL 1994, 59928) and applicable Laboratory requirements;

- ensuring that survey methods and equipment are appropriate for the type of radiological contamination expected and for current site conditions;

- providing direct support to field health physics personnel, when requested;

- ensuring that radiological controls are implemented in accordance with the radiological work permit (if any), the SSHASP, the Laboratory's Radiological Control Manual (LANL 1994, 59928), and any other applicable Laboratory requirements;

- ensuring that radiological surveys are performed and documented in accordance with required ESH-1 procedures;

- performing radiological surveys before the start and at the completion of field activities;

- providing guidance for radiological decontamination of equipment and personnel;

- taking the actions indicated in Table 4-3 and Section 6 of the SSHASP upon notification that the action levels given in the table have been reached;

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 shall not be required to provide the initial training requirements of Sections 10.5.3 or 10.5.4 of the HASP. They shall 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 field work for periods determined by expected exposure:
  - initial 40 hours of training and 24 hours of supervised field work (for areas in which contaminant concentrations may exceed exposure limits) or
  - initial 24 hours of training and 8 hours of supervised field work (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 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), "Hazardous Waste Operations and Emergency Response," the site safety officer shall conduct training on the contents of the SSHASP before field work 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 shall cover the contents of the SSHASP and applicable portions of the HASP.

- Radiological Worker II training, and
- waste generator and waste management training.

5.2.3 Medical Surveillance

Before the field 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 shall be specified in Section 11 of the SSHASP.

A written medical surveillance program that complies with the requirements of this section shall 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 PRS(s).

5.4 Hazard Assessment

Hazard assessment is the process of identifying and evaluating the hazards associated with operational activities. Evaluation and identification of hazards should occur

- during pre-operational planning of ER field work,
- 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.

chemical are included in Table 4-3 of the SSHASP. This table shall also 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; and animal attacks. These hazards have been assessed by ESH-5 with input from the Laboratory's Occupational Medicine Group (ESH-2), assuming variable exposure conditions on a projectwide 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" 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, shall be provided in Table 5 of the SSHASP. Site maps required by OSHA shall be included in Appendix A of the SSHASP to show the intended locations of the specified

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 shall be submitted to the focus area 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 shall 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 focus area H&S representative for distribution to the appropriate ESH group(s).

Visitor Policy

A visitor (e.g., regulatory personnel, property owners, field auditors, and the public) is anyone who arrives at the work site who is not identified as a field team member or who does not appear in

Site-specific exposure-monitoring strategies, including action levels, that meet applicable DOE and OSHA requirements shall be specified in Section 6 of the SSHASP for each project task having different requirements. Exposure-monitoring strategies, including establishment of action levels, should be 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 radioactive substances of concern. This information shall be included in Appendix C of the SSHASP for the chemical substances of occupational concern included in Table 4-2 of the SSHASP and is included 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 shall include use of direct-reading instruments, personal dosimetry, 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], "Hazardous Waste Operations and Emergency Response") 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. These methods are provided in the ER Project's Health and Safety Activities Manual (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 shall be specified in Section 6 of the SSHASP. Project managers 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 shall 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 shall use radiological instrumentation calibrated and maintained by the Health Physics Measurement Group (ESH-4). Subcontractors shall 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 shall be monitored for release in accordance with the health physics representative's radiological surveillance authorization agreement.

inspection, and maintenance of personal protective equipment (ER Project's 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 shall be specified, as applicable, in Section 7 of the SSHASP. Personnel who use ANTI-Cs shall 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 shall be reassessed by the site safety officer, and a SSHASP modification form shall 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 should make it a practice not to use personal protective equipment that shows signs of compromised integrity. The site safety officer shall monitor individuals in areas where personal protective equipment is required to ensure that they are properly attired.

Respiratory Protective Equipment

Use of respiratory protection shall occur 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 shall be specified, as applicable, in Section 7 of the SSHASP. Personnel required to use respirators shall have certification of current training, medical fitness, and respirator fit testing in accordance with these requirements, which are listed below and are summarized in Section 7.1 of the HASP. Contractors whose employees use respiratory protective equipment to perform ER Project work shall provide documentation to support compliance with each aspect of the mandated standards:

- designated qualified person,
- implementation of administrative and engineering controls,
- use of approved equipment,
- SOPs,
- respirator user's medical status,
- training,
- fit testing,
- work area surveillance,
- cleaning and disinfection,
- inspection and repair,

- Rinse water and waste generated on-site shall 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 shall be included in Section 9 of the SSHASP. Any deviations or exceptions to this section shall be described in Section 9 of the SSHASP.

This section has been developed to meet the requirements of 29 CFR 1926.24 and 1926.65(l), and, as applicable, 29 CFR 1926.65(q) or 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's Health and Safety Activities 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 field work, 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 field team leader, assisted by the site safety officer, shall direct and coordinate 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 only allowed to

- 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's 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 focus area H&S representative. In the event of an occurrence necessitating medical care, the field team leader shall arrange for notification of the key personnel listed in Appendix D of the SSHASP (i.e., other line managers, the focus area 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, shall 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 shall keep a daily record of H&S-related events in a bound logbook and shall verify employee training and medical surveillance records in accordance with Section 13.2 of the HASP. Health physics personnel shall 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 shall be provided to the field team manager at the close of the project, who will provide them to the FAPL for storage at the RPF.

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) for access to employee

For purposes of follow-up investigation of an accident or incident, the employee's consent for the investigator(s) to access his/her records shall 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's 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 shall provide a copy of the notification form to the subject employee and to his/her supervisor. These records shall be maintained in confidence in accordance with the requirements of Section 5.8. The original form shall be retained with other original site records. When it is necessary to communicate the results of exposure monitoring to others, it shall 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 shall be processed as specified in Section 9.4 of the ER Project HASP.

6.0 WASTE MANAGEMENT PLAN

6.1 Introduction

The Environmental Restoration (ER) Project generates waste during the corrective action processing 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, become regulated wastes. Removal of contaminants resulting from the above described activities lead to the generation of various types of waste regulated by the Resource Conservation and Recovery Act (RCRA), Toxic Substance 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).

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 the 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.

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 Environment, Safety, and Health [ESH] Division) for review and waste classification before waste is generated. 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, Chapter 4, Part

include packaging, labeling, characterization, short-term storage, generator treatment, and shipment of wastes.

The remaining parts of this section contain descriptions of common waste generating operations, definitions for commonly generated wastes, and a description of the record keeping procedures.

6.3.1 Waste Types

Wastes are generated from several primary ER 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 the 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 wastes, which are placed in containers and characterized based on direct sampling results and/or acceptable knowledge to determine the waste classification and appropriate management approach. Wastewaters that have been sampled 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 used, 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 soil contamination 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

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 gallons of hazardous mixed waste or 1 quart 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 will be 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) LDR 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 will be archived for each potential release site (PRS). 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 activities.

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 the Hazardous and Solid Waste Amendments (HSWA) portion (the HSWA Module) of Los Alamos National Laboratory's (Laboratory's) permit to operate under the Resource Conservation and Recovery Act (RCRA), the Environmental Restoration (ER) Project must adopt a community relations plan. The first edition of the ER Project's Installation Work Plan (IWP) (LANL 1990, 7517; 7518; 7519) included the original plan. That plan has evolved into a public involvement plan, which addresses the requirements specified in Section Q, Task II,D of the HSWA Module. This plan emphasizes early public participation in developing recommendations for ER Project activities.

The goal of public involvement is to provide the public with the opportunity to advise the ER Project on its cleanup activities. To create trust in the community, public involvement efforts must build long-term relationships based on accessibility and open communication. Key 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 has the lead responsibility for presenting understandable and consistent information to interested parties during the investigation and cleanup of ER Project sites. The team keeps the Laboratory's Community Relations Office and Public Affairs Office apprised of ER efforts and works with them on related public involvement efforts.

In 1993, the DOE, the Laboratory, and the ER Project created a working group to look at ways of increasing public participation in the ER Project. In February 1994, the working group invited members of the public to brainstorm informally about ways to obtain more effective public participation. Many of their ideas and suggestions were implemented, and in 1995, the "Plan for Increasing Public Participation in Cleanup Decisions for the Los Alamos National Laboratory" was finalized.

The specific objectives of the public participation plan are to

- give the public the information it needs to understand the ER Project's cleanup issues and provide informed input;
- make information readily available to the public;

public's involvement, the ER Project will prioritize PRSs 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 consist of progress reports; news releases; informal handouts for tours; and information sheets that include history when appropriate, 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 team maintains a home page 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 citizens may participate more knowledgeably in the decision-making process. The ER Project maintains communication with the public in several ways. The team notifies the public of community meetings, tours, and related programs through mailings from the Laboratory's facility mailing list (to be updated annually); public service announcements on local radio stations; publications in local newspapers (*Albuquerque Journal North, Santa Fe New Mexican, Rio Grande Sun, Taos News, and Los Alamos Monitor);* and information on the World Wide Web site. Dialogue with members of the public is provided through meetings of the Northern New Mexico Citizens' Advisory Board and meetings with various civic organizations.

The Laboratory's Public Reading Room in Los Alamos (phone: 505-665-4400 or 800-508-4400) is a repository for documents about the Laboratory's activities that are of interest to the public, including documents pertaining to the ER Project. 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, and the Office of the Governor of the San Ildefonso Pueblo.

Other information provided to members of the public includes notification of newly discovered off-site releases that might impact members of surrounding communities (e.g., San Ildefonso Pueblo). 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 has replaced formal meetings, except when required by regulation, with less formal meetings with community members, such as round-table discussions, site tours, 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

References for Chapter 7

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, ER ID 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, ER ID 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, ER ID 7519)

Descriptions of Technical Areas at Los Alamos National Laboratory

IWP
LA-UR-98-4652
November 1998

DESCRIPTIONS OF TECHNICAL AREAS AT LOS ALAMOS NATIONAL LABORATORY

The locations of the technical areas (TAs) operated by Los Alamos National Laboratory (the Laboratory) in Los Alamos County are shown in Chapter 2, Figure 2-2. The brief descriptions of activities conducted at the various TAs are from the Laboratory's 1990 Site Development Plan (Facilities Engineering Division Planning Group et. al. 1990, 57223).

Development Areas

Most Laboratory functions, about three-fifths of the land, and 93% of the population are concentrated in the following eight development areas. Each is composed of various TAs as indicated below.

Core Area and Two-Mile Mesa North
(TAs 3, 43, 58, 59, 62)
This development area includes the central technical, administrative, and physical support facilities of the Laboratory as well as experimental science and theoretical/computational science land uses.

Two-Mile Mesa South
(TAs 6, 22, 40)
This development area is presently used for the research and testing of special detonators and high-explosive systems and as a buffer zone for this function. Large portions of this development area therefore remain undeveloped.

Pajarito Corridor West
(TAs 35, 48, 50, 52, 55, 63, 64, 66)
Experimental science and special nuclear materials (SNM) land uses, which include radiochemistry, nuclear safeguards studies, analytical chemistry, reactor development, waste management, and plutonium processing occur in this development area.

Pajarito Corridor Central
(TAs 18, 46, 51, 65)
This development area includes experimental science land uses where research is performed in chemistry, photochemistry, solar energy, biological exposure effects, and nuclear chain reaction behavior.

East Jemez Corridor and Sigma Mesa
(TAs 2, 41, 60, 61)
This development area is used primarily for physical support and infrastructure land use activities and is the site of the existing sanitary landfill. The Omega West reactor is located in Los Alamos Canyon, as are special nuclear materials land uses involving the engineering design of nuclear components. It is also the location of lands leased to construction contractors and the privately owned Royal Crest Trailer Park.

Weapons Engineering
(TA-16)
This development area is dedicated to high-explosives research, development, and testing land uses. Functions at this site include engineering design, prototype manufacture, processing, and environmental testing of nuclear weapon warhead systems. Because TAs 11, 28, and 37 are not the focus of growth, they are not included in this development area, but are discussed elsewhere in this plan.

TA-57, Fenton Hill Site: This technical area is located west of the Laboratory in the Jemez Mountains. It is the site of the geothermal energy recovery (Hot Dry Rock) project. The Laboratory may decide to convert this demonstration operation to a seismic research facility.

TA-69: Located at the entry to TAs 6, 8, 9, 22, and 58, this technical area is suitable for future physical support and experimental science uses that have close functional ties to those technical areas. This area also provides an environmental buffer.

TAs 70 and 71: These undeveloped buffer areas are located southwest of White Rock between the Rio Grande and New Mexico Route 4. They are reserved for future large-scale experimental science.

TA-72: This undeveloped land along East Jemez Road and NM 502 may offer expansion opportunities for TA-53 related projects.

TA-73: This is the Los Alamos Airport and an adjacent buffer area along the south side of East Road.

TA-74, Otowi Tract: This large area, bordering San Ildefonso Pueblo on the east, is isolated form most of the Laboratory and contains significant concentrations of archaeological sites and an endangered species breeding area.

Potential Release Sites at Los Alamos National Laboratory

Table B-1	Los Alamos Environmental Restoration Potential Release Sites Under Investigation	B-1
Table B-2	Los Alamos Environmental Restoration Potential Release Sites Investigation Complete and Removed from Project	B-34

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1	00-001	Yes	Sediment Traps, Mortandad	Canyon	1049
2	00-003	Yes	Container storage, Western Steam Plant	Remedial Action	1071
3	00-004	No	Container storage, 6th St. Warehouses	Remedial Action	1071
4	00-005	Yes	Landfill	Remedial Action	1071
5	00-010(b)	No	Surface disposal site, 6th St. Warehouses	Remedial Action	1071
6	00-011(a)	Yes	Mortar impact area	Remedial Action	1071
7	00-011(c)	Yes	Mortar impact area	Remedial Action	1071
8	00-011(d)	Yes	Mortar impact area	Remedial Action	1071
9	00-011(e)	Yes	Mortar impact area	Remedial Action	1071
10	00-012	Yes	Underground tank, Western Steam Plant	Remedial Action	1071
11	00-016	Yes	Firing range	Remedial Action	1071
12	00-017	Yes	Waste lines	Remedial Action	1071
13	00-018(a)	Yes	Sludge bed, wastewater treatment plant, Pueblo (decommissioned)	Remedial Action	1071
14	00-018(b)	No	Sludge bed, wastewater treatment plant, Bayo (active)	Remedial Action	1071
15	00-019	Yes	Wastewater treatment plant, Central	Remedial Action	1071
16	00-027	No	Storage area, DP Road	Remedial Action	1071
17	00-028(a)	Yes	Effluent discharge, golf course	Remedial Action	1071
18	00-028(b)	Yes	Effluent discharge, ball fields	Remedial Action	1071
19	00-029(a)	No	Transformer	Remedial Action	1071
20	00-029(b)	No	Transformer	Remedial Action	1071
21	00-029(c)	No	Transformer	Remedial Action	1071
22	00-030(a)	Yes	Septic system, DP Road	Remedial Action	1071
23	00-030(b)	Yes	Septic system 6th St	Remedial Action	1071
24	00-030(c)	No	Septic system	Remedial Action	1071
25	00-030(d)	No	Septic system	Remedial Action	1071
26	00-030(e)N	No	Septic system	Remedial Action	1071
27	00-030(e)S	No	Septic system	Remedial Action	1071
28	00-030(f)	No	Septic system	Remedial Action	1071
29	00-030(g)	Yes	Septic system (near old Catholic Church parking lot)	Remedial Action	1071
30	00-030(h)	No	Septic system (near new Catholic Church)	Remedial Action	1071
31	00-030(i)	No	Septic system	Remedial Action	1071
32	00-030(j)	No	Septic system	Remedial Action	1071
33	00-030(k)	No	Septic system	Remedial Action	1071
34	00-030(l)	Yes	Septic system, 6th St. Warehouses	Remedial Action	1071
35	00-030(m)	Yes	Septic system, 6th St. Warehouses	Remedial Action	1071
36	00-030(n)	No	Septic system	Remedial Action	1071
37	00-030(o)	No	Septic system	Remedial Action	1071
38	00-030(p)	No	Septic system	Remedial Action	1071
39	00-030(q)	No	Septic system	Remedial Action	1071
40	00-031(a)	No	Soil contamination beneath former service station	Remedial Action	1071
41	00-031(b)	No	Soil contamination beneath former motorpool (two USTs)	Remedial Action	1071
42	00-032	No	Soil contamination beneath former motorpool (UST for used motor oil)	Remedial Action	1071
43	00-033(a)	Yes	Warehouses, 6th Street (UST removal)	Remedial Action	1071
44	00-033(b)	No	Outlet piping 6th Street Warehouse	Remedial Action	1071
45	00-034(a)	No	Landfill, Eastern Area	Remedial Action	1071
46	00-034(b)	No	Landfill, Western Area	Remedial Action	1071
47	00-039	Yes	Underground tanks	Remedial Action	1071
48	01-001(a)	Yes	Septic tank 134	Remedial Action	1078

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
			TA 2-56		
101	02-004(e)	No	Reactor facility acid pit TA 2-53	Canyon	1098
102	02-004(f)	No	Reactor facility equipment building	Canyon	1098
103	02-004(g)	No	Aboveground tank	Canyon	1098
104	02-005	Yes	Systematic leak, cooling tower blowdown, Cr	Canyon	1098
105	02-006(a)	Yes	Ind. or san. wastewater treat.	Canyon	1098
106	02-006(b)	Yes	Ind. or san. wastewater treat.	Canyon	1098
107	02-006(c)	No	Waste line	Canyon	1098
108	02-006(d)	No	Waste line	Canyon	1098
109	02-006(e)	No	Waste line	Canyon	1098
110	02-007	Yes	Septic system	Canyon	1098
111	02-008(a)	Yes	Outfall	Canyon	1098
112	02-008(b)	Yes	Ind. or san. wastewater treat.	Canyon	1098
113	02-008(c)	No	Outfall	Canyon	1098
114	02-009(a)	Yes	Non-intentional release	Canyon	1098
115	02-009(b)	Yes	Non-intentional release	Canyon	1098
116	02-009(c)	Yes	Non-intentional release	Canyon	1098
117	02-009(d)	No	Non-intentional release	Canyon	1098
118	02-009(e)	No	Reactor facility	Canyon	1098
119	02-010	No	Building	Canyon	1098
120	02-011(a)	No	Storm drain and outfall	Canyon	1098
121	02-011(b)	No	Storm drain and outfall	Canyon	1098
122	02-011(c)	No	Storm drain and outfall	Canyon	1098
123	02-011(d)	No	Storm drain and outfall	Canyon	1098
124	02-011(e)	No	Storm drain and outfall	Canyon	1098
125	02-012	No	Underground tanks, former TA 2-29 and former 2-67 replaced w 2-1	Canyon	1098
126	03-001(a)	Yes	<90 day storage	Remedial Action	1114
127	03-001(b)	Yes	Satellite accumulation area	Remedial Action	1114
128	03-001(c)	Yes	<90 day storage	Remedial Action	1114
129	03-001(d)	No	Satellite accumulation area	Remedial Action	1114
130	03-001(e)	No	<90 day storage	Remedial Action	1114
131	03-001(f)	No	<90 day storage	Remedial Action	1114
132	03-001(g)	No	Satellite accumulation area	Remedial Action	1114
133	03-001(h)	No	Satellite accumulation area	Remedial Action	1114
134	03-001(i)	No	Satellite accumulation area	Remedial Action	1114
135	03-001(j)	No	Satellite accumulation area	Remedial Action	1114
136	03-001(k)	Yes	Storage pad	Remedial Action	1114
137	03-001(l)	No	<90 day storage	Remedial Action	1114
138	03-001(n)	No	Satellite accumulation area	Remedial Action	1114
139	03-001(o)	No	Waste container	Remedial Action	1114
140	03-001(q)	No	Satellite accumulation area	Remedial Action	1114
141	03-001(s)	No	Satellite accumulation areas	Remedial Action	1114
142	03-001(t)	No	Satellite accumulation area	Remedial Action	1114
143	03-001(u)	No	Satellite accumulation area	Remedial Action	1114
144	03-001(v)	No	Satellite accumulation area	Remedial Action	1114
145	03-001(w)	No	Satellite accumulation area	Remedial Action	1114
146	03-001(x)	No	Satellite accumulation area	Remedial Action	1114
147	03-001(y)	No	Satellite accumulation area	Remedial Action	1114
148	03-002(a)	Yes	Container storage area	Remedial Action	1114
149	03-002(b)	Yes	Storage area	Remedial Action	1114
150	03-002(c)	Yes	Storage area	Remedial Action	1114
151	03-002(d)	Yes	Container storage area	Remedial Action	1114

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
205	03-014(i)	Yes	Wastewater treatment facility	Remedial Action	1114
206	03-014(j)	Yes	Wastewater treatment facility	Remedial Action	1114
207	03-014(k)	Yes	Wastewater treatment facility	Remedial Action	1114
208	03-014(l)	Yes	Wastewater treatment facility	Remedial Action	1114
209	03-014(m)	Yes	Wastewater treatment facility	Remedial Action	1114
210	03-014(n)	Yes	Wastewater treatment facility	Remedial Action	1114
211	03-014(o)	Yes	Wastewater treatment facility	Remedial Action	1114
212	03-014(p)	Yes	Wastewater treatment facility	Remedial Action	1114
213	03-014(q)	Yes	Wastewater treatment facility	Remedial Action	1114
214	03-014(r)	Yes	Wastewater treatment facility	Remedial Action	1114
215	03-014(s)	Yes	Wastewater treatment facility	Remedial Action	1114
216	03-014(t)	Yes	Wastewater treatment facility	Remedial Action	1114
217	03-014(u)	Yes	Wastewater treatment facility	Remedial Action	1114
218	03-014(v)	No	Wastewater treatment facility	Remedial Action	1114
219	03-014(w)	No	Wastewater treatment facility	Remedial Action	1114
220	03-014(x)	No	Wastewater treatment facility	Remedial Action	1114
221	03-014(y)	No	Wastewater treatment facility	Remedial Action	1114
222	03-014(z)	No	Wastewater treatment facility	Remedial Action	1114
223	03-015	Yes	Outfall	Remedial Action	1114
224	03-016(a)	No	Septic system	Remedial Action	1114
225	03-016(b)	No	Septic system	Remedial Action	1114
226	03-016(c)	No	Septic system	Remedial Action	1114
227	03-016(d)	No	Septic system	Remedial Action	1114
228	03-016(e)	No	Septic system	Remedial Action	1114
229	03-016(f)	No	Septic system	Remedial Action	1114
230	03-018	Yes	Septic system	Remedial Action	1114
231	03-019	Yes	Septic tank	Remedial Action	1114
232	03-020(a)	Yes	Disposal pit	Remedial Action	1114
233	03-021	Yes	Surface disposal site	Remedial Action	1114
234	03-022	No	Sump	Remedial Action	1114
235	03-023	No	Sump	Remedial Action	1114
236	03-025(a)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
237	03-025(b)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
238	03-025(c)	No	Tank and/or assoc. equipment	Remedial Action	1114
239	03-026(a)	No	Sump	Remedial Action	1114
240	03-026(b)	Yes	Sumps	Remedial Action	1114
241	03-026(c)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
242	03-026(d)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
243	03-027	No	Separation site	Remedial Action	1114
244	03-028	Yes	Surface impoundment	Remedial Action	1114
245	03-029	Yes	Landfill	Remedial Action	1114
246	03-030	No	Surface impoundment	Remedial Action	1114
247	03-031	Yes	Tank and/or assoc. equipment	Remedial Action	1114
248	03-032	Yes	Tank and/or assoc. equipment	Remedial Action	1114
249	03-033	Yes	Sump	Remedial Action	1114
250	03-034(a)	Yes	Tank and/or assoc. equipment, radioactive liquid waste tanks	Remedial Action	1114
251	03-034(b)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
252	03-035(a)	Yes	Underground tank	Remedial Action	1114
253	03-035(b)	Yes	Underground storage tank	Remedial Action	1114
254	03-036(a)	Yes	Aboveground tanks	Remedial Action	1114
255	03-036(b)	No	Aboveground tanks	Remedial Action	1114
256	03-036(c)	Yes	Aboveground tanks	Remedial Action	1114
257	03-036(d)	Yes	Aboveground tanks	Remedial Action	1114

Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
310	03-049(d)	Yes	Outfall	Remedial Action	1114
311	03-049(e)	Yes	Outfall	Remedial Action	1114
312	03-050(a)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
313	03-050(b)	No	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
314	03-050(c)	No	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
315	03-050(d)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
316	03-050(e)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
317	03-050(f)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
318	03-050(g)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
319	03-051(a)	No	Soil contamination (oil from leaking compressor)	Remedial Action	1114
320	03-051(b)	No	Soil contamination (oil from leaking compressor)	Remedial Action	1114
321	03-051(c)	No	Soil contamination (vacuum pump leaking)	Remedial Action	1114
322	03-051(d)	No	Soil contamination (oil from leaking compressor)	Remedial Action	1114
323	03-052(a)	Yes	Storm drainage	Remedial Action	1114
324	03-052(b)	No	Storm drainage	Remedial Action	1114
325	03-052(c)	Yes	Storm drainage	Remedial Action	1114
326	03-052(d)	No	Storm drainage (non-PCB transformers/capacitors)	Remedial Action	1114
327	03-052(e)	Yes	Storm drainage	Remedial Action	1114
328	03-052(f)	Yes	Storm drainage	Remedial Action	1114
329	03-053	No	Operational facility	Remedial Action	1114
330	03-054(a)	Yes	Outfall	Remedial Action	1114
331	03-054(b)	Yes	Outfall	Remedial Action	1114
332	03-054(c)	Yes	Outfall	Remedial Action	1114
333	03-054(d)	Yes	Outfall	Remedial Action	1114
334	03-054(e)	Yes	Outfall	Remedial Action	1114
335	03-055(a)	Yes	Outfall	Remedial Action	1114
336	03-055(c)	Yes	Outfall	Remedial Action	1114
337	03-055(d)	Yes	Outfall	Remedial Action	1114
338	03-056(a)	Yes	Storage area	Remedial Action	1114
339	03-056(b)	No	Container storage area	Remedial Action	1114
340	03-056(c)	Yes	Transformer storage area	Remedial Action	1114
341	03-056(d)	Yes	Drum storage	Remedial Action	1114
342	03-056(e)	No	Satellite accumulation area	Remedial Action	1114
343	03-056(f)	No	Drum storage	Remedial Action	1114
344	03-056(g)	No	Satellite accumulation area	Remedial Action	1114
345	03-056(h)	No	Transformer storage area	Remedial Action	1114
346	03-056(i)	No	Drum storage	Remedial Action	1114
347	03-056(j)	No	Storage area	Remedial Action	1114
348	03-056(k)	No	Container storage area	Remedial Action	1114
349	03-056(l)	Yes	Drum storage	Remedial Action	1114
350	03-056(m)	Yes	Drum storage	Remedial Action	1114
351	03-056(n)	Yes	Drum storage	Remedial Action	1114
352	03-057	No	Sump/Grease trap	Remedial Action	1114

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
407	08-004(d)	Yes	Drain	Remedial Action	1157
408	08-005	Yes	Container storage area	Remedial Action	1157
409	08-006(a)	Yes	Material disposal area (MDA Q) Land fill	Remedial Action	1157
410	08-006(b)	Yes	Landfill [duplicate of 8-006(a) (MDA Q)]	Remedial Action	1157
411	08-007	Yes	Silver recovery unit	Remedial Action	1157
412	08-009(a)	Yes	Ind. or san. wastewater treat.	Remedial Action	1157
413	08-009(c)	No	Storm drain and outfall	Remedial Action	1157
414	08-009(d)	Yes	Ind. or san. wastewater treat.	Remedial Action	1157
415	08-009(e)	Yes	Ind. or san. wastewater treat.	Remedial Action	1157
416	08-009(f)	No	Outfall	Remedial Action	1157
417	09-001(a)	Yes	Firing sites	Remedial Action	1157
418	09-001(b)	Yes	Firing sites	Remedial Action	1157
419	09-001(c)	Yes	Firing sites	Remedial Action	1157
420	09-001(d)	Yes	Firing sites	Remedial Action	1157
421	09-002	Yes	Burn pit	Remedial Action	1157
422	09-003(a)	Yes	Settling tank	Remedial Action	1157
423	09-003(b)	Yes	Settling tank	Remedial Action	1157
424	09-003(c)	Yes	Electric manhole	Remedial Action	1157
425	09-003(d)	Yes	Settling tank	Remedial Action	1157
426	09-003(e)	Yes	Settling tank	Remedial Action	1157
427	09-003(f)	Yes	Settling tank	Remedial Action	1157
428	09-003(g)	Yes	Settling tank	Remedial Action	1157
429	09-003(h)	Yes	Settling tank	Remedial Action	1157
430	09-003(i)	Yes	Settling tank	Remedial Action	1157
431	09-004(a)	Yes	Settling tank	Remedial Action	1157
432	09-004(b)	Yes	Settling tank	Remedial Action	1157
433	09-004(c)	Yes	Settling tank	Remedial Action	1157
434	09-004(d)	Yes	Settling tank	Remedial Action	1157
435	09-004(e)	Yes	Settling tank	Remedial Action	1157
436	09-004(f)	Yes	Settling tank	Remedial Action	1157
437	09-004(g)	Yes	Settling tank	Remedial Action	1157
438	09-004(h)	Yes	Settling tank	Remedial Action	1157
439	09-004(i)	Yes	Settling tank	Remedial Action	1157
440	09-004(j)	Yes	Settling tank	Remedial Action	1157
441	09-004(k)	Yes	Settling tank	Remedial Action	1157
442	09-004(l)	Yes	Settling tank	Remedial Action	1157
443	09-004(m)	Yes	Settling tank	Remedial Action	1157
444	09-004(n)	Yes	Settling tank	Remedial Action	1157
445	09-004(o)	Yes	Settling tank	Remedial Action	1157
446	09-005(a)	Yes	Septic system	Remedial Action	1157
447	09-005(b)	Yes	Septic system	Remedial Action	1157
448	09-005(c)	Yes	Septic system	Remedial Action	1157
449	09-005(d)	Yes	Septic system	Remedial Action	1157
450	09-005(e)	Yes	Septic system	Remedial Action	1157
451	09-005(f)	Yes	Septic system	Remedial Action	1157
452	09-005(g)	Yes	Septic system	Remedial Action	1157
453	09-005(h)	Yes	Septic system	Remedial Action	1157
454	09-006	Yes	Septic system	Remedial Action	1157
455	09-007	Yes	Basket pit	Remedial Action	1157
456	09-008(b)	Yes	Surface impoundment	Remedial Action	1157
457	09-009	Yes	Surface impoundment	Remedial Action	1157
458	09-010(a)	No	Storage area	Remedial Action	1157
459	09-010(b)	No	Storage area	Remedial Action	1157
460	09-011(b)	No	Storage area	Remedial Action	1157

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
515	11-011(c)	Yes	Ind. or san. wastewater treat.	Remedial Action	1082
516	11-011(d)	Yes	Ind. or san. wastewater treat.	Remedial Action	1082
517	11-012(a)	No	Building	Remedial Action	1082
518	11-012(b)	No	Building	Remedial Action	1082
519	11-012(c)	No	Building	Remedial Action	1082
520	11-012(d)	No	Building	Remedial Action	1082
521	12-001(a)	Yes	Firing site, steel lined chamber	Remedial Action	1085
522	12-001(b)	Yes	Firing site (former)	Remedial Action	1085
523	12-002	Yes	Open burning ground	Remedial Action	1085
524	12-004(a)	No	Radiation test facility	Remedial Action	1085
525	12-004(b)	No	Pipe	Remedial Action	1085
526	13-001	Yes	Firing site	Remedial Action	1082
527	13-002	Yes	Landfill	Remedial Action	1082
528	13-003(a)	Yes	Septic tank same as 16-005(i)	Remedial Action	1082
529	13-003(b)	No	Septic system	Remedial Action	1082
530	13-004	Yes	Disposal pit	Remedial Action	1082
531	14-001(a)	No	Firing site	Remedial Action	1085
532	14-001(b)	No	Firing site	Remedial Action	1085
533	14-001(c)	No	Firing site	Remedial Action	1085
534	14-001(d)	No	Firing site	Remedial Action	1085
535	14-001(e)	No	Firing site	Remedial Action	1085
536	14-001(f)	No	Firing site-Bullet Test Facility	Remedial Action	1085
537	14-001(g)	No	Firing site (active)	Remedial Action	1085
538	14-002(a)	Yes	Firing site	Remedial Action	1085
539	14-002(b)	Yes	Firing site	Remedial Action	1085
540	14-002(c)	Yes	Building	Remedial Action	1085
541	14-002(d)	Yes	Firing site	Remedial Action	1085
542	14-002(e)	Yes	Firing site	Remedial Action	1085
543	14-002(f)	Yes	Firing site	Remedial Action	1085
544	14-003	Yes	Open burning ground	Remedial Action	1085
545	14-004(b)	Yes	Storage area	Remedial Action	1085
546	14-005	Yes	Incinerator (active)	Remedial Action	1085
547	14-006	Yes	Tank and/or assoc. equip.	Remedial Action	1085
548	14-007	Yes	Septic system	Remedial Action	1085
549	14-009	Yes	Surface disposal site	Remedial Action	1085
550	14-010	Yes	Sump	Remedial Action	1085
551	15-001	No	Surface disposal	Remedial Action	1086
552	15-002	Yes	Disposal pit and burn site	Remedial Action	1086
553	15-003	Yes	Firing site (still active)	Remedial Action	1086
554	15-004(a)	Yes	Firing site C	Remedial Action	1086
555	15-004(b)	Yes	Firing site A	Remedial Action	1086
556	15-004(c)	Yes	Firing site B	Remedial Action	1086
557	15-004(d)	No	Firing site C	Remedial Action	1086
558	15-004(f)	Yes	Machine firing site E-F, non-RCRA hazard but VCA uranium	Remedial Action	1086
559	15-004(g)	Yes	Machine firing site	Remedial Action	1086
560	15-004(h)	No	Firing site	Remedial Action	1086
561	15-004(i)	Yes	Detonation ground	Remedial Action	1086
562	15-005(b)	No	Storage area	Remedial Action	1086
563	15-005(c)	No	Storage area (R-41)	Remedial Action	1086
564	15-006(a)	Yes	Firing site PHERMEX (still active)	Remedial Action	1086
565	15-006(b)	Yes	Firing site Ector (still active)	Remedial Action	1086
566	15-006(c)	Yes	Firing site R-44	Remedial Action	1086
567	15-006(d)	Yes	Firing site R-45	Remedial Action	1086

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
621	16-003(i)	Yes	Sump	Remedial Action	1082
622	16-003(j)	Yes	Sump	Remedial Action	1082
623	16-003(k)	Yes	Sumps/Drain lines with TA-16-260	Remedial Action	1082
624	16-003(l)	Yes	Sump	Remedial Action	1082
625	16-003(m)	Yes	Sump	Remedial Action	1082
626	16-003(n)	Yes	Sump	Remedial Action	1082
627	16-003(o)	Yes	Sump	Remedial Action	1082
628	16-003(p)	No	Sump	Remedial Action	1082
629	16-003(q)	No	Sump	Remedial Action	1082
630	16-004(a)	Yes	Wastewater treatment facility	Remedial Action	1082
631	16-004(b)	Yes	Wastewater treatment facility	Remedial Action	1082
632	16-004(c)	Yes	Wastewater treatment facility	Remedial Action	1082
633	16-004(d)	Yes	Wastewater treatment facility	Remedial Action	1082
634	16-004(e)	Yes	Wastewater treatment facility	Remedial Action	1082
635	16-004(f)	Yes	Wastewater treatment facility	Remedial Action	1082
636	16-005(a)	Yes	Septic tank	Remedial Action	1082
637	16-005(b)	Yes	Decommissioned septic system	Remedial Action	1082
638	16-005(c)	Yes	Septic tank	Remedial Action	1082
639	16-005(d)	Yes	Septic tank	Remedial Action	1082
640	16-005(e)	Yes	Septic tank	Remedial Action	1082
641	16-005(f)	Yes	Decommissioned septic system	Remedial Action	1082
642	16-005(g)	Yes	Burn site	Remedial Action	1082
643	16-005(h)	Yes	Septic tank	Remedial Action	1082
644	16-005(i)	Yes	Septic tank same as 13-003(a)	Remedial Action	1082
645	16-005(j)	Yes	Septic tank	Remedial Action	1082
646	16-005(k)	Yes	Septic tank	Remedial Action	1082
647	16-005(l)	Yes	Grease trap	Remedial Action	1082
648	16-005(m)	Yes	Soil contamination area associated with former chemical pit	Remedial Action	1082
649	16-005(n)	Yes	Septic system	Remedial Action	1082
650	16-005(o)	Yes	Septic system	Remedial Action	1082
651	16-006(a)	Yes	Septic system	Remedial Action	1082
652	16-006(b)	Yes	Septic system	Remedial Action	1082
653	16-006(c)	Yes	Septic system	Remedial Action	1082
654	16-006(d)	Yes	Septic system	Remedial Action	1082
655	16-006(e)	Yes	Septic system	Remedial Action	1082
656	16-006(f)	Yes	Septic system	Remedial Action	1082
657	16-006(g)	Yes	Septic tank	Remedial Action	1082
658	16-006(h)	Yes	Pump pit	Remedial Action	1082
659	16-006(i)	Yes	Septic system	Remedial Action	1082
660	16-007(a)	Yes	Surface impoundment	Remedial Action	1082
661	16-008(a)	Yes	Surface impoundment (90s Line pond)	Remedial Action	1082
662	16-009(a)	Yes	Burn site	Remedial Action	1082
663	16-010(a)	Yes	Burn site	Remedial Action	1082
664	16-010(b)	Yes	Burn site	Remedial Action	1082
665	16-010(c)	Yes	Burn site	Remedial Action	1082
666	16-010(d)	Yes	Burn site	Remedial Action	1082
667	16-010(e)	Yes	Burn site	Remedial Action	1082
668	16-010(f)	Yes	Burn site	Remedial Action	1082
669	16-010(g)	Yes	Wastewater treatment facility	Remedial Action	1082
670	16-010(h)	Yes	Burn site	Remedial Action	1082
671	16-010(i)	Yes	Burn site	Remedial Action	1082
672	16-010(j)	Yes	Burn site	Remedial Action	1082
673	16-010(k)	Yes	Trough	Remedial Action	1082

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
727	16-024(b)	No	Magazine	Remedial Action	1082
728	16-024(c)	No	Magazine	Remedial Action	1082
729	16-024(d)	No	Magazine	Remedial Action	1082
730	16-024(e)	Yes	Operational facility	Remedial Action	1082
731	16-024(f)	No	Magazine	Remedial Action	1082
732	16-024(g)	No	Magazine	Remedial Action	1082
733	16-024(h)	No	Magazine	Remedial Action	1082
734	16-024(i)	No	Magazine	Remedial Action	1082
735	16-024(j)	No	Magazine	Remedial Action	1082
736	16-024(k)	No	Magazine	Remedial Action	1082
737	16-024(l)	No	Magazine	Remedial Action	1082
738	16-024(m)	No	Magazine	Remedial Action	1082
739	16-024(n)	No	Magazine	Remedial Action	1082
740	16-024(o)	No	Magazine	Remedial Action	1082
741	16-024(p)	No	Magazine	Remedial Action	1082
742	16-024(q)	No	Magazine	Remedial Action	1082
743	16-024(r)	No	Magazine	Remedial Action	1082
744	16-024(s)	No	Magazine	Remedial Action	1082
745	16-024(t)	No	Operational facility	Remedial Action	1082
746	16-024(u)	No	Magazine	Remedial Action	1082
747	16-024(v)	No	Magazine	Remedial Action	1082
748	16-025(a)	Yes	Abandoned building & appurtenances	Remedial Action	1082
749	16-025(a2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
750	16-025(b)	Yes	Abandoned building & appurtenances	Remedial Action	1082
751	16-025(b2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
752	16-025(c)	Yes	Abandoned HE building & appurtenances	Remedial Action	1082
753	16-025(c2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
754	16-025(d)	Yes	Abandoned building & appurtenances	Remedial Action	1082
755	16-025(d2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
756	16-025(e)	Yes	Abandoned building & appurtenances	Remedial Action	1082
757	16-025(e2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
758	16-025(f)	Yes	Abandoned building & appurtenances	Remedial Action	1082
759	16-025(f2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
760	16-025(g)	Yes	Abandoned building & appurtenances	Remedial Action	1082
761	16-025(g2)	Yes	Magazine	Remedial Action	1082
762	16-025(h)	Yes	Abandoned building & appurtenances	Remedial Action	1082
763	16-025(h2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
764	16-025(i)	Yes	Abandoned building & appurtenances	Remedial Action	1082
765	16-025(j)	Yes	Abandoned building & appurtenances	Remedial Action	1082
766	16-025(k)	Yes	Abandoned building & appurtenances	Remedial Action	1082
767	16-025(l)	Yes	Abandoned building & appurtenances	Remedial Action	1082
768	16-025(m)	Yes	Abandoned building & appurtenances	Remedial Action	1082
769	16-025(n)	Yes	Abandoned building & appurtenances	Remedial Action	1082
770	16-025(o)	Yes	Abandoned building & appurtenances	Remedial Action	1082
771	16-025(p)	Yes	Abandoned building & appurtenances	Remedial Action	1082
772	16-025(q)	Yes	Abandoned building & appurtenances	Remedial Action	1082
773	16-025(r)	Yes	Abandoned building & appurtenances	Remedial Action	1082
774	16-025(s)	Yes	Abandoned building & appurtenances	Remedial Action	1082
775	16-025(t)	Yes	Abandoned building & appurtenances	Remedial Action	1082
776	16-025(u)	Yes	Abandoned building & appurtenances	Remedial Action	1082
777	16-025(v)	Yes	Abandoned building & appurtenances	Remedial Action	1082
778	16-025(w)	Yes	Abandoned building & appurtenances	Remedial Action	1082
779	16-025(x)	Yes	Abandoned building & appurtenances	Remedial Action	1082
780	16-025(y)	Yes	Abandoned building & appurtenances	Remedial Action	1082

Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
835	16-029(d2)	Yes	Sump	Remedial Action	1082
836	16-029(e)	Yes	Sump	Remedial Action	1082
837	16-029(e2)	Yes	Sump	Remedial Action	1082
838	16-029(f)	Yes	Sump	Remedial Action	1082
839	16-029(f2)	Yes	Outfall	Remedial Action	1082
840	16-029(g)	Yes	Sump	Remedial Action	1082
841	16-029(g2)	Yes	Pump pit	Remedial Action	1082
842	16-029(h)	Yes	Sump	Remedial Action	1082
843	16-029(h2)	Yes	Drain line and outfall	Remedial Action	1082
844	16-029(i)	Yes	Outfall	Remedial Action	1082
845	16-029(j)	Yes	Outfall	Remedial Action	1082
846	16-029(k)	Yes	Sump	Remedial Action	1082
847	16-029(l)	Yes	Sump	Remedial Action	1082
848	16-029(m)	Yes	Sump	Remedial Action	1082
849	16-029(n)	Yes	Sump	Remedial Action	1082
850	16-029(o)	Yes	Sump	Remedial Action	1082
851	16-029(p)	Yes	Sump	Remedial Action	1082
852	16-029(q)	Yes	Sump	Remedial Action	1082
853	16-029(r)	Yes	Outfall	Remedial Action	1082
854	16-029(s)	Yes	Sump	Remedial Action	1082
855	16-029(t)	Yes	Sump	Remedial Action	1082
856	16-029(u)	Yes	Sump	Remedial Action	1082
857	16-029(v)	Yes	Sump	Remedial Action	1082
858	16-029(w)	Yes	Sump	Remedial Action	1082
859	16-029(x)	Yes	Sump	Remedial Action	1082
860	16-029(y)	Yes	Sump	Remedial Action	1082
861	16-029(z)	Yes	Sump	Remedial Action	1082
862	16-030(a)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
863	16-030(b)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
864	16-030(c)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
865	16-030(d)	No	Outfall	Remedial Action	1082
866	16-030(e)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
867	16-030(f)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
868	16-030(g)	No	Outfall	Remedial Action	1082
869	16-030(h)	Yes	Outfall	Remedial Action	1082
870	16-031(a)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
871	16-031(b)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
872	16-031(c)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
873	16-031(d)	Yes	Cooling tower, TA 16-28	Remedial Action	1082
874	16-031(e)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
875	16-031(f)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
876	16-031(g)	Yes	Cooling tower outfall (inactive)	Remedial Action	1082
877	16-031(h)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
878	16-032(a)	Yes	Sump	Remedial Action	1082
879	16-032(c)	Yes	Sump	Remedial Action	1082
880	16-032(d)	Yes	Decommissioned HE sump	Remedial Action	1082
881	16-032(e)	Yes	Decommissioned HE sump	Remedial Action	1082
882	16-033(a)	No	Underground tank	Remedial Action	1082
883	16-033(b)	No	Underground tank	Remedial Action	1082
884	16-033(c)	No	Underground tank	Remedial Action	1082
885	16-033(d)	No	Tank and/or assoc. equip	Remedial Action	1082
886	16-033(e)	No	Underground tank	Remedial Action	1082
887	16-033(f)	No	Underground tank	Remedial Action	1082
888	16-033(g)	No	Underground tank	Remedial Action	1082

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
942	18-013	No	Waste tank	Canyon	1093
943	19-001	Yes	Septic system	Remedial Action	1071
944	19-002	Yes	Surface disposal site	Remedial Action	1071
945	19-003	Yes	Septic tank	Remedial Action	1071
946	20-001(a)	Yes	Landfill	Remedial Action	1100
947	20-001(b)	Yes	Landfill	Remedial Action	1100
948	20-001(c)	Yes	Landfill	Remedial Action	1100
949	20-002(a)	Yes	Firing site	Remedial Action	1100
950	20-002(b)	Yes	Firing site	Remedial Action	1100
951	20-002(c)	Yes	Firing site	Remedial Action	1100
952	20-002(d)	Yes	Firing site	Remedial Action	1100
953	20-003(a)	Yes	Firing site	Remedial Action	1100
954	20-003(b)	No	Firing site	Remedial Action	1100
955	20-003(c)	No	Firing site	Remedial Action	1100
956	20-004	No	Septic system	Remedial Action	1100
957	20-005	Yes	Septic tank	Remedial Action	1100
958	21-001	No	Container storage	MDA	1106
959	21-002(a)	Yes	Container storage	MDA	1106
960	21-002(b)	No	Container storage	MDA	1106
961	21-003	Yes	Container storage	MDA	1106
962	21-004(a)	No	Aboveground tank	MDA	1106
963	21-004(b)	Yes	Tank and/or assoc. equipment	MDA	1106
964	21-004(c)	Yes	Tank and/or assoc. equipment	MDA	1106
965	21-005	Yes	Disposal pit	MDA	1106
966	21-006(a)	Yes	Disposal pit Bldg 21-2	MDA	1106
967	21-006(b)	Yes	Disposal pit	MDA	1106
968	21-006(c)	Yes	Disposal pit Bldg 21-3	MDA	1106
969	21-006(d)	Yes	Disposal pit Bldg 21-3	MDA	1106
970	21-006(e)	Yes	Surface disposal site Bldg 21-4	MDA	1106
971	21-006(f)	No	Disposal pit Bldg 21-4	MDA	1106
972	21-007	Yes	Incinerators	MDA	1106
973	21-009	No	Waste treatment lab	MDA	1106
974	21-010(a)	Yes	Waste treatment facility	MDA	1106
975	21-010(b)	Yes	Waste treatment facility	MDA	1106
976	21-010(c)	Yes	Waste treatment facility	MDA	1106
977	21-010(d)	Yes	Waste treatment facility	MDA	1106
978	21-010(e)	Yes	Waste treatment facility	MDA	1106
979	21-010(f)	Yes	Waste treatment facility	MDA	1106
980	21-010(g)	Yes	Waste treatment facility	MDA	1106
981	21-010(h)	Yes	Waste treatment facility	MDA	1106
982	21-011(a)	Yes	Waste treatment facility	MDA	1106
983	21-011(b)	Yes	Sump	MDA	1106
984	21-011(c)	Yes	Tank and Sump	MDA	1106
985	21-011(d)	Yes	Aboveground tank	MDA	1106
986	21-011(e)	Yes	Aboveground tank	MDA	1106
987	21-011(f)	Yes	Aboveground tank	MDA	1106
988	21-011(g)	Yes	Aboveground tank	MDA	1106
989	21-011(h)	No	Aboveground tank	MDA	1106
990	21-011(i)	Yes	Aboveground tank	MDA	1106
991	21-011(j)	Yes	Aboveground tank	MDA	1106
992	21-011(k)	Yes	Outfall	MDA	1106
993	21-012(a)	Yes	Dry well	MDA	1106
994	21-012(b)	Yes	Dry well	MDA	1106
995	21-013(a)	Yes	Surface disposal site	MDA	1106

Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1047	21-027(b)	Yes	Outfalls	MDA	1106
1048	21-027(c)	Yes	Ind. or san. wastewater treat.	MDA	1106
1049	21-027(d)	Yes	Drain line	MDA	1106
1050	21-028(a)	No	Container storage	MDA	1106
1051	21-028(c)	No	Container storage Bldg 21-3	MDA	1106
1052	21-028(d)	No	Container storage	MDA	1106
1053	21-029	Yes	Soil contamination area	MDA	1106
1054	21-030	No	Sump	MDA	1106
1055	22-010(a)	Yes	Septic system	Remedial Action	1111
1056	22-010(b)	yes	Septic system	Remedial Action	1111
1057	22-011	Yes	Disposal pit	Remedial Action	1111
1058	22-012	Yes	Decontamination facility	Remedial Action	1111
1059	22-014(a)	Yes	Ind. or san. wastewater treat.	Remedial Action	1111
1060	22-014(b)	Yes	Sump	Remedial Action	1111
1061	22-015(a)	Yes	Drain lines and dry wells	Remedial Action	1111
1062	22-015(b)	Yes	Sump and outfall	Remedial Action	1111
1063	22-015(c)	Yes	Outfall	Remedial Action	1111
1064	22-015(d)	Yes	Drain line and outfall	Remedial Action	1111
1065	22-015(e)	Yes	Ind. or san. wastewater treat.	Remedial Action	1111
1066	22-016	Yes	Septic system	Remedial Action	1111
1067	26-001	Yes	Surface disposal site	Remedial Action	1071
1068	26-002(a)	Yes	Tank and/or assoc. equip.	Remedial Action	1071
1069	26-002(b)	Yes	Ind. or san. wastewater treat.	Remedial Action	1071
1070	26-003	Yes	Septic tank	Remedial Action	1071
1071	27-001	Yes	Buried naval guns	Canyon	1093
1072	27-002	Yes	Firing sites	Canyon	1093
1073	27-003	Yes	Bazooka impact area	Canyon	1093
1074	31-001	Yes	Outfall from sanitary septic system	Remedial Action	1079
1075	32-001	Yes	Incinerator (former location)	Remedial Action	1079
1076	32-002(a)	Yes	Septic tank (former location); drain lines	Remedial Action	1079
1077	32-002(b)	Yes	Septic system	Remedial Action	1079
1078	32-003	No	Transformer site (former location)	Remedial Action	1079
1079	32-004	No	Drain line and outfall	Remedial Action	1079
1080	33-001(a)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1081	33-001(b)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1082	33-001(c)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1083	33-001(d)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1084	33-001(e)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1085	33-002(a)	Yes	Septic tank located at MDA K	Remedial Action	1122
1086	33-002(b)	Yes	Sump located at MDA K	Remedial Action	1122
1087	33-002(c)	Yes	Sump located at MDA K	Remedial Action	1122
1088	33-002(d)	Yes	Drain line and outfall located at MDA K	Remedial Action	1122
1089	33-002(e)	Yes	Drain line and outfall located at MDA K	Remedial Action	1122
1090	33-003(a)	Yes	Material disposal area MDA D	Remedial Action	1122
1091	33-003(b)	Yes	Material disposal area MDA D	Remedial Action	1122
1092	33-004(a)	Yes	Septic system	Remedial Action	1122
1093	33-004(b)	Yes	Septic system	Remedial Action	1122
1094	33-004(c)	Yes	Septic system	Remedial Action	1122
1095	33-004(d)	Yes	Septic system	Remedial Action	1122
1096	33-004(e)	Yes	Seepage pit	Remedial Action	1122
1097	33-004(f)	Yes	Septic system	Remedial Action	1122
1098	33-004(g)	Yes	Outfall	Remedial Action	1122
1099	33-004(h)	Yes	Outfall	Remedial Action	1122
1100	33-004(i)	Yes	Outfall	Remedial Action	1122

Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1155	35-004(b)	Yes	Storage areas	Remedial Action	1129
1156	35-004(e)	Yes	Container storage area	Remedial Action	1129
1157	35-004(g)	Yes	Container storage area	Remedial Action	1129
1158	35-004(h)	Yes	Container storage area	Remedial Action	1129
1159	35-004(m)	No	Container storage area	Remedial Action	1129
1160	35-006	Yes	Surface impoundment (closure) Bldg 85, duplicate of 35-005(a)	Remedial Action	1129
1161	35-008	Yes	Surface disposal and landfill	Remedial Action	1129
1162	35-009(a)	Yes	Septic system	Remedial Action	1129
1163	35-009(b)	Yes	Septic system	Remedial Action	1129
1164	35-009(c)	Yes	Septic system	Remedial Action	1129
1165	35-009(d)	Yes	Septic system	Remedial Action	1129
1166	35-009(e)	Yes	Septic system	Remedial Action	1129
1167	35-010(a)	Yes	Sanitary lagoon	Remedial Action	1129
1168	35-010(b)	Yes	Sanitary lagoon	Remedial Action	1129
1169	35-010(c)	Yes	Sanitary lagoon	Remedial Action	1129
1170	35-010(d)	Yes	Sand filters	Remedial Action	1129
1171	35-010(e)	No	Discharge headwall from sand filter	Remedial Action	1129
1172	35-011(a)	Yes	Underground storage tank	Remedial Action	1129
1173	35-013(a)	Yes	Sump	Remedial Action	1129
1174	35-013(b)	Yes	Sump	Remedial Action	1129
1175	35-013(c)	Yes	Sump	Remedial Action	1129
1176	35-013(d)	Yes	Sump	Remedial Action	1129
1177	35-014(a)	Yes	Operational release	Remedial Action	1129
1178	35-014(b)	Yes	Leaking drum	Remedial Action	1129
1179	35-014(d)	No	Operational release	Remedial Action	1129
1180	35-014(e)	Yes	Oil spill	Remedial Action	1129
1181	35-014(e2)	No	Oil spill	Remedial Action	1129
1182	35-014(e3)	No	Operational release	Remedial Action	1129
1183	35-014(f)	No	Soil contamination	Remedial Action	1129
1184	35-014(g)	Yes	Soil contamination	Remedial Action	1129
1185	35-014(g2)	No	Soil contamination	Remedial Action	1129
1186	35-014(g3)	No	Soil contamination	Remedial Action	1129
1187	35-015(a)	Yes	Soil contamination	Remedial Action	1129
1188	35-015(b)	Yes	Waste oil treatment	Remedial Action	1129
1189	35-016(a)	Yes	Drains and outfalls	Remedial Action	1129
1190	35-016(b)	No	Outfall	Remedial Action	1129
1191	35-016(c)	Yes	Outfall	Remedial Action	1129
1192	35-016(d)	Yes	Outfall	Remedial Action	1129
1193	35-016(e)	No	Outfall	Remedial Action	1129
1194	35-016(f)	No	Storm drain	Remedial Action	1129
1195	35-016(g)	No	Outfall	Remedial Action	1129
1196	35-016(h)	No	Storm drain	Remedial Action	1129
1197	35-016(i)	Yes	Drains and outfalls	Remedial Action	1129
1198	35-016(j)	No	Storm drain	Remedial Action	1129
1199	35-016(k)	Yes	Drains and outfalls	Remedial Action	1129
1200	35-016(l)	No	Storm drain	Remedial Action	1129
1201	35-016(m)	Yes	Drains and outfalls	Remedial Action	1129
1202	35-016(n)	No	Storm drain	Remedial Action	1129
1203	35-016(o)	Yes	Drains and outfalls	Remedial Action	1129
1204	35-016(p)	Yes	Outfall	Remedial Action	1129
1205	35-016(q)	Yes	Drains and outfalls	Remedial Action	1129
1206	35-018(a)	No	Transformer	Remedial Action	1129
1207	36-001	Yes	Material disposal area (MDA AA)	Remedial Action	1130

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1261	42-001(b)	Yes	Ash storage tank (former location	Remedial Action	1129
1262	42-001(c)	Yes	Ash storage tank (former location	Remedial Action	1129
1263	42-002(a)	No	Decontam. facility (former location)	Remedial Action	1129
1264	42-002(b)	Yes	Decontam. facility driveway (former location)	Remedial Action	1129
1265	42-003	Yes	Septic system (former location)	Remedial Action	1129
1266	43-001(a1)	Yes	Waste lines (Pre-1981)	Remedial Action	1136
1267	43-001(a2)	No	Waste lines (Post-1981)	Remedial Action	1136
1268	43-001(b2)	No	Outfall	Remedial Action	1136
1269	43-002	Yes	Incinerator	Remedial Action	1136
1270	45-001	Yes	Wastewater treatment facility	Remedial Action	1079
1271	45-002	Yes	Vehicle decontamination facility	Remedial Action	1079
1272	45-003	Yes	Waste lines	Remedial Action	1079
1273	45-004	Yes	Sanitary sewer outfall	Remedial Action	1079
1274	46-002	Yes	Surface impoundment	Remedial Action	1140
1275	46-003(a)	Yes	Septic system	Remedial Action	1140
1276	46-003(b)	Yes	Septic system	Remedial Action	1140
1277	46-003(c)	Yes	Septic system	Remedial Action	1140
1278	46-003(d)	Yes	Septic system	Remedial Action	1140
1279	46-003(e)	Yes	Septic system	Remedial Action	1140
1280	46-003(f)	Yes	Septic system	Remedial Action	1140
1281	46-003(g)	Yes	Septic system	Remedial Action	1140
1282	46-003(h)	Yes	Operational release	Remedial Action	1140
1283	46-004(a)	Yes	Waste line	Remedial Action	1140
1284	46-004(a2)	Yes	Outfall	Remedial Action	1140
1285	46-004(b)	Yes	Operational release	Remedial Action	1140
1286	46-004(b2)	Yes	Operational release	Remedial Action	1140
1287	46-004(c)	Yes	Sump	Remedial Action	1140
1288	46-004(c2)	Yes	Outfall	Remedial Action	1140
1289	46-004(d)	Yes	Sump	Remedial Action	1140
1290	46-004(d2)	Yes	Stack emissions	Remedial Action	1140
1291	46-004(e)	Yes	Sump	Remedial Action	1140
1292	46-004(e2)	No	Outfall	Remedial Action	1140
1293	46-004(f)	Yes	Outfall	Remedial Action	1140
1294	46-004(f2)	No	Outfall	Remedial Action	1140
1295	46-004(g)	Yes	Outfall/Stack emissions	Remedial Action	1140
1296	46-004(h)	Yes	Outfall/Stack emissions	Remedial Action	1140
1297	46-004(m)	Yes	Outfall	Remedial Action	1140
1298	46-004(p)	Yes	Sump	Remedial Action	1140
1299	46-004(q)	Yes	Outfall	Remedial Action	1140
1300	46-004(r)	Yes	Outfall	Remedial Action	1140
1301	46-004(s)	Yes	Outfall	Remedial Action	1140
1302	46-004(t)	Yes	Outfall	Remedial Action	1140
1303	46-004(u)	Yes	Outfall	Remedial Action	1140
1304	46-004(v)	Yes	Outfall	Remedial Action	1140
1305	46-004(w)	Yes	Outfall	Remedial Action	1140
1306	46-004(x)	Yes	Outfall	Remedial Action	1140
1307	46-004(y)	Yes	Outfall	Remedial Action	1140
1308	46-004(z)	Yes	Outfall	Remedial Action	1140
1309	46-005	Yes	Surface impoundment	Remedial Action	1140
1310	46-006(a)	Yes	Operational release	Remedial Action	1140
1311	46-006(b)	Yes	Operational release	Remedial Action	1140
1312	46-006(c)	Yes	Operational release	Remedial Action	1140
1313	46-006(d)	Yes	Operational release	Remedial Action	1140

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1359	49-008(b)	No	Soil contamination (Area 6)	MDA	1144
1360	49-008(c)	No	Soil contamination (Area 11)	MDA	1144
1361	49-008(d)	No	Firing sites (Bottle House area) soil contamination and underground chamber	MDA	1144
1362	49-009	No	Aboveground tank (former location)	MDA	1144
1363	50-001(a)	Yes	Waste treatment facility	MDA	1147
1364	50-001(b)	No	Waste lines and manholes	MDA	1147
1365	50-002(a)	Yes	Underground tanks	MDA	1147
1366	50-002(b)	Yes	Underground tank	MDA	1147
1367	50-002(c)	Yes	Underground tank	MDA	1147
1368	50-002(d)	No	Underground tank	MDA	1147
1369	50-003(a)	No	Storage area	MDA	1147
1370	50-004(a)	Yes	Waste lines	MDA	1147
1371	50-004(b)	Yes	Underground tanks	MDA	1147
1372	50-004(c)	Yes	Waste lines	MDA	1147
1373	50-006(a)	Yes	Operational release	MDA	1147
1374	50-006(c)	Yes	Operational release	MDA	1147
1375	50-006(d)	Yes	Effluent discharge	MDA	1147
1376	50-007	No	Incinerator	MDA	1147
1377	50-008	No	Reduction site	MDA	1147
1378	50-009	Yes	Material disposal area (MDA C)	MDA	1147
1379	50-010	No	Decontamination facility	MDA	1147
1380	50-011(a)	Yes	Septic system	MDA	1147
1381	50-011(b)	No	Septic system	MDA	1147
1382	51-001	No	Septic system	MDA	1148
1383	52-001(a)	Yes	UHTREX equip.	Remedial Action	1129
1384	52-001(b)	Yes	UHTREX equip.	Remedial Action	1129
1385	52-001(c)	Yes	UHTREX equip.	Remedial Action	1129
1386	52-001(d)	Yes	UHTREX equip.	Remedial Action	1129
1387	52-002(a)	Yes	Septic system	Remedial Action	1129
1388	52-002(b)	Yes	Septic system	Remedial Action	1129
1389	52-002(c)	Yes	Septic system	Remedial Action	1129
1390	52-002(d)	Yes	Septic system	Remedial Action	1129
1391	52-002(f)	Yes	Septic system	Remedial Action	1129
1392	52-003(a)	No	Waste treatment facility	Remedial Action	1129
1393	53-001(a)	Yes	Storage area	Remedial Action	1100
1394	53-001(b)	Yes	Storage area	Remedial Action	1100
1395	53-001(c)	No	Storage area	Remedial Action	1100
1396	53-001(e)	No	Storage area	Remedial Action	1100
1397	53-001(g)	No	Storage area	Remedial Action	1100
1398	53-002(a)	Yes	Disposal lagoon inactive (NE, NW impoundments)	Remedial Action	1100
1399	53-002(b)	Yes	Disposal lagoon (active) RCRA corrective action	Remedial Action	1100
1400	53-004	No	Operational facility	Remedial Action	1100
1401	53-005	Yes	Disposal pit	Remedial Action	1100
1402	53-006(a)	No	Underground tank	Remedial Action	1100
1403	53-006(b)	Yes	Underground tank	Remedial Action	1100
1404	53-006(c)	Yes	Underground tank	Remedial Action	1100
1405	53-006(d)	Yes	Underground tank	Remedial Action	1100
1406	53-006(e)	Yes	Underground tank	Remedial Action	1100
1407	53-006(f)	Yes	Underground tank	Remedial Action	1100
1408	53-007(a)	Yes	Aboveground neutralizer tank	Remedial Action	1100
1409	53-007(b)	Yes	Aboveground tanks (2)	Remedial Action	1100

Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
			sludge)		
1454	54-015(k)	Yes	Storage area (TRU waste mound)	MDA	1148
1455	54-016(b)	No	Sump	MDA	1148
1456	54-017	Yes	Material disposal area (MDA G) disposal pits 16,22 (active before 11/19/80)	MDA	1148
1457	54-018	Yes	Material disposal area (MDA G) disposal pits 27-33, 35-37 (active after 11/19/80)	MDA	1148
1458	54-019	Yes	Material disposal area (MDA G) disposal shafts (active before 11/19/80)	MDA	1148
1459	54-020	Yes	Material disposal area (MDA G) disposal shafts (active after 11/19/80)	MDA	1148
1460	55-008	Yes	Sumps and tanks	Remedial Action	1129
1461	55-009	Yes	Sumps and tanks	Remedial Action	1129
1462	57-001(b)	No	Drilling mud pits	Remedial Action	1154
1463	57-001(c)	No	Drilling mud pits	Remedial Action	1154
1464	57-002	No	Landfill	Remedial Action	1154
1465	57-003	No	Storage area	Remedial Action	1154
1466	57-004(a)	No	Surface impoundment	Remedial Action	1154
1467	57-004(b)	No	Surface impoundment	Remedial Action	1154
1468	57-006	No	Drum and contents Fenton Hill (removed)	Remedial Action	1154
1469	57-007	No	Leach field	Remedial Action	1154
1470	59-001	Yes	Septic system	Remedial Action	1114
1471	59-004	No	Outfall	Remedial Action	1114
1472	60-002	Yes	Storage area	Remedial Action	1114
1473	60-004(b)	No	Storage area	Remedial Action	1114
1474	60-004(c)	No	Storage area	Remedial Action	1114
1475	60-004(d)	No	Storage area	Remedial Action	1114
1476	60-004(e)	No	Storage area	Remedial Action	1114
1477	60-004(f)	No	Storage area	Remedial Action	1114
1478	60-005(a)	Yes	Surface impoundment - formerly 3-029(a)	Remedial Action	1114
1479	60-006(a)	Yes	Septic tank	Remedial Action	1114
1480	60-007(a)	Yes	Systematic or intent. prod. release	Remedial Action	1114
1481	60-007(b)	Yes	Systematic or intent. prod. release	Remedial Action	1114
1482	61-002	Yes	Transformer storage area	Remedial Action	1114
1483	61-004(a)	Yes	Septic tank	Remedial Action	1114
1484	61-005	Yes	Landfill (LA County Municipal)	Remedial Action	1114
1485	61-006	Yes	Waste oil tank	Remedial Action	1114
1486	61-007	Yes	Transformer site - systematic leak	Remedial Action	1114
1487	63-001(a)	Yes	Septic system	Remedial Action	1129
1488	63-001(b)	Yes	Septic system	Remedial Action	1129
1489	69-001	Yes	Incinerator and assoc. equip.	Remedial Action	1157
1490	72-001	No	Firing range	Remedial Action	1100
1491	73-001(a)	Yes	Landfill	Remedial Action	1071
1492	73-001(b)	Yes	Surface disposal site (waste oil pit)	Remedial Action	1071
1493	73-001(c)	Yes	Landfill	Remedial Action	1071
1494	73-001(d)	Yes	Landfill	Remedial Action	1071
1495	73-002	Yes	Incinerator surface disposal	Remedial Action	1071
1496	73-003	No	Steam cleaning plant	Remedial Action	1071
1497	73-004(a)	Yes	Septic tank	Remedial Action	1071
1498	73-004(b)	Yes	Septic tank	Remedial Action	1071
1499	73-004(c)	Yes	Septic tank	Remedial Action	1071
1500	73-004(d)	Yes	Septic tank (land fill)	Remedial Action	1071
1501	73-005	Yes	Surface disposal site	Remedial Action	1071
1502	73-006	Yes	Airport building outfalls	Remedial Action	1071

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1557	C-06-003	No	Building	Remedial Action	1111
1558	C-06-005	No	Building	Remedial Action	1111
1559	C-06-006	No	Building	Remedial Action	1111
1560	C-06-007	No	Building	Remedial Action	1111
1561	C-06-008	No	Building	Remedial Action	1111
1562	C-06-009	No	Building	Remedial Action	1111
1563	C-06-010	No	Building	Remedial Action	1111
1564	C-06-011	No	Building	Remedial Action	1111
1565	C-06-012	No	Building	Remedial Action	1111
1566	C-06-013	No	Building	Remedial Action	1111
1567	C-06-014	No	Building	Remedial Action	1111
1568	C-06-015	No	Building	Remedial Action	1111
1569	C-06-016	No	Building	Remedial Action	1111
1570	C-06-017	No	Building	Remedial Action	1111
1571	C-06-018	No	Building	Remedial Action	1111
1572	C-06-019	No	Building	Remedial Action	1111
1573	C-06-021	No	Building	Remedial Action	1111
1574	C-08-010	Yes	Building	Remedial Action	1157
1575	C-08-014	No	Laboratory	Remedial Action	1157
1576	C-09-001	Yes	Soil contamination	Remedial Action	1157
1577	C-10-001	No	Surface soil, 2 10x10 foot plots, Bayo Canyon	Remedial Action	1079
1578	C-11-001	No	Laboratory	Remedial Action	1082
1579	C-11-002	No	Laboratory	Remedial Action	1082
1580	C-12-001	No	Building	Remedial Action	1085
1581	C-12-002	No	Building	Remedial Action	1085
1582	C-12-003	No	Building	Remedial Action	1085
1583	C-12-004	No	Building	Remedial Action	1085
1584	C-12-005	No	Building	Remedial Action	1085
1585	C-14-001	No	Building	Remedial Action	1085
1586	C-14-002	No	Building	Remedial Action	1085
1587	C-14-003	No	Building	Remedial Action	1085
1588	C-14-004	No	Building	Remedial Action	1085
1589	C-14-005	No	Building	Remedial Action	1085
1590	C-14-006	No	Building	Remedial Action	1085
1591	C-14-007	No	Building	Remedial Action	1085
1592	C-14-008	No	Building	Remedial Action	1085
1593	C-14-009	No	Building	Remedial Action	1085
1594	C-15-001	No	Surface disposal	Remedial Action	1086
1595	C-15-004	No	Transformers	Remedial Action	1086
1596	C-15-005	No	Laboratory and building	Remedial Action	1086
1597	C-15-006	No	Building	Remedial Action	1086
1598	C-15-007	No	Non-intentional release	Remedial Action	1086
1599	C-15-010	No	Underground tank	Remedial Action	1086
1600	C-15-011	No	Underground tank	Remedial Action	1086
1601	C-16-001	No	Building	Remedial Action	1082
1602	C-16-002	No	Building	Remedial Action	1082
1603	C-16-005	No	Building	Remedial Action	1082
1604	C-16-006	No	Building	Remedial Action	1082
1605	C-16-008	No	Building	Remedial Action	1082
1606	C-16-009	No	Building	Remedial Action	1082
1607	C-16-010	No	Building	Remedial Action	1082
1608	C-16-011	No	Building	Remedial Action	1082
1609	C-16-012	No	Building	Remedial Action	1082

Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1664	C-21-036	No	Aboveground tank	MDA	1106
1665	C-21-037	No	Aboveground tank	MDA	1106
1666	C-33-001	No	Transformer	Remedial Action	1122
1667	C-33-002	No	Transformer	Remedial Action	1122
1668	C-33-003	No	Soil contamination area	Remedial Action	1129
1669	C-35-007	No	Soil contamination	Remedial Action	1129
1670	C-36-001	No	Containment vessel	Remedial Action	1130
1671	C-36-003	Yes	Storm drainages	Remedial Action	1130
1672	C-36-06(e)	No	I-J Firing Site, Projectile Test Area (duplicate of 15-006(e))	Remedial Action	1130
1673	C-41-004	No	Storm drains	Canyon	1098
1674	C-43-001	No	Outfall	Remedial Action	1136
1675	C-45-001	No	Parking lot of former treatment plant	Remedial Action	1079
1676	C-46-001	No	One-time spill	Remedial Action	1140
1677	C-46-002	No	Stack emissions	Remedial Action	1140
1678	C-46-003	No	Stack emissions	Remedial Action	1140
1679	C-50-001	No	Transformer	MDA	1147
1680	C-59-001	No	PCB-containing capacitors & transformer	Remedial Action	1114
1681	C-60-001	No	Underground tank	Remedial Action	1114
1682	C-60-002	No	Underground tank	Remedial Action	1114
1683	C-60-003	No	One-time spill at pesticide shed	Remedial Action	1114
1684	C-60-004	No	Underground tank	Remedial Action	1114
1685	C-61-001	No	Transformer storage area - PCB leak	Remedial Action	1114
1686	C-61-002	No	Subsurface contamination	Remedial Action	1114
1687	C-73-001	No	Underground tank	Remedial Action	1071
1688	C-73-002	No	Underground tank	Remedial Action	1071
1689	C-73-003	No	Underground tank	Remedial Action	1071
1690	C-73-004	No	Underground tank	Remedial Action	1071
1691	C-73-005(a)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1692	C-73-005(b)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1693	C-73-005(c)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1694	C-73-005(d)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1695	C-73-005(e)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1696	C-73-005(f)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071

Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
55	03-045(d)	Yes	Aboveground storage tank (Ind. or san. wastewater treatment)	Remedial Action	1114
56	03-055(b)	No	Outfall	Remedial Action	1114
57	05-006(a)	No	Former building location	Remedial Action	1129
58	05-006(d)	No	Former building location	Remedial Action	1129
59	05-006(f)	No	Former building location	Remedial Action	1129
60	05-006(g)	No	Former building location	Remedial Action	1129
61	06-003(b)	No	Firing site	Remedial Action	1111
62	06-004	No	Sump	Remedial Action	1111
63	08-008(a)	No	Storage area	Remedial Action	1157
64	08-008(b)	No	Storage area	Remedial Action	1157
65	08-008(c)	No	Storage area	Remedial Action	1157
66	08-008(d)	No	Storage area	Remedial Action	1157
67	08-009(b)	No	Ind. or san. wastewater treat.	Remedial Action	1157
68	08-010(a)	No	Storage area	Remedial Action	1157
69	08-010(b)	No	Storage area	Remedial Action	1157
70	08-010(c)	No	Storage area	Remedial Action	1157
71	08-011(a)	No	Underground tank	Remedial Action	1157
72	08-011(b)	No	Underground tank	Remedial Action	1157
73	09-008(a)	No	Surface impoundment	Remedial Action	1157
74	09-010(c)	No	Storage area	Remedial Action	1157
75	09-011(a)	No	Storage area	Remedial Action	1157
76	09-015	No	Manhole	Remedial Action	1157
77	09-016	No	Underground tank	Remedial Action	1157
78	10-001(e)	No	Detonation Test Area	Remedial Action	1079
79	11-003(a)	No	Mortar impact area	Remedial Action	1082
80	11-008	No	Surface disposal	Remedial Action	1082
81	11-010(a)	No	Container storage area	Remedial Action	1082
82	11-010(b)	No	Container storage	Remedial Action	1082
83	12-003	No	Storage area	Remedial Action	1085
84	14-004(a)	No	Storage area (still active)	Remedial Action	1085
85	14-004(c)	No	Storage area	Remedial Action	1085
86	14-008	No	Landfill and surface disposal	Remedial Action	1085
87	15-004(e)	No	Mistakenly called firing site (actually manhole bunker)	Remedial Action	1086
88	15-005(a)	No	Storage area	Remedial Action	1086
89	15-005(d)	No	Storage area	Remedial Action	1086
90	15-008(e)	No	Surface disposal	Remedial Action	1086
91	15-009(d)	No	Septic tank	Remedial Action	1086
92	15-013(a)	No	Underground tank	Remedial Action	1086
93	15-013(b)	No	Underground tank	Remedial Action	1086
94	15-014(c)	No	Ind. or san. wastewater treat.	Remedial Action	1086
95	15-014(f)	No	Ind. or san. wastewater treat.	Remedial Action	1086
96	16-007(b)	No	Surface disposal site	Remedial Action	1082
97	16-008(b)	No	Surface impoundment	Remedial Action	1082
98	16-012(a2)	No	Container storage	Remedial Action	1082
99	16-023(a)	No	Incinerator	Remedial Action	1082
100	16-032(b)	No	Decommissioned HE sump	Remedial Action	1082
101	18-005(b)	No	Storage area	Canyon	1093
102	18-005(c)	No	Storage area	Canyon	1093
103	18-009(a)	No	Transformer	Canyon	1093
104	18-009(c)	No	Transformer	Canyon	1093
105	18-009(d)	No	Transformer	Canyon	1093
106	18-009(e)	No	Transformer	Canyon	1093

Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
160	35-005(a)	No	Surface impoundment (closure) Bldg 85 duplicate of 35-006	Remedial Action	1129
161	35-005(b)	No	Surface impoundment (closure) Bldg 125	Remedial Action	1129
162	35-007	No	Waste oil treatment	Remedial Action	1129
163	35-011(b)	No	Underground storage tank	Remedial Action	1129
164	35-011(c)	No	Underground storage tank	Remedial Action	1129
165	35-011(d)	No	Underground storage tank	Remedial Action	1129
166	35-012(a)	No	Underground storage tank	Remedial Action	1129
167	35-012(b)	No	Underground storage tank (inactive)	Remedial Action	1129
168	35-014(c)	No	Operational release	Remedial Action	1129
169	35-017	No	Soil contamination from reactor	Remedial Action	1129
170	35-018(b)	No	Former transformer site	Remedial Action	1129
171	36-003(d)	No	Septic system	Remedial Action	1130
172	36-004(f)	No	Firing site	Remedial Action	1130
173	36-007(a)	No	Storage area	Remedial Action	1130
174	36-007(b)	No	Storage area	Remedial Action	1130
175	36-007(c)	No	Storage area	Remedial Action	1130
176	36-007(d)	No	Storage area	Remedial Action	1130
177	36-007(e)	No	Storage area	Remedial Action	1130
178	36-007(f)	No	Storage area	Remedial Action	1130
179	37-001	No	Septic system	Remedial Action	1082
180	39-002(g)	No	Storage area (still active)	Remedial Action	1132
181	39-007(b)	No	Storage area	Remedial Action	1132
182	39-007(c)	No	Storage area	Remedial Action	1132
183	39-007(e)	No	Storage area	Remedial Action	1132
184	39-009	No	Outfall	Remedial Action	1132
185	40-002(a)	No	Container storage area	Remedial Action	1111
186	40-002(b)	No	Container storage area	Remedial Action	1111
187	40-002(c)	No	Container storage area	Remedial Action	1111
188	40-003(b)	No	Burning area/open detonation (closure)	Remedial Action	1111
189	40-008	No	HE storage area decommissioned	Remedial Action	1111
190	41-004	No	Container storage	Canyon	1098
191	42-004	No	Canyon disposal	Remedial Action	1129
192	43-001(b1)	No	Outfall	Remedial Action	1136
193	43-003	No	Carcass storage	Remedial Action	1136
194	43-004	No	Waste storage	Remedial Action	1136
195	43-005	No	Radioactive liquid storage	Remedial Action	1136
196	46-001	No	Aboveground tank	Remedial Action	1140
197	46-004(i)	No	Outfall	Remedial Action	1140
198	46-004(j)	No	Outfall	Remedial Action	1140
199	46-004(k)	No	Outfall	Remedial Action	1140
200	46-004(l)	No	Outfall	Remedial Action	1140
201	46-004(n)	No	Outfall	Remedial Action	1140
202	46-004(o)	No	Outfall	Remedial Action	1140
203	46-006(e)	No	Surface disposal	Remedial Action	1140
204	46-008misc	No	Storage area	Remedial Action	1140
205	46-010(a)	No	Storage area	Remedial Action	1140
206	46-010(b)	No	Storage area	Remedial Action	1140
207	46-010(c)	No	Storage area	Remedial Action	1140
208	46-010(e)	No	Storage area	Remedial Action	1140
209	46-010(f)	No	Storage area	Remedial Action	1140
210	46-010misc	No	Storage area	Remedial Action	1140

Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
261	55-005	No	Filtration Unit	Remedial Action	1129
262	55-006	No	Glass breaker	Remedial Action	1129
263	55-007	No	Thermal combustion unit	Remedial Action	1129
264	55-010	No	Solvent spills	Remedial Action	1129
265	55-011(a)	No	Storm drain	Remedial Action	1129
266	55-011(b)	No	Storm drain	Remedial Action	1129
267	55-011(c)	No	Storm drain	Remedial Action	1129
268	55-011(d)	No	Storm drain	Remedial Action	1129
269	55-011(e)	No	Storm drain	Remedial Action	1129
270	55-012	No	Container storage area	Remedial Action	1129
271	55-013(a)	No	Storage area	Remedial Action	1129
272	55-013(b)	No	Storage area	Remedial Action	1129
273	57-001(a)	No	Drilling mud pits	Remedial Action	1154
274	57-005	No	Pond filtration unit	Remedial Action	1154
275	59-002	No	Container storage area	Remedial Action	1114
276	59-003	No	Sump	Remedial Action	1114
277	60-001(a)	No	Storage area (active storage)	Remedial Action	1114
278	60-001(b)	No	Storage area (active Storage)	Remedial Action	1114
279	60-001(c)	No	Storage area (active)	Remedial Action	1114
280	60-001(d)	No	Storage area - pesticide shed	Remedial Action	1114
281	60-003	No	Oil-water separator	Remedial Action	1114
282	60-004(a)	No	Storage area	Remedial Action	1114
283	60-005(b)	No	Drilling mud pit	Remedial Action	1114
284	60-006(b)	No	Septic system	Remedial Action	1114
285	60-006(c)	No	Septic tank	Remedial Action	1114
286	61-001	No	Storage area	Remedial Action	1114
287	61-003	No	Burn sites	Remedial Action	1114
288	61-004(b)	No	Septic tank	Remedial Action	1114
289	61-004(c)	No	Septic tank	Remedial Action	1114
290	63-002	No	Container storage area	Remedial Action	1129
291	64-001	No	Storage area	Remedial Action	1114
292	69-002(a)	No	Septic system	Remedial Action	1157
293	69-002(b)	No	Septic system	Remedial Action	1157
294	72-002	No	Firing site	Remedial Action	1100
295	72-003(a)	No	Septic system	Remedial Action	1100
296	72-003(b)	No	Septic system	Remedial Action	1100
297	C-04-001	No	Former building location	Remedial Action	1129
298	C-05-001	No	Former building location	Remedial Action	1129
299	C-06-020	No	Building	Remedial Action	1111
300	C-08-001	No	Building	Remedial Action	1157
301	C-08-002	No	Building	Remedial Action	1157
302	C-08-003	No	Building	Remedial Action	1157
303	C-08-004	No	Building	Remedial Action	1157
304	C-08-005	No	Building	Remedial Action	1157
305	C-08-006	No	Building	Remedial Action	1157
306	C-08-007	No	Building	Remedial Action	1157
307	C-08-008	No	Building	Remedial Action	1157
308	C-08-009	No	Building	Remedial Action	1157
309	C-08-011	No	Building	Remedial Action	1157
310	C-08-012	No	Building	Remedial Action	1157
311	C-08-013	No	Building	Remedial Action	1157
312	C-08-015	No	Building	Remedial Action	1157
313	C-08-016	No	Building	Remedial Action	1157
314	C-08-017	No	Storage area	Remedial Action	1157

Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
369	C-21-004	No	Non-intentional release area	MDA	1106
370	C-21-008	No	One-time spill	MDA	1106
371	C-21-010	No	Systematic leak	MDA	1106
372	C-21-011	No	One-time spill	MDA	1106
373	C-21-013	No	Disposal pit	MDA	1106
374	C-21-014	No	Warehouse	MDA	1106
375	C-21-015	No	Building	MDA	1106
376	C-21-016	No	Storage area	MDA	1106
377	C-21-017	No	Storage area	MDA	1106
378	C-21-018	No	Storage area	MDA	1106
379	C-21-019	No	Storage area	MDA	1106
380	C-21-020	No	Storage area	MDA	1106
381	C-21-021	No	Storage area	MDA	1106
382	C-21-022	No	Laboratory	MDA	1106
383	C-21-023	No	Laboratory	MDA	1106
384	C-21-024	No	Warehouse	MDA	1106
385	C-21-025	No	Building	MDA	1106
386	C-21-026	No	Building	MDA	1106
387	C-21-028	No	Tank	MDA	1106
388	C-21-029	No	Aboveground tank	MDA	1106
389	C-21-030	No	Aboveground tank	MDA	1106
390	C-25-001	No	Building	Remedial Action	1082
391	C-31-001	No	Buildings	Remedial Action	1079
392	C-32-001	No	Buildings	Remedial Action	1079
393	C-35-001	No	Former UST site	Remedial Action	1129
394	C-35-002	No	Former UST site	Remedial Action	1129
395	C-35-003	No	Former UST site	Remedial Action	1129
396	C-35-004	No	Operational release	Remedial Action	1129
397	C-35-005	No	Operational release	Remedial Action	1129
398	C-35-006	No	Operational release	Remedial Action	1129
399	C-35-008	No	Leaking transformer	Remedial Action	1129
400	C-36-002	No	Surface disposal	Remedial Action	1130
401	C-40-001	No	Usage site	Remedial Action	1111
402	C-41-001	No	Sump	Canyon	1098
403	C-41-002	No	Underground tank	Canyon	1098
404	C-41-003	No	Underground tank	Canyon	1098
405	C-41-005	No	Underground tank - mystery tank	Canyon	1098
406	C-51-001	No	Storage area	MDA	1148
407	C-51-002	No	Buildings	MDA	1148
408	C-52-001	No	Former transformer site	Remedial Action	1129
409	C-52-002	No	Former transformer site	Remedial Action	1129
410	C-53-001	No	Transformer	Remedial Action	1100
411	C-53-002	No	Transformer	Remedial Action	1100
412	C-53-003	No	Transformer	Remedial Action	1100
413	C-53-004	No	Transformer	Remedial Action	1100
414	C-53-005	No	Transformer	Remedial Action	1100
415	C-53-006	No	Transformer	Remedial Action	1100
416	C-53-007	No	Transformer	Remedial Action	1100
417	C-53-008	No	Transformer	Remedial Action	1100
418	C-53-009	No	Transformer	Remedial Action	1100
419	C-53-010	No	Transformer	Remedial Action	1100
420	C-53-011	No	Transformer	Remedial Action	1100
421	C-53-012	No	Transformer	Remedial Action	1100
422	C-53-013	No	Transformer	Remedial Action	1100

APPENDIX D

To be delivered at a later date.

Environmental Restoration
University of California
Environmental Restoration Project, MS M992
Los Alamos, New Mexico 87545
505-667-0808/FAX 505-665-4747

U.S. Department of Energy
Los Alamos Area Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
505-667-7203/FAX 505-665-4504

Date: December 21, 1998
Refer to: EM/ER:98-482

Mr. Benito Garcia
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: SUBMISSION OF THE LOS ALAMOS NATIONAL LABORATORY 1999 INSTALLATION WORK PLAN'S APPENDIX D- FISCAL YEAR 1999-2003 WORK SCHEDULES

Dear Mr. Garcia:

Enclosed is the Work Schedule for Fiscal Years 1999 through 2003 which supercedes all other related scheduling documents previously submitted. The timely approach of submitting Appendix D subsequent to the November 19, 1998 Installation Work Plan submittal was discussed with John Kieling of your staff and found to be acceptable.

This Work Schedule addresses those solid waste management units listed in Module VII of the Laboratory's Hazardous and Solid Waste Amendment Permit (NM0890010515). This schedule is substantially derived from our current baseline and reflects agreements and inputs that resulted from a presentation given to the Bureau December 7, 1998.

The Laboratory anticipates significant changes to this Work Schedule, particularly for Fiscal Years 2000 through 2003. These changes may result from a number of factors, including ecological risk concerns, budget changes, and consideration of the New Mexico Environment Department and Department of Energy priorities, as appropriate.

Should you have any questions, please contact Mr. Dave McInroy at (505) 667-0819 or Mr. Joe Mose at (505) 667-5808.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/JW/gt

Enclosure: Appendix D for 1999 Installation Work Plan

Cy (w/enc.):
M. Buksa, EM/ER, MS M992
D. Griswold, AL-ERD, MS A906
J. Harry, EES-5, MS M992
M. Leavitt, NMED-GWQB
J. Mose, LAAO, MS A316
D. Neleigh, EPA, R.6, 6PD-N
S. Rae, ESH-18, MS K497
C. Rodriguez, CIO/ER, MS M992
T. Taylor, LAAO, MS A316
T. Trujillo, DOE-AL, MS A906
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G. Rael, AL-ERD, MS A906
J. Vozella, LAAO, MS A316
EM/ER File, MS M992
Tracker, RM 604, MS M992

CERTIFICATION

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated 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 violation.

Document Title: SUBMISSION OF THE LOS ALAMOS NATIONAL LABORATORY 1999 INSTALLATION WORK PLAN'S APPENDIX D- FISCAL YEAR 1999-2003 WORK SCHEDULES

Name: Julie A. Canepa Date: 12/23/98

Julie A Canepa, Program Manager
Environmental Restoration Project
Los Alamos National Laboratory

or

Tom Baca, Program Director
Environmental Management
Los Alamos National Laboratory

Name: T. J. Taylor Date: 12/23/98

Theodore J. Taylor, Program Manager
Environmental Restoration Program
DOE-Los Alamos Area Office

or

Joseph Vozella,
Acting Assistant Area Manager of
Environmental Projects
Environment, Safety, and Health Branch
DOE-Los Alamos Area Office

LOS ALAMOS NATIONAL LABORATORY/ENVIRONMENTAL RESTORATION
FISCAL YEAR 1999 WORK SCHEDULE*

Regulatory Deliverable	PRS Number	Unit Description	SRS Score	AP 4.5 Score	Due Date /Submittal Date
RFI Report	73-001(a)	Landfill	46	50.6	Oct-98
	73-001(b)	Surface disposal site (waste oil pit)	32	TBD	Complete
	73-001(c)	Landfill	35	TBD	
	73-001(d)	Landfill	46	TBD	
SAP	53-006(b)	Underground tank	29	TBD	Oct-98
	53-006(c)	Underground tank	29	TBD	Complete
	53-006(d)	Underground tank	29	TBD	
	53-006(e)	Underground tank	29	TBD	
SAP	0-017 (Hospital)	Waste Lines	36	TBD	Dec-98 Complete
RFI Report	21-015	Material disposal area (MDA B)	47	TBD	Sep-99
SAP	22-012	Decontamination Facility	56	TBD	Mar-99
	22-015(a)	Drain Lines and Dry Wells	46	34.6	
	22-015(b)	Sump and Outfall	46	8.8	
	22-015(d)	Drainline and Outfall	56	32.8	
	22-015(e)	Ind. Or San. Wastewater Treatment	56	17.5	
RFI Report	0-017 (Hospital)	Waste Line	36	TBD	May-99
RFI Report	21-017(a)	Material disposal area (MDA U)	47	TBD	Sep-99
	21-017(b)	Material disposal area (MDA U)	47	TBD	
	21-017(c)	Material disposal area (MDA U)	47	TBD	
RFI Report	49-001(b)	Material disposal area (MDA AB)	26	34.6	Sep-99
	49-001(c)	Material disposal area (MDA AB)	29	17.5	
	49-001(d)	Material disposal area (MDA AB)	29	17.5	
	49-001(g)	Material disposal area (MDA AB) (miscellaneous)	39	59.2	
Phase II SAP	35-015(a)	Soil Contamination	72	3.6	Sep-99
	35-003(d-g)	Waste Water Treatment Facility	69	32-5 - 59	
	35-003(l-o)	Waste Water Treatment Facility	69	27.6 – 59	
	35-003(q)	Waste Water Treatment Facility	69	59	
	35-016(a-h)	Drains and Outfalls	53 – 65	47.2 – 96	
	35-016(l)	Storm Drain	69	64	
	35-016(n-q)	Drains and Outfalls	58 – 72	42.8 – 92	
	35-008	Surface Disposal	65	61	
	35-014(e)	Oil Spill	65	61	
	35-014(g)	Soil Contamination	72	39.8	
RFI Report	73-004(a)	Steam cleaning plant	29	3.6	Sep-99
	73-004(b)	Septic tank	35	10.6	
	73-005	Septic tank	35	10.6	
	73-006	Surface disposal site	38	56	

* The work listed on this schedule is subject to modification

LOS ALAMOS NATIONAL LABORATORY/ENVIRONMENTAL RESTORATION
FISCAL YEAR 2000 WORK SCHEDULE*

Regulatory Deliverable	PRS Number	Unit Description	SRS Score	AP 4.5 Score
RFI Report	11-001(a)	Firing site	61	61.8
	11-001(b)	Firing site	61	56
	11-002	Burn site	61	15.3
	11-005(a)	Septic system	26	TBD
	11-005(b)	Septic system	26	TBD
	11-005(c)	Ind. or san. Wastewater treatment.	28	TBD
	11-006(a)	Sump	61	TBD
	11-006(b)	Tank and/or assoc. equip.	61	8.8
	11-006(c)	Tank and/or assoc. equip.	61	61.8
	11-006(d)	Tank and/or assoc. equip.	61	8.8
	11-011(a)	Ind. or san. Wastewater treatment.	28	19.3
	11-011(b)	Ind. or san. Wastewater treatment.	28	19.3
	11-011(d)	Ind. or san. Wastewater treatment.	28	8.8

* The work listed on this schedule is subject to modification

LOS ALAMOS NATIONAL LABORATORY/ENVIRONMENTAL RESTORATION
FISCAL YEAR 2000 WORK SCHEDULE*

Regulatory Deliverable	PRS Number	Unit Description	SRS Score	AP 4.5 Score
RFI Report	TA-54	Various	N/A	N/A
RFI Report	49-001(a)	Material disposal area (MDA AB) (experimental shafts)	29	TBD
	49-001(e)	Material disposal area (MDA AB) (experimental shafts)	29	TBD
	49-001(f)	Material disposal area (MDA AB) (experimental shafts)	29	TBD
RFI Report	50-009	Material disposal area (MDA C)	60	15.8
Work Plans	Canyons	Canon de Valle	46	TBD
	Canyons	Water Canyon	54	TBD
	Canyons	Indio Canyon	44	TBD
	Canyons	Ancho Canyon	54	TBD
	Canyons	Chaquehui Canyon	54	TBD
	Canyons	Sandia Canyon	57	TBD
	Canyons	Cañada Del Buey	56	TBD
RFI Report	42-001(a)	incinerator (former location)	None	18.3
	42-001(b)	ash storage tank (former location	None	TBD
	42-001(c)	ash storage tank (former location	None	TBD
	42-002(b)	Decontam. facility driveway	None	18.3
	42-003	Septic system (former location)	None	15.3
RFI Report	0-017	Waste lines	36	TBD
RFI Report	21-022(h)	Waste lines	22	27.5
RFI Report	15-007(d)	Shaft	None	15.3
	15-009(f)	Septic tank	42	3.6
	15-009(k)	Septic tank	42	TBD
RFI Report	15-009(b)	Septic System	39	88

* The work listed on this schedule is subject to modification

LOS ALAMOS NATIONAL LABORATORY/ENVIRONMENTAL RESTORATION
FISCAL YEAR 2001 WORK SCHEDULE*

Regulatory Deliverable	PRS Number	Unit Description	SRS Score	AP 4.5 Score
RFI Report	53-002(a)	Disposal lagoon inactive (NE, NW impoundments)	67	47.8
RFI Report	53-002(b)	Disposal lagoon (active) RCRA corrective action	67	3.6
Work Plans	Canyons	Guaje Canyon	54	TBD
	Canyons	Rendija Canyon	49	TBD
	Canyons	Barrancas Canyon	44	TBD
	Canyons	Bayo Canyon	50	TBD
	Canyons	Potrillo Canyon	53	TBD
	Canyons	Fence Canyon	44	TBD
SAP	15-004(i)	Detonation ground	None	TBD
	15-007(a)	Material disposal area (MDA N) Landfill	28	3.6
	15-008(d)	Surface disposal (still active)	33	69
	15-009(b)	Septic system	39	8.8

* The work listed on this schedule is subject to modification

LOS ALAMOS NATIONAL LABORATORY/ENVIRONMENTAL RESTORATION
FISCAL YEAR 2002 WORK SCHEDULE*

Regulatory Deliverable	PRS Number	Unit Description	SRS Score	AP 4.5 Score
RFI Report	15-004(i)	Detonation ground	None	TBD
	15-008(d)	Surface disposal (still active)	33	69
RFI Report	20-001(c)	Landfill	40	TBD
RFI Report	21-018(b)	Material disposal area (MDA V)	42	15.8
RFI Report	21-022(h)	Waste lines	22	27.5
RFI Report	49-001(b)	Material disposal area (MDA AB) (experimental shafts)	26	TBD
	49-001(c)	Material disposal area (MDA AB) (experimental shafts)	29	TBD
	49-001(d)	Material disposal area (MDA AB) (experimental shafts)	29	TBD
	49-001(g)	Material disposal area (MDA AB) (miscellaneous)	39	TBD
CMS Plan	54-007(a)	Septic system (tank and seepage trench)	60	TBD
	54-007(b)	Septic system	60	TBD
	54-007(c)	Septic system	32	TBD
	54-013(b)	Material disposal area (MDA G) Disposal Pit (truck washing pit converted to Pit 19)	60	TBD
	54-014(b)	Material disposal area (MDA G) Storage pit (Pit 9, TRU waste)	60	TBD
	54-014(c)	Material disposal area (MDA G) Storage shafts (shafts 200-233)	60	TBD
	54-014(d)	Material disposal area (MDA G) Storage trenches A, B, C, D	60	TBD
	54-015(k)	Storage area (TRU waste mound)	60	TBD
	54-017	Material disposal area (MDA G) Disposal pits 16,22 (active before 11/19/80)	60	TBD
	54-018	Material disposal area (MDA G)Disposal pits 27-33,35-37 (active after 11/19/80)	60	TBD
	54-019	Material disposal area (MDA G) Disposal shafts (active before 11/19/80)	60	TBD
SAP	26-001	Surface disposal site	49	TBD
	26-002(a)	Tank and/or assoc. equip.	40	TBD
	26-002(b)	Industrial or sanitary waste water treatment.	40	TBD

* The work listed on this schedule is subject to modification

LOS ALAMOS NATIONAL LABORATORY/ENVIRONMENTAL RESTORATION
FISCAL YEAR 2003 WORK SCHEDULE*

Regulatory Deliverable	PRS Number	Unit Description	SRS Score	AP 4.5 Score
RFI Report	5-001(a)	Firing Site	51	15.3
	5-001(b)	Firing Site	51	15.3
	5-002	Canyonside disposal	51	23.5
	5-004	Septic system	49	41.5
	5-005(a)	French drain	51	15.3
	5-005(b)	Outfall	51	27
	5-006(b)	Soil contamination beneath bldgs.	49	15.3
	5-006(c)	Soil contamination beneath bldgs.	49	27
	5-006(e)	Soil contamination beneath bldgs.	51	15.3
RFI Report	46-003(a)	Septic system	43	TBD
	46-003(b)	Septic system	38	TBD
	46-003(c)	Septic system	38	TBD
	46-003(e)	Septic system	38	TBD
	46-003(f)	Septic system	51	TBD
	46-003(g)	Septic system	43	TBD
	46-004(a2)	Outfall	51	30.5
	46-004(f)	Outfall	51	37.6
	46-004(r)	Outfall	51	37.6
	46-004(s)	Outfall	51	27.5
	46-004(t)	Outfall	51	68.3
	46-004(w)	Outfall	51	37.6
	46-005	Surface impoundment	31	3.6
	46-008(a)	Storage area	51	17.5
	46-008(d)	Storage area	51	10.6
	46-008(e)	Storage area	51	3.6
	46-008(f)	Storage area	51	17.5
	46-008(g)	Storage area	51	68.3
	46-009(a)	Surface disposal	51	74.5
	46-009(b)	Surface disposal	51	70
RFI Report	4-001	Firing Site	53	43.9
	4-002	Surface disposal	53	43.9
	4-003(b)	Outfall	53	51.5
RFI Report	3-012(b)	Operational release and outfall	TBD	65
	3-045(b)	Ind. or san. waste water treatment	33	65
	3-045(c)	Outfall	33	59.3
RFI Report	15-007(a)	Material disposal area (MDA N) Landfill	28	23.6
RFI Report	16-005(c)	Septic tank	38	3.6
	16-005(j)	Septic tank	36	TBD
	16-005(m)	Soil contamination area associated with former chemical pit	36	TBD
	16-023(b)	Incinerator	28	3.6
	16-024(e)	Operational facility	32	8.8
	16-025(a)	Abandoned building & appurtenances	36	3.6
	16-025(e)	Abandoned building & appurtenances	32	8.8
RFI Report	21-011(a)	Waste treatment facility	42	TBD
	21-011(b)	Sump	36	TBD
	21-011(d)	Aboveground tank	42	TBD
	21-011(e)	Aboveground tank	42	TBD
	21-011(f)	Aboveground tank	42	TBD
RFI Report	15-004(I)	Detonation ground	TBD	TBD
CMS/CMI	TA-54	Various	TBD	TBD

* The work listed on this schedule is subject to modification

Annual Work Schedule for the Environmental Restoration Project at Los Alamos National Laboratory

IWP
LA-UR-98-4652

November 1998

ACRONYMS AND ABBREVIATIONS

ABS	absorption factor
AEA	Atomic Energy Act
AEC	US Atomic Energy Commission
AF	adherence factor
ALARA	as low as reasonably achievable
ANTI-C	radiologic protective clothing
AOC	area of concern
AP	administrative procedure
AR	administrative record
BUS	Business Systems (Division)
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
D&D	decontamination and decommissioning
DOE	US Department of Energy
DOE/UC	US Department of Energy/University of California
DOE-AL	US Department of Energy/Albuquerque Operations Office
DOE-HQ	US Department of Energy/Headquarters
DOE-LAAO	US Department of Energy/Los Alamos Area Office
DOL	US Department of Labor
DOT	US Department of Transportation
ED	exposure duration
EM	Office of Environmental Restoration and Waste Management
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
FSF	Field Support Facility
FY	fiscal year
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
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
ICR	incremental cancer risk
ID	identification number
IRIS	Integrated Risk Information System

APPROXIMATE CONVERSION FACTORS FOR SELECTED SI (METRIC) UNITS

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

#62060

Installation Work Plan for Environmental Restoration Project

Revision 7

A Department of Energy
Environmental Cleanup Program

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Los Alamos
NATIONAL LABORATORY

LA-UR-98-4652

EXECUTIVE SUMMARY

Background

In 1989, the US Department of Energy (DOE) created the Office of Environmental Restoration and Waste Management (EM). The goal of this office is to implement the department's policy of ensuring that its past, present, and future operations do not threaten human health, safety, or the environment. The EM Office implements procedures to meet these goals through three associate directorates: Environmental Restoration (ER), Waste Operations, and Technology Development. Among other responsibilities, the EM Office is responsible for assessing, cleaning up, and decommissioning sites at DOE facilities and at sites formerly used by DOE and its predecessors. This Installation Work Plan (IWP) describes how the DOE and the University of California (UC) are conducting the office's 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-mi² Laboratory site and the communities adjacent to it are situated on the Pajarito Plateau. The ephemeral and intermittent streams that drain the plateau have created numerous narrow fingerlike mesas, whose tops range in elevation from approximately 7,800 ft on the flank of the Jemez Mountains to about 6,200 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.

Since its inception in 1943, the Laboratory's primary mission has been nuclear weapons research and development. The Laboratory's current central mission is reducing global nuclear danger. This mission supports core competencies that enable the Laboratory to also contribute to defense, civilian, and industrial needs. In turn, the intellectual challenges of civilian and industrial problems strengthen the core competencies for the defense programs. The core competencies include the following: complex experimentation and measurement; theory, modeling, and high-performance computing; analysis and assessment; nuclear weapons science and technology; earth and environmental science; nuclear and advanced materials; bioscience and biotechnology; and nuclear science, plasmas, and beams.

Since the early 1970s, the Laboratory has reported the results of an environmental surveillance program that routinely samples air, water, soil, and foodstuffs throughout the Los Alamos area to determine whether contamination from Laboratory operations is present and, if so, at what levels. The data collected under this program are published annually for distribution to the public and to local, state, and federal agencies. The ER Project at the Laboratory augments the environmental surveillance program by identifying potential threats to human health and the environment from past Laboratory operations and by mitigating them through efficient corrective actions that comply with applicable environmental regulations. Corrective actions include such measures as source containment to prevent contaminant migration, controls on future land use, and excavation and/or treatment of the source to remove hazards to health and the environment.

Statutory Basis of the ER Project

The ER Project at the Laboratory responds 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

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substances not covered by RCRA. The hazardous waste provisions of RCRA govern the day-to-day operations of hazardous waste management, treatment, storage, and disposal (TSD) facilities. The law established a permitting system and set standards for all hazardous-waste-producing operations at a facility. Under this law, the Laboratory qualifies as a treatment and storage facility and must have a permit to operate such a facility. In 1984, Congress amended RCRA by passing the Hazardous and Solid Waste Amendments (HSWA). Section 3004(u) of RCRA (as amended by HSWA) mandates that permits for TSD facilities include provisions for corrective action to address releases from facilities currently in operation and to investigate and clean up contamination in areas designated as solid waste management units (SWMUs).

The Environmental Protection Agency (EPA) issued the HSWA Module to the Laboratory's RCRA Hazardous Waste Facility Permit in 1990. The New Mexico Environment Department (NMED) obtained corrective action authority from EPA on January 2, 1996. The HSWA Module in DOE/UC's RCRA permit prescribes a specific corrective action program for the Laboratory and provides the primary guidance for the Laboratory's ER Project. The HSWA Module defines the principal requirements with which DOE/UC must comply in implementing the ER Project at the Laboratory. However, RCRA does not address several issues of concern at Los Alamos. For example, source, by-product, and special nuclear materials are exempt from RCRA's definition of solid waste and are therefore not subject to the provisions of the HSWA Module. DOE/UC recognize that these radioactive constituents are of concern and should be addressed with concerns about hazardous wastes. Thus, DOE/UC's ER Project addresses radioactive as well as other hazardous substances not regulated by RCRA. This approach is intended to implement a technically comprehensive program that covers potential concerns at sites that may contain hazardous substances not regulated under RCRA and radioactive materials regulated under the Atomic Energy Act. The ER Project also addresses the provisions of applicable DOE orders. DOE/UC understand that provisions in this IWP pertaining to subjects outside the scope of RCRA is not enforceable under the RCRA permit.

This IWP has been prepared in accordance with the HSWA Module and with the corrective action requirements proposed for incorporation in EPA's regulations for hazardous waste. This document also meets requirements of the Outline for Facility-Wide Workplans as provided by NMED in the March 1998 Document Requirement Guide. EPA proposed Subpart S of 40 CFR 264 in July 1990 to implement the corrective action program mandated in Section 3004(u) of RCRA. This IWP describes how each step in the corrective action process will be implemented at the Laboratory.

The primary goal of the RCRA facility investigation (RFI) is to 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. DOE/UC in cooperation with NMED have 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.

Public involvement is an important component of the Laboratory's ER Project; accordingly, the ER Project is implementing a public participation 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.

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The HSWA Module provides a schedule for investigating the SWMUs that the EPA originally selected from potential release sites (PRSs) identified by DOE/UC. DOE/UC have aggregated all PRSs to be taken through the corrective action process in 3 operational focus areas (formerly 24 operable units). These PRSs are addressed in RFI work plans, which provide information on how each site will be investigated. RFI work plans have been completed for all mesa-top PRSs and for Los Alamos Canyon, Pueblo Canyon, Mortandad Canyon, and Pajarito Canyon. The NMED and EPA are continuing their review of the work plans and field investigations in the 3 operational focus areas. The Project has oversight responsibility for decommissioning activities in conjunction with remediation activities for the purpose of coordination of field campaigns.

The current projection for the completion of the RFI/CMS process at the Laboratory is approximately the year 2008, depending on funding levels. This process will address the 2,121 PRSs at the Laboratory in order to meet all applicable environmental regulations. The schedule also addresses the spread of effort over a period compatible with the availability of national resources, including funding.

Current risks from known PRSs are low; however, DOE/UC have implemented a process of evaluating all new data as it becomes available and jointly decides with NMED the priorities of upcoming field work.

Contents of the 1998 IWP

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

Chapter 2 describes the Laboratory and its environmental setting. Chapter 3 contains three major sections: (1) the requirements of the corrective action process, (2) the assessment strategy for conducting corrective action, and (3) the field sampling for conducting characterization and corrective action confirmation. A discussion of the decision process leading to the next phase of investigation or remediation is 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 complies with applicable Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response requirements given in 29 CFR 1926.65 or 29 CFR 1910.120. It establishes generic health and safety requirements, procedures, and emergency actions that apply to all field operations projectwide 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 ER Project's waste management activities. This chapter includes types of wastes anticipated to be generated and waste storage and treatment options.

Chapter 7 contains the ER Project's public involvement plan. It describes the ER Project's approach to public outreach and public involvement in the decision-making process both at the Laboratory and project levels. The Laboratory's current approach to public involvement, which includes working with the Laboratory's Community Relations Office to coordinate the public

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participation activities of all Laboratory organizations and the Laboratory's increased outreach to Native Americans, is described.

This document also contains four appendices:

- Appendix A — Descriptions of Technical Areas at Los Alamos National Laboratory;
- Appendix B — Potential Release Sites at Los Alamos National Laboratory;
- Appendix C — Methodology for Calculating Human Health Screening Action Levels in Mesa-Top Soils and Sediments; and
- Appendix D — Annual Work Schedule for the Environmental Restoration Project at Los Alamos National Laboratory.

The appendices are followed by a list of acronyms and abbreviations and a table for converting metric to English units of measure.

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1.0 PROJECT MANAGEMENT PLAN

1.1 Background

In 1989, the US Department of Energy-Headquarters (DOE-HQ) created the Office of Environmental Restoration and Waste Management (EM). The goal of this office is to implement the department's policy of ensuring that its past, present, and future operations do not threaten human or environmental health and safety (DOE 1993, 12602; 12603). The EM Office implements procedures to meet these goals through three associate directorates: Environmental Restoration (ER), Waste Operations, and Technology Development. Among other responsibilities, the EM Office is responsible for assessing, cleaning up, and decommissioning sites at DOE facilities and sites formerly used by DOE and its predecessors. As a facility operated by the DOE, Los Alamos National Laboratory (the Laboratory) is a part of this program.

The Laboratory is administered for the DOE by the University of California (UC). Since its inception in 1943, the Laboratory's primary mission has been nuclear weapons research and development. The Laboratory's current central mission is reducing global nuclear danger. This mission supports core competencies that enable the Laboratory to also contribute to defense, civilian, and industrial needs. In turn, the intellectual challenges of civilian and industrial problems strengthen the core competencies for the defense programs. The core competencies include the following: complex experimentation and measurement; theory, modeling, and high-performance computing; analysis and assessment; nuclear weapons science and technology; earth and environmental science; nuclear and advanced materials; bioscience and biotechnology; and nuclear science, plasmas, and beams.

Many of the processes used in carrying out the Laboratory's past and present missions involve the use of hazardous and radioactive materials. During World War II and for a while thereafter, 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. In that period also, the DOE and the Laboratory began to conduct surveys and to clean up areas where spills and disposal had occurred.

The current investigation being conducted at Los Alamos under DOE's ER Project is intended to definitively determine the presence or absence of hazardous and radioactive constituents and to address any sites where such materials are still found to exist at levels which might have an adverse affect on human health or the environment. The ER Project at the Laboratory is committed to excellence in carrying out its responsibilities for investigating and remediating hazardous waste disposal sites. This Installation Work Plan describes how the DOE/UC are conducting the DOE's ER Project at the Laboratory and complies with the New Mexico Environment Department's (NMED) Outline for Facility-Wide Workplans provided in Section II.B.4.a.(1) of NMED 1998 (57897).

This document consists of seven chapters containing information required by the Laboratory's permit to operate under the Resource Conservation and Recovery Act (RCRA). The Environmental Protection Agency (EPA) is the regulatory agency that issued this permit; however, in January 1996, NMED received corrective action authority. EPA and NMED have since negotiated a work share agreement that delineates each agency's roles and responsibilities. This first chapter describes the ER Project and its management plan. Chapter 2 describes the Laboratory and its environment, and Chapter 3 describes the ER Project's technical approach to

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environmental restoration, including the requirements of the corrective action process, the project's assessment strategy, and field sampling. Chapters 4–7 present the project's plans for quality assurance, records management, health and safety, waste management, and public involvement, respectively. In addition, this document contains four appendices that supplement information provided in Chapters 1–7. The appendices are followed by a list of acronyms and abbreviations and a table showing conversion of metric to English units of measure.

This plan is revised as needed to reflect the current status of the ER Project at the Laboratory, future plans, and near- and long-term schedules.

1.2 Purpose and Scope

DOE established its ER Project as a DOE ER Major Systems Acquisition (MSA) Project. One MSA project includes the national laboratories assigned to the DOE Operations Office in Albuquerque (ER MSA AL-1). MSA AL-1 at Los Alamos includes two integrated activities: one, the Remedial Action Project, hereafter referred to as the ER Project, addresses remedial actions at the Laboratory; the other is the Decommissioning Project, which is operated as part of the Laboratory's ER Project. The ER Project and Decommissioning Project are integrated to take advantage of opportunities to coordinate field activities. The DOE's Albuquerque Field Office (DOE-AL) is responsible for implementing the DOE-AL's ER Project. DOE-HQ delegates authority for conducting the DOE-AL ER Project to the DOE-AL ER Division. DOE area offices and their prime contractors execute approved assessment and remediation tasks at their installations. The DOE's Los Alamos Area Office (DOE-LAAO) is the primary line of communication with UC for day-to-day operations.

LAAO oversees MSA AL-1 at the Laboratory as part of its Environment and Projects Office. The Laboratory's ER Project Office tracks and manages the ER Project as part of the Environmental Programs Directorate. The ER Project, including the Decommissioning Project, is conducted under the management principles outlined in DOE Order 430.1A, "Life Cycle Asset Management."

In November 1989, the New Mexico Environmental Improvement Division [now New Mexico Environment Department (NMED)] issued a hazardous waste operating permit authorized under RCRA to the DOE/UC that addresses treatment and storage of hazardous wastes at the Laboratory (NMEID 1989, 11737). In addition, in March 1990, the EPA issued a Hazardous and Solid Waste Amendments (HSWA) attachment to the permit, known as the HSWA Module, which went into effect on May 23, 1990 (EPA 1990, 1585). The HSWA Module sets forth the procedural requirements for assessing and remediating sites known as solid waste management units (SWMUs). The NMED now has responsibility for implementing most HSWA regulations.

The purposes of the RCRA facility investigation (RFI) are to perform a detailed investigation to determine nature, extent, and migration rate of releases, if any, and to provide information necessary for addressing contamination. The objective of the corrective measures study (CMS) is to identify and evaluate alternatives to remediate identified releases from SWMUs. All corrective measures implemented at the Laboratory comply specifically with RCRA regulations and the HSWA Module; with the National Environmental Policy Act (NEPA); with applicable DOE Directives; with applicable Executive Orders; and with other applicable federal and state laws and regulations (Section 1.2.1.5); or are consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as appropriate.

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Laboratory sites that are being investigated include SWMUs and areas of concern (sites that contain potentially hazardous substances [such as radionuclides] that are not regulated under RCRA), collectively called potential release sites (PRSs). Under the ER Project's original structure, the PRSs were aggregated into 24 operable units (OUs), based on geographical and other considerations. In 1997, the OUs were regrouped into 3 field management units, called focus areas, as described in Section 1.3. As a result of the corrective action process, all PRSs requiring remediation are remediated by means of accelerated cleanup, corrective measures implementation (CMI) after completion of a CMS, RCRA closure, or other remedial measures, as appropriate. The corrective action process is described further in Section 1.2.1.1.

1.2.1 Statutory and Regulatory Framework

The principal requirements for the ER Project are those derived from RCRA Sections 3004(u) and (v); the CERCLA; the Atomic Energy Act (AEA); and New Mexico state law, primarily the New Mexico Hazardous Waste Act. The ER Project must implement RCRA requirements for assessing and cleaning up sites at active hazardous waste treatment and storage units. Section 3004(u) provides for remediation of all hazardous waste sites at a given facility regulated under RCRA. Section 3004(v) extends this requirement to contaminated properties located beyond but bordering the Laboratory boundary.

Decommissioning is conducted under the authority of the AEA. Hazardous wastes are regulated both by RCRA and the state hazardous waste management regulations; radioactive materials are regulated under the AEA and/or CERCLA. The hazardous waste portion of mixed waste is also subject to RCRA. In addition, the ER Project complies with applicable DOE Directives and Laboratory policies.

The statutes described in the following sections provide the criteria for evaluating the technical performance of the ER Project. Table 1-1 lists the current environmental permits under which the ER Project at the Laboratory operates. The scope and status of permits that address hazardous waste operations at the Laboratory are the responsibility of the Laboratory's Environment, Safety, and Health Division.

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TABLE 1-1

CURRENT ENVIRONMENTAL PERMITS APPLICABLE TO THE ER PROJECT

Permit Type	Permitted Activity	Issue Date	Expiration Date	Administering Agency
HSWA Module VIII	Environmental Restoration	Mar. 1990	Mar. 2000	NMED
RCRA Hazardous Waste Facility	Hazardous waste storage and treatment	Nov. 1989	Nov. 1999	NMED

1.2.1.1 Resource Conservation and Recovery Act

The ER Project is regulated by the RCRA. The hazardous waste management provisions of RCRA, as enacted in 1976 govern the day-to-day operations of hazardous waste generation, treatment, storage, and disposal facilities. Under this law, the Laboratory qualifies as a treatment and storage facility and has a permit to operate regulated hazardous waste treatment or storage units.

In 1984, Congress amended RCRA by passing HSWA. Sections 201, 202, 203, 206, 207, 212, 215, and 224 of HSWA modified the permitting sections of RCRA (Sections 3004 and 3005). In accordance with these provisions of HSWA, the Laboratory's permit to operate hazardous waste treatment and storage units includes a section (the HSWA Module) that prescribes a specific corrective action program for the Laboratory, which primarily focuses on the investigation and cleanup, if required, of inactive sites. The fundamental unit to which these requirements apply is the SWMU, defined by EPA in the HSWA Module 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."

The HSWA Module specifies a three-step corrective action process (Figure 1-1):

- RFI—The goal of this step is to identify the nature and extent of contamination at the source and the environmental pathways along which contaminants could travel to human and environmental receptors. This step is implemented by characterizing the extent of contamination in the detail necessary to determine what corrective measures, if any, need to be taken. This approach focuses on answering those questions relevant to deciding further actions in a cost-effective manner.

- CMS—If characterization indicates that corrective measures are needed, this study evaluates alternatives that might need to be implemented. These measures are evaluated based on their projected efficacy in reducing risks to human and environmental health and safety in a cost-effective manner.

- CMI—This step implements the selected remedy, verifies its effectiveness, and establishes ongoing control and monitoring requirements, if needed.

The ER Project uses this three-step process with some modifications, such as accelerated cleanup as described in Section 3.1.3.2 of this document.

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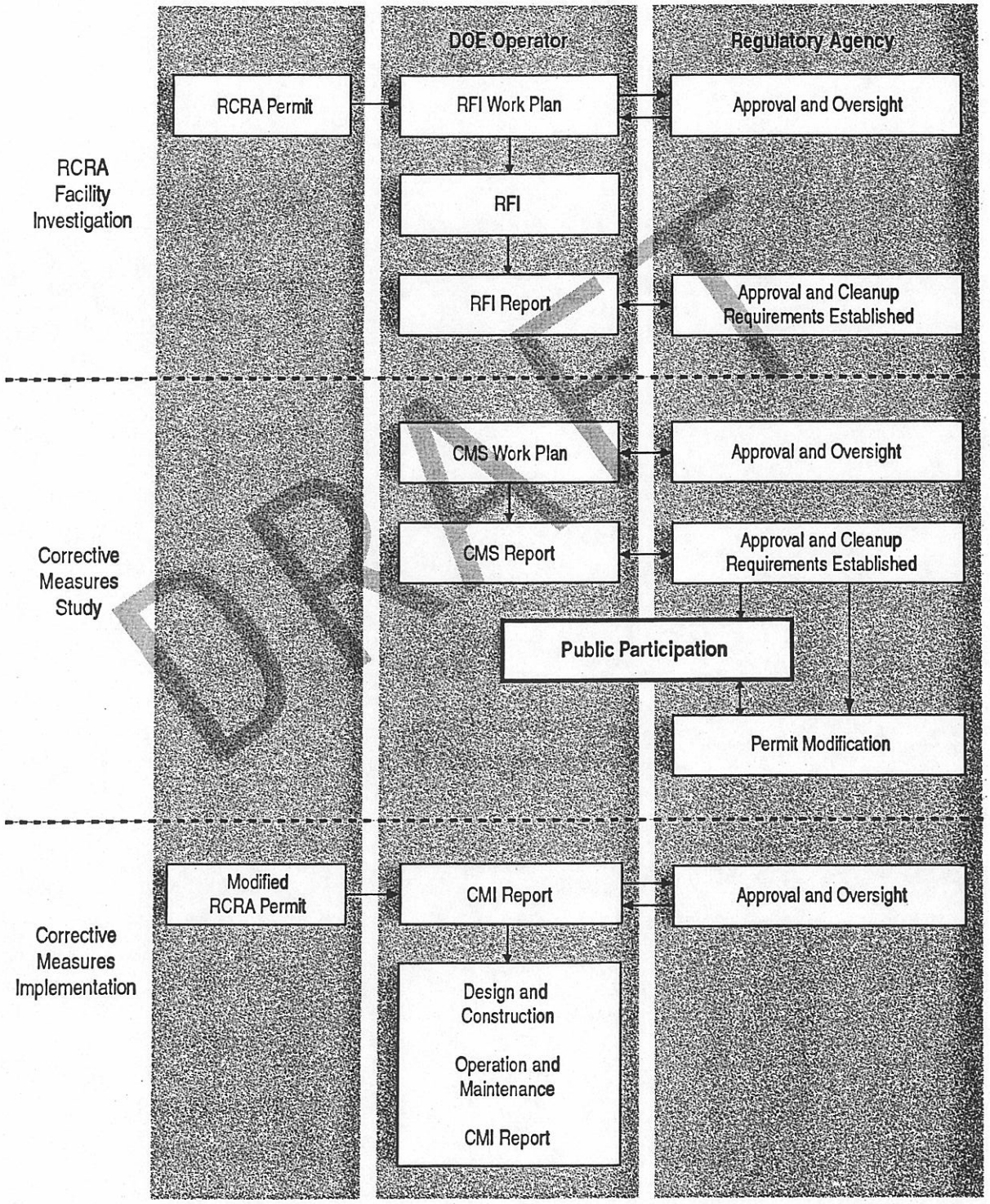

Figure 1-1. Three-step corrective action process.

1.2.1.2 Comprehensive Environmental Response, Compensation, and Liability Act

CERCLA 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. Under the provisions of the National Contingency Plan, a plan prepared by EPA under CERCLA, the EPA ranks facilities throughout the nation according to their potential hazard to human and environmental health and safety. The higher-ranking facilities listed on the National Priorities List are being assessed and cleaned up first. The Laboratory is not on the National Priorities List. The Laboratory is not regulated by EPA under CERCLA; however, it is striving to investigate and remediate sites suspected of being and known to be contaminated with other hazardous constituents that may not be regulated under RCRA.

1.2.1.3 Integration of the Provisions of RCRA and CERCLA

Even though the Laboratory is a designated RCRA facility and is not on the National Priorities List, DOE guidance specifies that the Laboratory conform to CERCLA requirements to the extent possible. DOE guidance resulting from Executive Order 12580 (DOE 1993, 37500), Superfund Implementation, leads to the following interpretation under that guidance:

- CERCLA applies if hazardous substances are released into the environment or if a substantial threat of release exists.
- CERCLA specifies that the remediation requirement applies in equal fashion to federal and nonfederal entities.

1.2.1.4 Integration of the Provisions of RCRA and NEPA

NEPA provides a national policy to promote efforts that 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. In accordance with the provisions of DOE guidance, the ER Project has integrated NEPA procedural requirements with the RCRA process for assessing and cleaning up contaminated sites. In most cases, the primary instrument for this integration is the RFI/CMS process prescribed by RCRA.

1.2.1.5 Other Statutes and Regulations

(a) Federal Statutes

The following federal acts also affect the conduct of the Laboratory's ER Project:

- 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.

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- 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. Final regulations, which were proposed in 1979 and 1980 and were withdrawn in 1982, have not yet been promulgated. Meanwhile, guidance for implementing the Fish and Wildlife Coordination Act is based on court rulings and past DOE experience.

- 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.

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- The Occupational Safety and Health Act of 1970 provides for the general welfare by ensuring that, so far as possible, 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 PCBs.

- The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 addresses the release of hazardous substances into the environment. Its Section 120(h) specifies requirements for the transfer of ownership of potentially contaminated or previously contaminated property at federal facilities.

(b) State Statutes

This section lists state statutes that can affect the Laboratory's ER Project.

- 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. Because this act meets federal requirements, EPA has authorized the state to regulate site closures under RCRA (exclusive of HSWA).

- 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. Its requires use of means of

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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, Executive Orders, and Secretary of Energy Notices

A number of DOE Orders and Directives, Executive Orders, and Secretary of Energy Notices also apply to the ER Project.

The DOE Orders and Directives and Secretary of Energy Notices that apply to the ER MSA AL-1 Project are detailed in Appendix G of the contract between DOE and UC (http://iosun.lanl.gov:2001/qp/appg.html).

The following Executive Orders (EOs) are applicable to the ER MSA AL-1 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

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;

- establish at the Laboratory through the ER Project a procedural framework and schedules for developing, implementing, coordinating, and monitoring corrective actions that are consistent with CERCLA or 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, EPA, and the public can review, comment on, and participate in the corrective action review process at the Laboratory;

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- record plans, procedures, costs, and other data and prepare progress and technical reports so that 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; and

- complete decommissioning activities at all facilities currently designated and at those that may be designated as surplus facilities in the future.

1.2.2.2 Technical Objectives

The overall technical objectives of the Laboratory's ER Project are to effectively formulate, evaluate, implement, and manage characterization, remediation, and decommissioning in a manner that fully complies with applicable environmental regulations and protects human health and the environment. These objectives are met in a cost-effective manner by using existing technologies or through pilot studies that demonstrate the efficacy of corrective measures.

1.2.2.3 Quality Assurance Objectives

The intent of all quality programs is to ensure that appropriate controls are built into a program, project, or activity; that the quality of the results is known and documented; and that the effectiveness of the controls, as implemented, can be evaluated. The ER Project's Quality Management Plan (QMP), presented in Chapter 3 of this document, has been prepared in accordance with DOE Order 5700.6C. The intent of the plan is to present a comprehensive, coherent quality assurance program. Personnel implement the requirements established in the QMP through the quality assurance project plan, quality procedures, and standard operating procedures (SOPs).

1.3 Structure of the ER Project

This section describes the current structure of the ER Project.

1.3.1 Organization of the Project Office

1.3.1.1 Management Team

Figure 1-2 shows the current composition of the ER Project management team. The ER program manager, who reports to the Program Director for Environmental Management Programs, is responsible for the effective implementation of the ER Project throughout the Laboratory. In executing those responsibilities, the ER program manager is directly supported by five project leaders. These project leaders are responsible for the management of the different facets of the Project known as focus areas. The focus areas are

- Regulatory Compliance,

- Analysis and Assessments,

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- Remedial Actions,
- Canyons, and
- Material Disposal Areas.

Focus area teams and responsibilities are described in the following sections of this document.

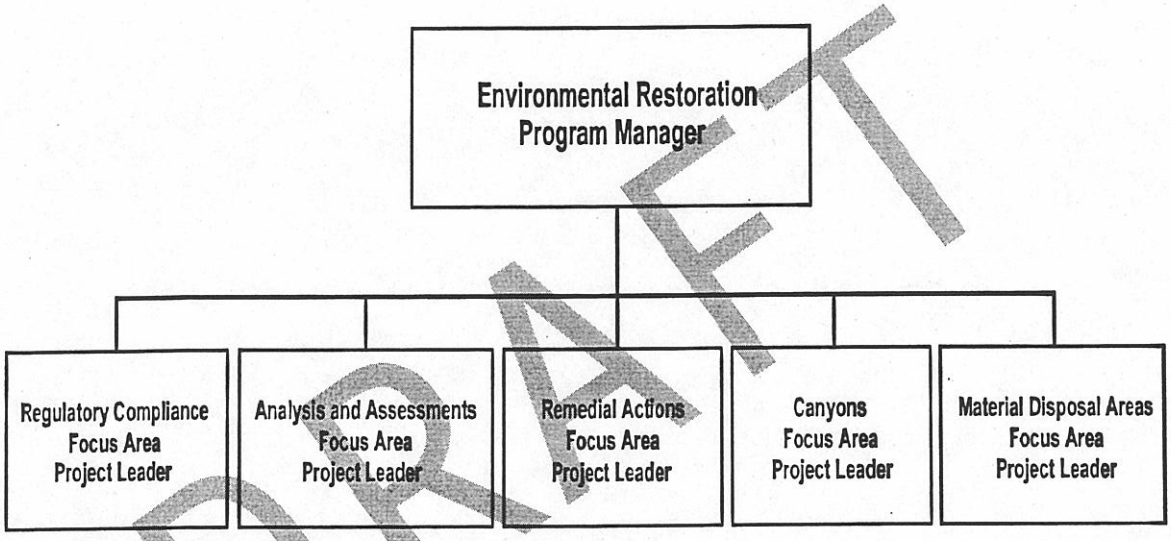

Figure 1-2. Organization of the ER Project Management Team.

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1.3.1.2 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:

- Regulatory Integration and Operations,
- ER Policy and Guidance,
- Communication and Outreach, and
- Deliverables Tracking and Consistency.

The project leader and team leaders are responsible for day-to-day interactions with the Administrative Authority, the public, other stakeholders, and various operational managers of the Laboratory.

1.3.1.3 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 Analysis and Review, and
- Data Analysis and Assessments.

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.

1.3.1.4 Remedial Actions Focus Area

The project leader for the Remedial 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 (if deemed necessary) of PRSs. Each team addresses PRSs of similar type or PRSs located in similar geographic locations with corresponding technical issues.

Corrective action activities implemented by Remedial Action Focus Area teams are arrived at through interaction with other focus areas, the DOE, the public, and the Administrative Authority.

1.3.1.5 Canyons Focus Area

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

- Field Characterization of the Canyon Systems and
- Discrete Unit Characterization and Remediation.

Team leaders supervise staff and field teams responsible for the RCRA characterization of 19 major canyon systems and associated surface water and groundwater systems that drain from Laboratory lands and PRSs within those systems.

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1.3.1.6 Material Disposal Areas Focus Area

The project leader for the Material Disposal Areas (MDAs) Focus Area is responsible for directing three team leaders that manage the following teams:

- TA-21 MDAs
- TA-49 MDAs, and
- TA-50, -51, and -54 MDAs.

Team leaders supervise staff and field teams responsible for the characterization, stabilization, and remediation (if deemed necessary) of MDAs. Teams follow a consistent framework for focusing characterization activities around presumptive remedies.

Corrective action activities implemented by the MDAs Focus Area are arrived at through interactions with the DOE, the public, and the Administrative Authority.

1.3.1.7 Other Key Personnel and Functions in the ER Project

DOE-LAAO Interaction

Representatives of both the DOE and UC interact with the NMED. The representatives strive to work as partners to achieve objectives mutually acceptable to DOE/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 DOE-LAAO ER project managers and the Laboratory focus area project leaders. The teaming occurs during all phases of the ER Project. Figure 1-3 shows the current LAAO organization.

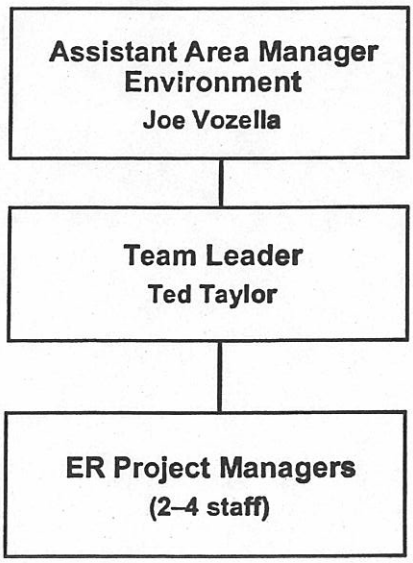

Figure 1-3. Organization of DOE-LAAO.

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Contract and Procurement Administration

The Laboratory's Business Systems (BUS) Division has assigned a contract administration coordinator to serve ER Project needs through a dedicated contract administration team assigned to the Environmental Management Division in which the ER Project resides. Having the contract administration coordinator in direct communication with members of the ER Project management team or team leaders expedites the procurement of services required for implementing the ER Project.

Budget Analysis

The Laboratory's BUS Division has assigned a budget analysis team to provide financial support to the ER program manager and project leaders. The budget analysis team works with Project Planning and Control System personnel (described in Section 1.3.2 of this document) to integrate the project management baseline with costing for the ER Project. The budget analysis team is responsible for analyzing financial data, preparing monthly reports, determining the cause of cost variances, and developing forecasts. The budget analysis team makes recommendations and reports costing irregularities to the ER program manager and project leaders. The budget analysis team also works with the ER Contract and Procurement team to ensure that procurements are costed appropriately and are in compliance with the ER Project baseline.

Field Support Facility

The Field Support Facility furnishes the following services to the ER Project:

- drilling coordination, which includes contract administration of drilling subcontractors, provision of a fabrication and staging area, and provision of Laboratory-owned drill rigs with remote capability;
- a sample management office that provides sample shipping, contract administration for sample analysis, and sample tracking services; and
- data management that provides verification and validation services for analytical data generated by subcontract analytical laboratories.

The Field Support Facility also has responsibility for the ER electronic database that contains analytical and field information. The ER database exists within the Facility for Information Management, Analysis, and Display (FIMAD). FIMAD is described in Chapter 4 of this document.

1.3.2 Project Planning and Control System

The ER Project Planning and Control (PP&C) Team documents, for LANL ER management, the technical scope of the cleanup effort at the Laboratory in the form of an integrated cost and schedule baseline. PP&C provides direct support to the ER program manager and project leaders. The primary benefit of this support is the ability to use the system for project management functions, which include cost and schedule planning, project tracking, resource management, and load leveling. The teams also integrate information from the focus areas on a projectwide basis. The PP&C team leader reports directly to the ER program manager. The information consolidated by the project office is used for the current-year baseline, the five-year plan, and

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reporting to the program manager and DOE. The ER PP&C use the system for critical path analysis, what-if scenarios, and load leveling.

Each ER focus area is supported by a cost and schedule analyst. The PP&C team member who supports the ER program manager ensures consistency in level of detail, unit costs, etc. The platform used for baseline development and management consists of Primavera Project Planner for scheduling and establishment of the performance measurement baseline, Excel for performance reporting, and G2 for estimating. Its basic structure is characterized by a risk-based graded approach to system design. In addition, the system as a tool is quite robust and reflects a conscious effort to accomodate different management styles and techniques. The three basic elements consist of baseline development, performance reporting, and change control.

The current financial planning and control system integrates the ER Project's finances with the Laboratory's financial system. As each year's baseline plan is developed, budgets are negotiated between the ER program manager and project leaders. These negotiations allow the project to establish the baseline cost for the next fiscal year on the basis of a proposed budget.

The ER Project has integrated its financial system with the Laboratory's financial management information system to encompass all cost elements needed by the ER Project for cost planning and reporting down to the eighth level of the work breakdown structure. As Laboratory systems are improved (time-accounting improvements, authorization controls for charging to cost accounts, etc.), the ER Project will incorporate these changes into the financial planning and control system.

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1.3.3 Reporting Requirements

The development and implementation of reporting requirements for the ER Project are mandated by DOE and NMED through DOE/UC's operational RCRA . Appropriate DOE-LAAO and UC officials, as copermittees, sign the following certification for each deliverable 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.

All reporting data and documentation requirements conform to DOE Order 430.1A, "Life-Cycle Asset Management," and comply with applicable guidance from DOE-HQ, DOE-AL, DOE-LAAO, and internal Laboratory criteria.

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. The major plans and reports are associated with the RFI, accelerated cleanups, CMS, and CMI. In addition, periodic technical progress reports are submitted to DOE and the regulators.

In addition to the HSWA Module, it is the policy of the ER Project Office to see that all reports comply, to the extent feasible, with EPA's RFI guidance and DOE guidance regarding consistency with CERCLA. At a minimum, the reports describe the procedures, methods, and results of field investigations and include information on the type and extent of contamination, sources and migration pathways, and actual and potential receptors. The reports contain information adequate to support further corrective action decisions (e.g., comparisons with screening action level criteria). All reports are made available to the public through the Laboratory's Public Reading Room and other information repositories maintained for the public (see Chapter 7 of this document).

In addition, the Decommissioning Project prepares formal Laboratory reports upon completion of a decommissioning project. The formal report provides background information, characterization data, decommissioning methods and techniques, final survey and release data, and any lessons learned. The purpose of the final report is to capture project history and provide a formal record of completion.

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References for Chapter 1

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, ER ID 12602; ER ID 12603)

DOE (US Department of Energy), May 1993. "Executive Order 12580: Superfund Implementation," CERCLA Information Brief EH-231-015/0593. (DOE 1993, ER ID 37500)

DOE (US Department of Energy), June 7, 1993. "Project Control System Guidelines," DOE Notice N4700.6, Washington, DC. (DOE 1993, ER ID 1058)

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, ER ID 1585)

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)

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, ER ID 11737)

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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-acre site northwest of Santa Fe. The project ultimately acquired an additional 3,120 privately owned acres and 45,666 acres of public land managed by the US Forest Service. In 1943, this land became known as the Los Alamos Site, later Los Alamos Scientific 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) and is currently officially known as Los Alamos National Laboratory. Figure 2-1 shows the location of the Laboratory. A map showing active technical areas at the Laboratory is shown in Figure 2-2, and summaries of the activities at the Laboratory's active technical areas (TAs) are provided in Appendix A.

2.1.2 Geography

Los Alamos National 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). The 43-mi^2 Laboratory site and the communities adjacent to it are situated on 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 7,800 ft on the flank of the Jemez Mountains to about 6,200 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 2-3). The San Ildefonso Pueblo borders Los Alamos County and the Laboratory to the east.

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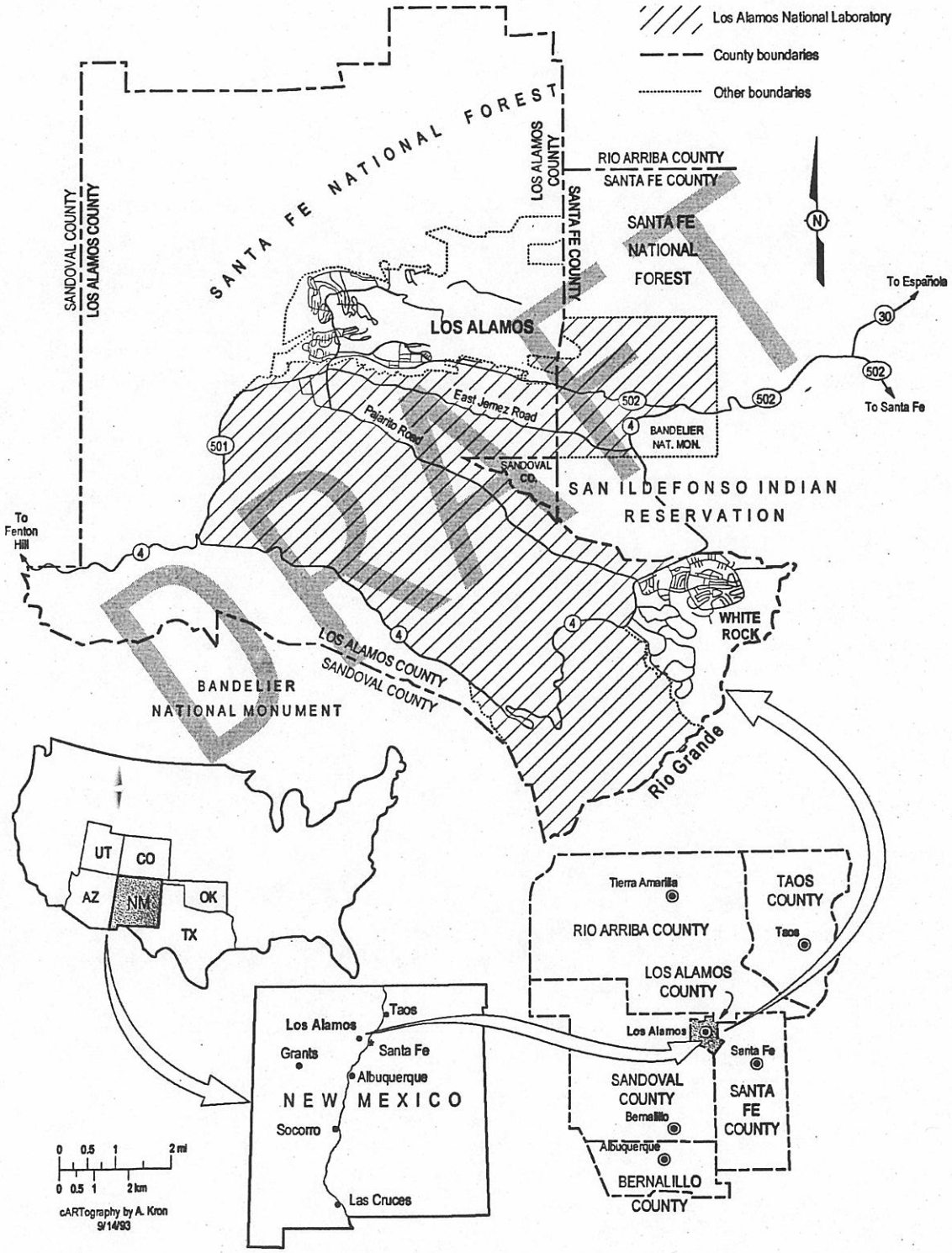

Figure 2-1. Location map of Los Alamos National Laboratory.

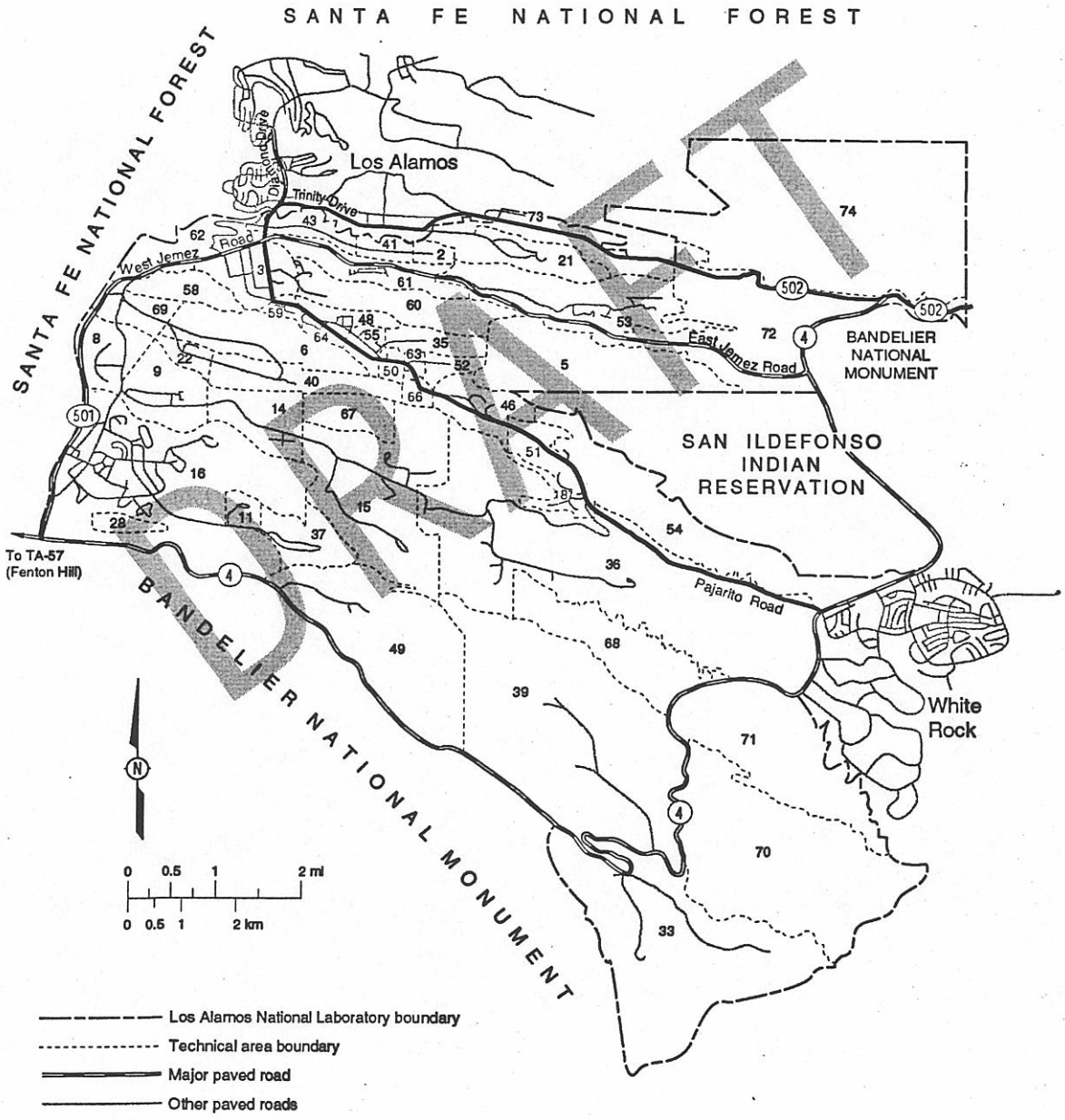

Figure 2-2. Technical areas at Los Alamos National Laboratory.

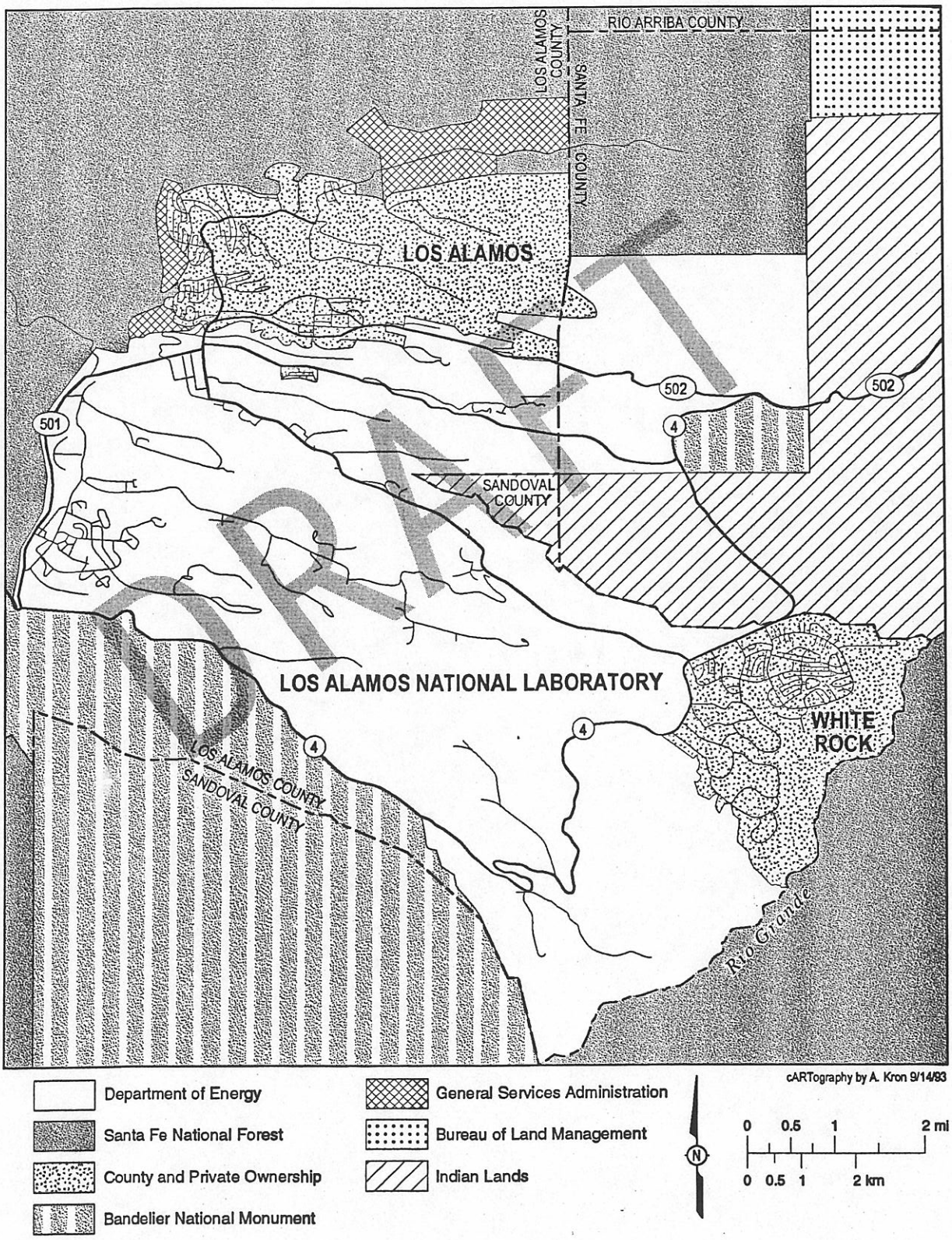

Figure 2-3. Land use map for the Laboratory and adjacent lands.

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.

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 Road 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 Road 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 1992 population of approximately 18,200, based on the 1990 census adjusted to 1992 (Environmental Protection Group 1994, 35363). Two residential areas (Los Alamos and White Rock) and their related commercial areas exist in the county (Figure 2-1). 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 11,400. The White Rock area (including the residential areas of White Rock, La Senda, and Pajarito Acres) has about 6,800 residents. About 40% of the people employed in Los Alamos commute from other counties. Population data from 1990, adjusted to 1992, place about 224,000 persons within a 50-mi radius of Los Alamos (Table 2-1) (Environmental Protection Group 1994, 35363).

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Table 2-1

1992 POPULATION WITHIN 80 km OF LOS ALAMOS

	Distance from TA-53 (km)								
Direction	1–2	2–4	4–8	8-15	15–20	20–30	30–40	40–60	60–80
N	1	0	0	0	0	0	1,169	0	378
NNE	0	0	0	582	0	558	1,781	1,850	227
NE	1	0	0	0	326	15,860	1,039	1,170	3,965
ENE	0	0	0	2,031	1,609	2,843	2,827	1,222	2,267
E	0	0	87	26	582	1,199	728	0	1,422
ESE	0	0	0	0	0	306	24,239	1,091	1,511
SE	0	0	6,796	0	0	0	56,036	2,558	8
SSE	0	0	0	0	0	0	446	4,551	99
S	0	0	0	50	0	347	670	7,363	0
SSW	0	0	0	20	0	891	219	8,981	36,507
SW	0	0	0	0	0	0	343	4,532	0
WSW	0	0	0	0	0	343	341	2,775	225
W	0	0	0	0	0	0	0	179	144
WNW	0	1,443	6,572	0	0	0	0	0	3,359
NW	0	526	1,731	0	0	0	0	1,481	0
NNW	0	581	582	0	0	0	0	65	64
1992 Population Distribution	2	2,550	15,768	2,709	2,517	22,347	89,838	37,818	50,176

Note: Total population within 80 km of Los Alamos is 223,725.

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.

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 2-4). 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 2-4). Volcanism over the last 13 Ma (million years) 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 2-4).

Figure 2-5 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 2-6). 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 2-7 and Figure 2-8 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").

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

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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 Ma (Manley 1979, 11714)
2. Tschicoma Formation: 2.53 to 6.7 Ma (Dalrymple et al. 1967, 49924)
3. Puye Formation: 1.7 to 4 Ma (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 Ma (Gardner and Goff 1984, 44021; WoldeGabriel et al. 1996, 54427)
5. Otowi Member of the Bandelier Tuff: 1.61 Ma (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542)
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 Ma) and the overlying Tshirege Member (1.22 Ma) of the Bandelier Tuff
7. Tshirege Member of the Bandelier Tuff: 1.22 Ma (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542)

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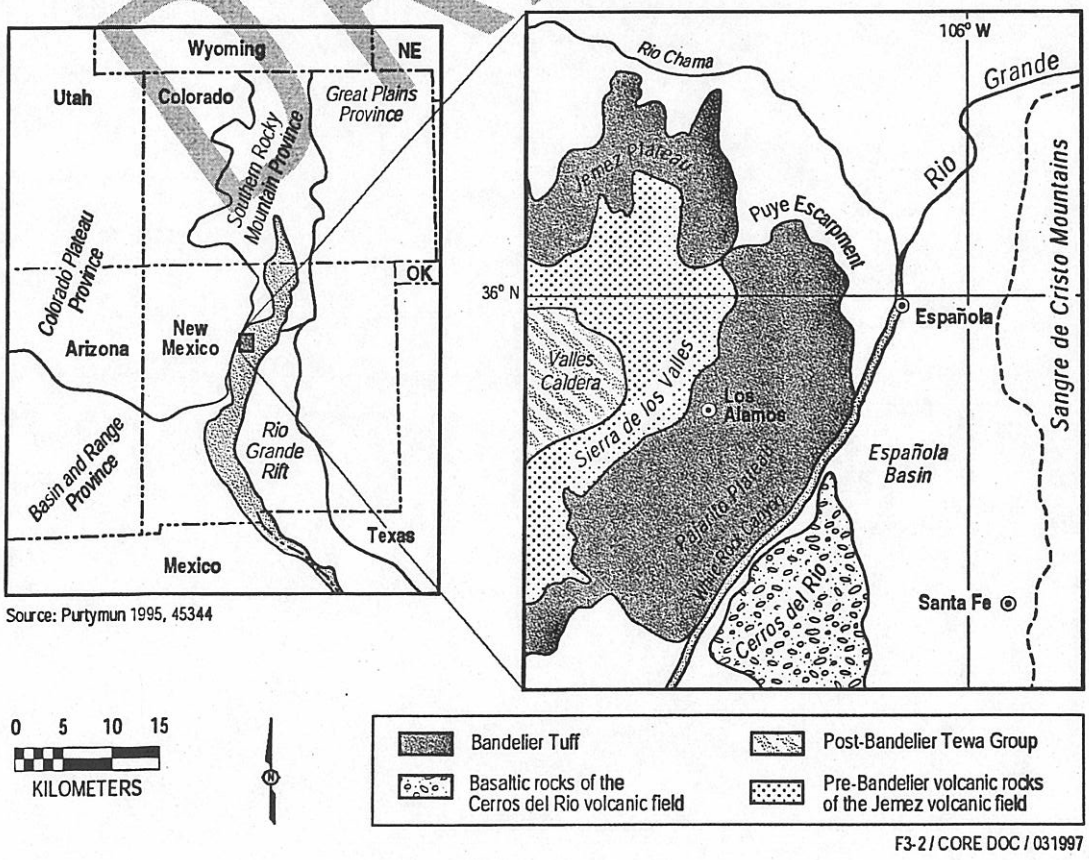

Figure 2-4. Physiographic features of the Pajarito Plateau.

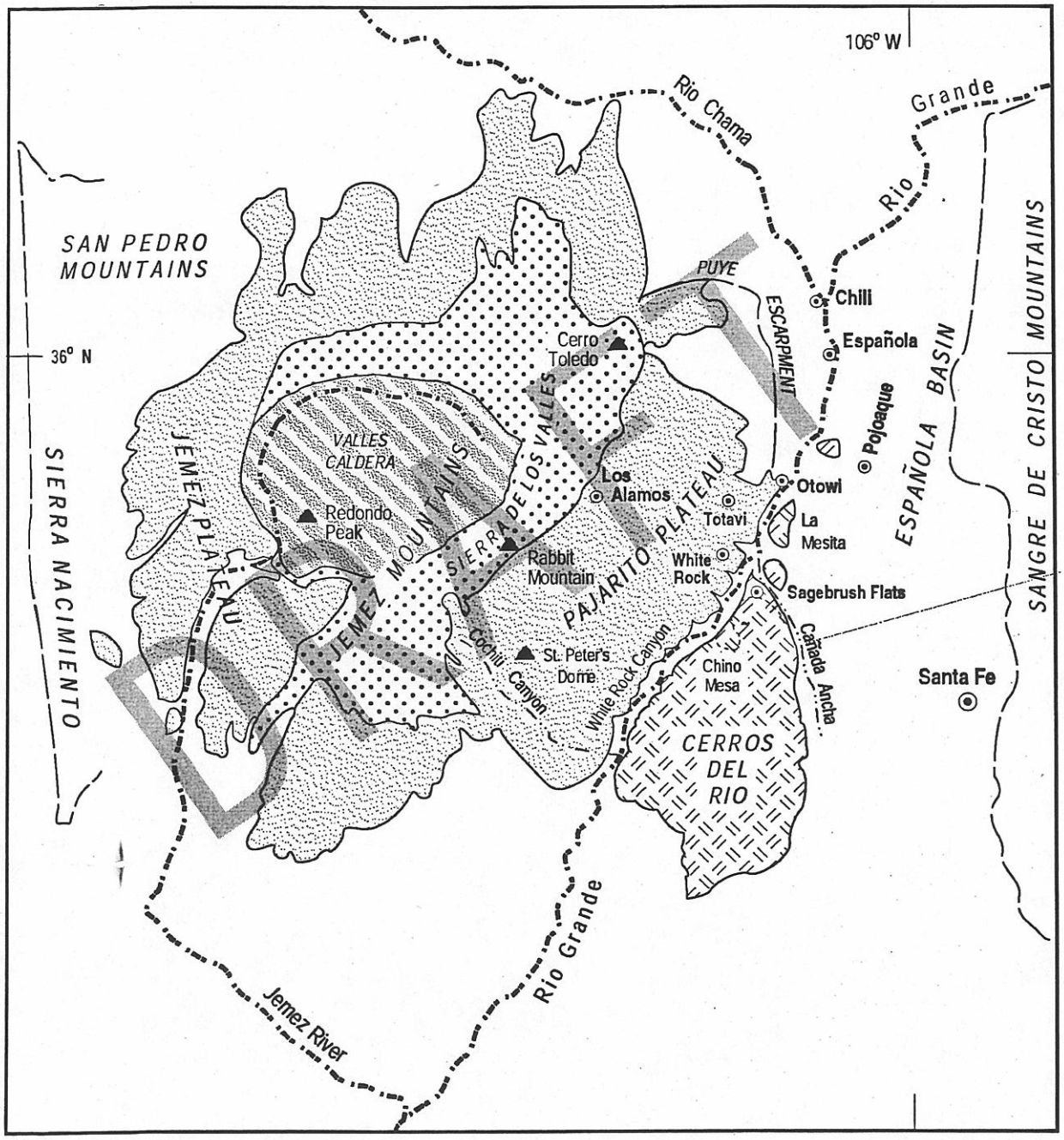

Figure 2-5. General geologic and geographic features of the Pajarito Plateau and surrounding areas.

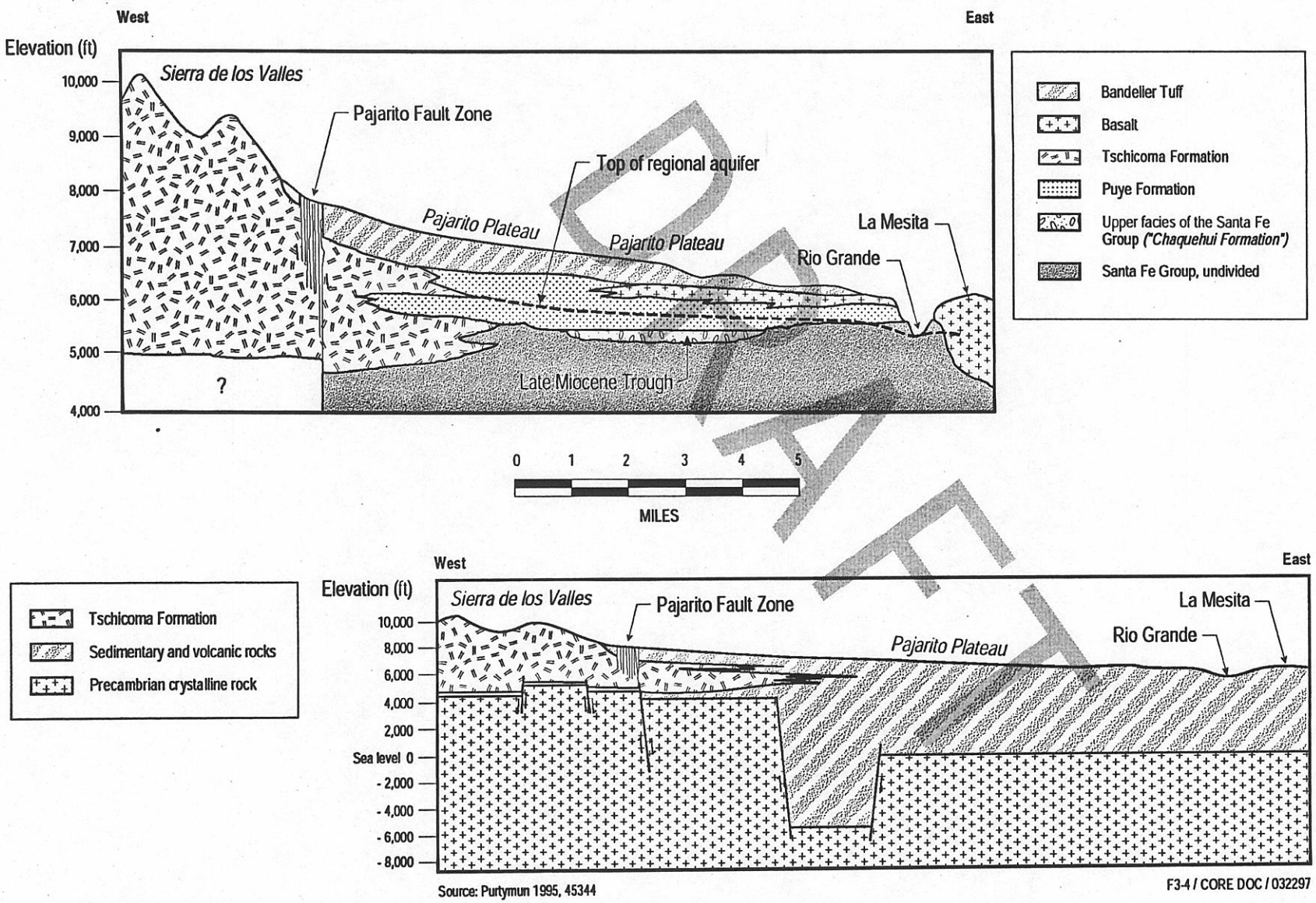

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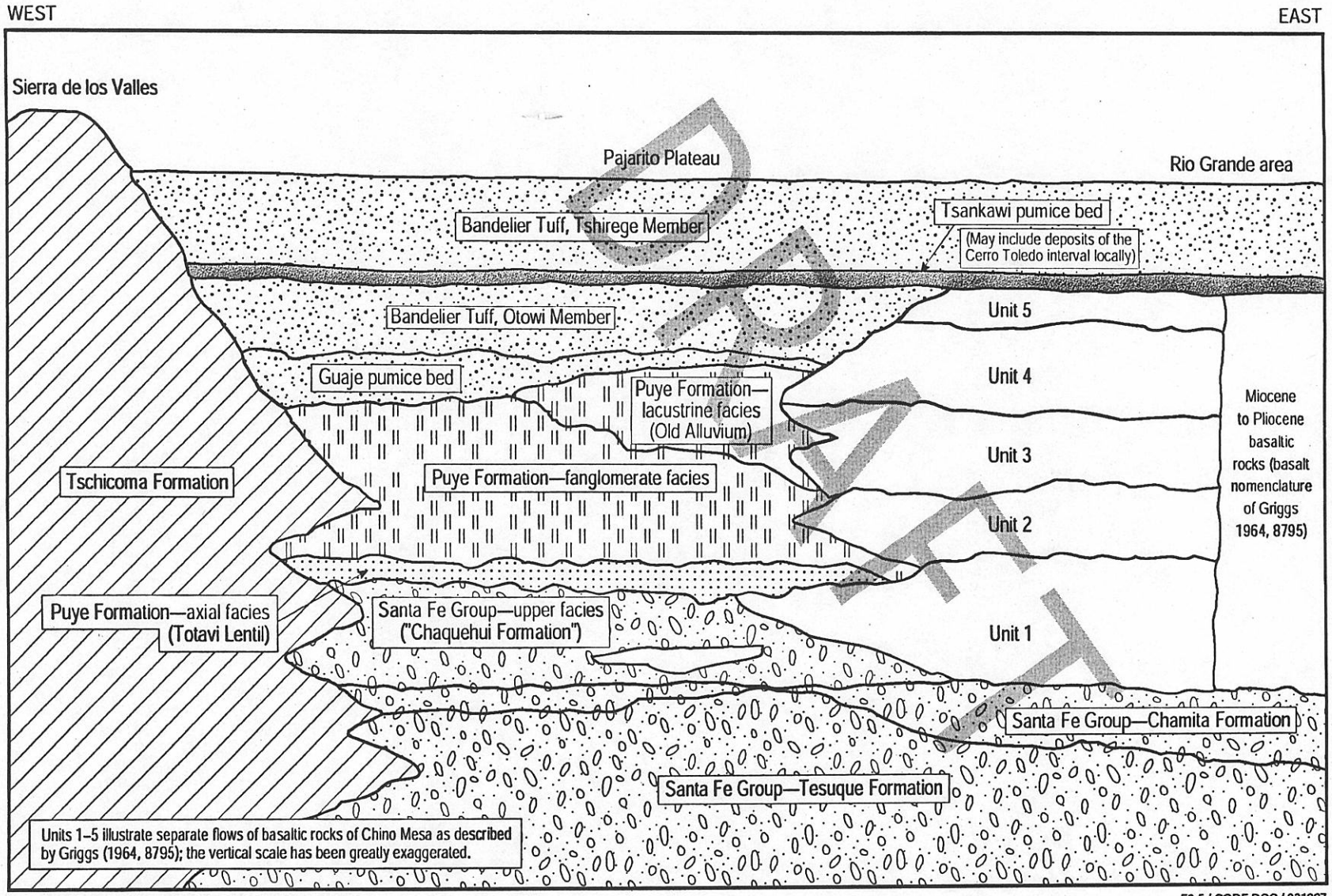
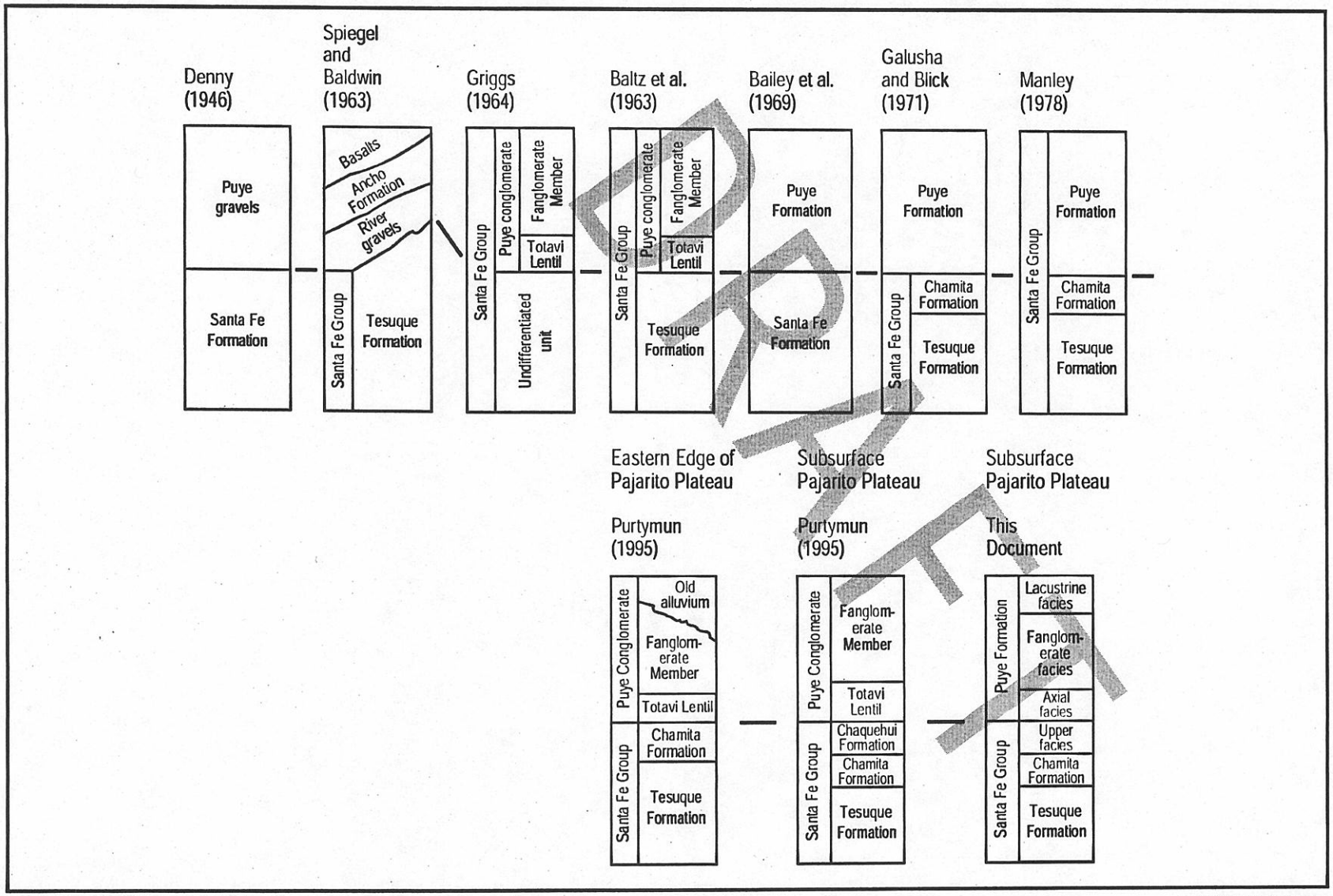
Figure 2-6. Generalized geologic cross sections of the Pajarito Plateau.



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

Figure 2-7. Schematic cross section of the Pajarito Plateau showing complex interfingering of volcanic and sedimentary rocks.



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Source: Modified from Purtymun 1995, 45344

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Figure 2-8. Stratigraphic relationships and evolution of nomenclature for pre-Bandelier Tuff rocks of the Pajarito Plateau.

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 2-5 shows area locations, and Figure 2-7 and Figure 2-8 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 2-8). 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 2-7 and Figure 2-8) 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.

The 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 Ma (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 2,219 ft (67.6 m) in Otowi well O-1 (Purtymun 1995, 45344).

The Chamita Formation. The Chamita Formation overlies and interfingers with the Tesuque Formation. It consists of arkosic siltstones, sandstones, 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 (9.1 m) 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 Ma and the age estimates for the overlying "Chaquehui Formation" (see below) support that suggestion. However, paleomagnetic data in the area indicate an age range of 4.5 to 6 Ma (MacFadden 1977, 21569), and tephra dates by Manley (1979, 11714) support a younger age of about 5 Ma 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.

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The "Chaquehui Formation." Sedimentary deposits referred to as the "Chaquehui Formation" by Purtymun (1995, 45344), and shown as upper facies of the Santa Fe Group on Figure 2-7 and Figure 2-8, 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 "Chaquehui Formation" overlies the Chamita Formation in well boreholes on the Pajarito Plateau. However, because it contains interbedded basalt lava flows dated at 8 to 9 Ma (Laughlin et al. 1993, 54424), it is equivalent in age to older parts of the Chamita Formation. The "Chaquehui Formation" forms 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 "Chaquehui Formation" suggests that these deposits may represent axial deposits of an ancestral Rio Grande within the Chamita Formation.

The 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 2,500 ft (762 m) thick in the Sierra de los Valles. The Tschicoma Formation thins eastward under the Bandelier Tuff on the Pajarito Plateau where it interfingers with the peneconteporaneous 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 Ma (Dalrymple et al. 1967, 49924). Turbeville et al. (1989, 21587) report an age of 2.53 Ma 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 Ma) and the overlying El Rechuelos Rhyolite (2.0 Ma) (Loeffler et al. 1988, 54409).

The Puye Formation

The Puye Formation is a large apron of alluvial fans which 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; Purtyman 1995, 45344), this formation crops out in canyons north of Los Alamos Canyon. Turbeville et al. (1989, 21587) estimated its areal distribution at 200 km^2 (518 mi^2) and its volume at ~15 km^3 (~3.6 mi^3). Its age is generally placed at between 1.9 and 3.5 Ma, but it may be as young as 1.6 Ma and as old as 6.7 Ma 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

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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 ~700 ft (~213 m) in Pueblo Canyon (Griggs 1964, 8795) but thins to 50 ft (15 m) in areas north of the Pajarito Plateau (Dethier and Manley 1985, 21506). In the central and eastern portions of the Laboratory, it is ~600 ft (~183 m) 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 2-7 and Figure 2-8).

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 ~50 ft (~15 m) 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 Ma (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. 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 PM-1 near the eastern edge of the plateau.

Basaltic Rock of the Cerros del Rio Volcanic Field ("Basaltic Rocks of Chino Mesa")

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

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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 2-7). 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 (152 m) 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. The maar deposits resulted from steam explosions that occurred where basalt erupted through an aquifer or standing body of water.

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The 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 Ma 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).

The 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 ~28 ft (~8.5 m) 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 separates 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 (30.5 m) 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 2-5) 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.

The 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 ~1.2 Ma 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 of 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 (61 m) thick. Its thickness exceeds 600 ft (183 m) near the southern edge of the Laboratory at TA-49 but is thinner (often <200 ft [<61 m]) 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

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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 degree of welding and glass crystallization that accompanies 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 2-9) based on a combination of hydrologic properties and lithologic characteristics. There is a certain amount of confusion 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 2-10 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 follow paragraphs describe, in ascending order, subunits of the Tshirege Member.

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.

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.

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.

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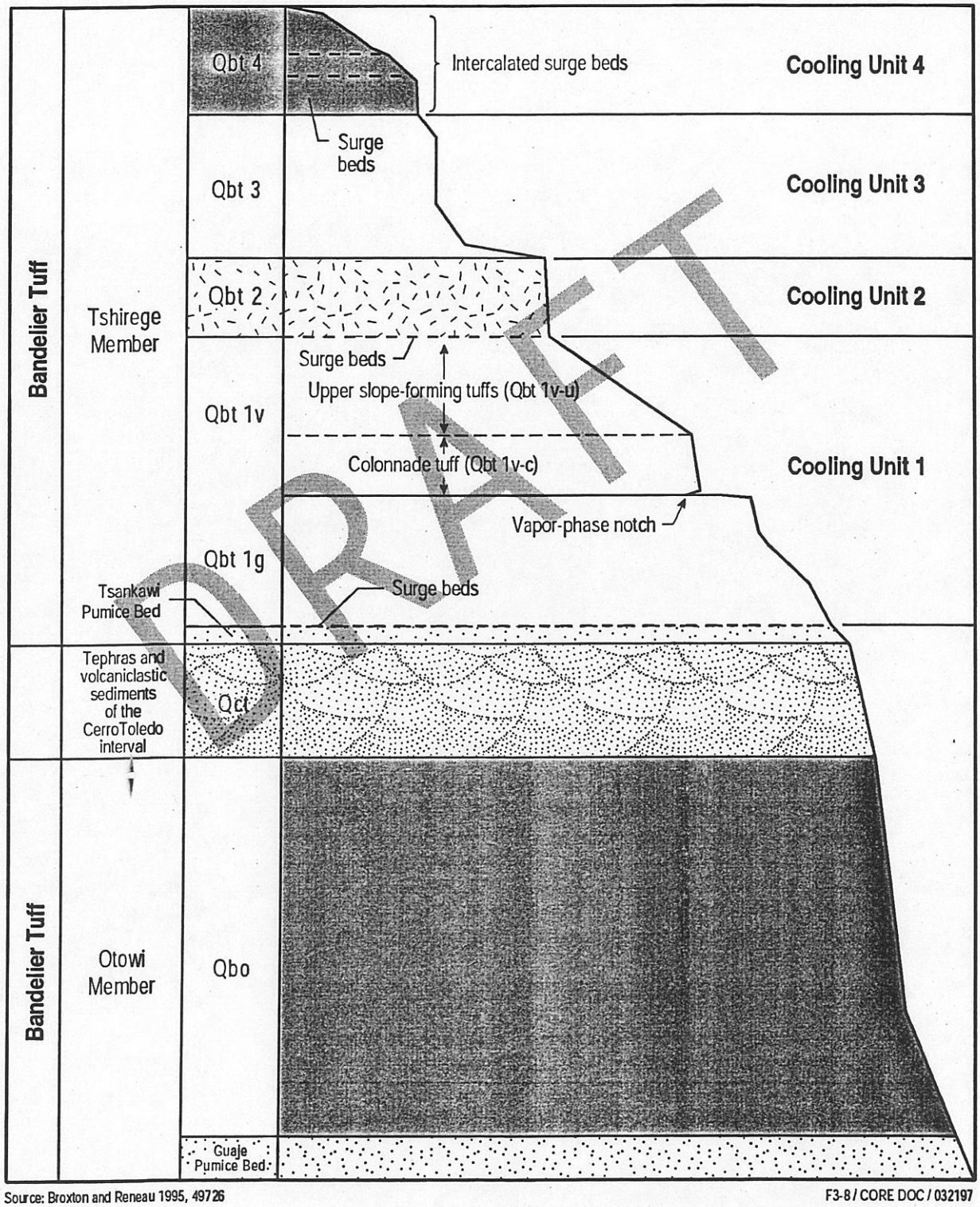

Source: Broxton and Reneau 1995, 49726

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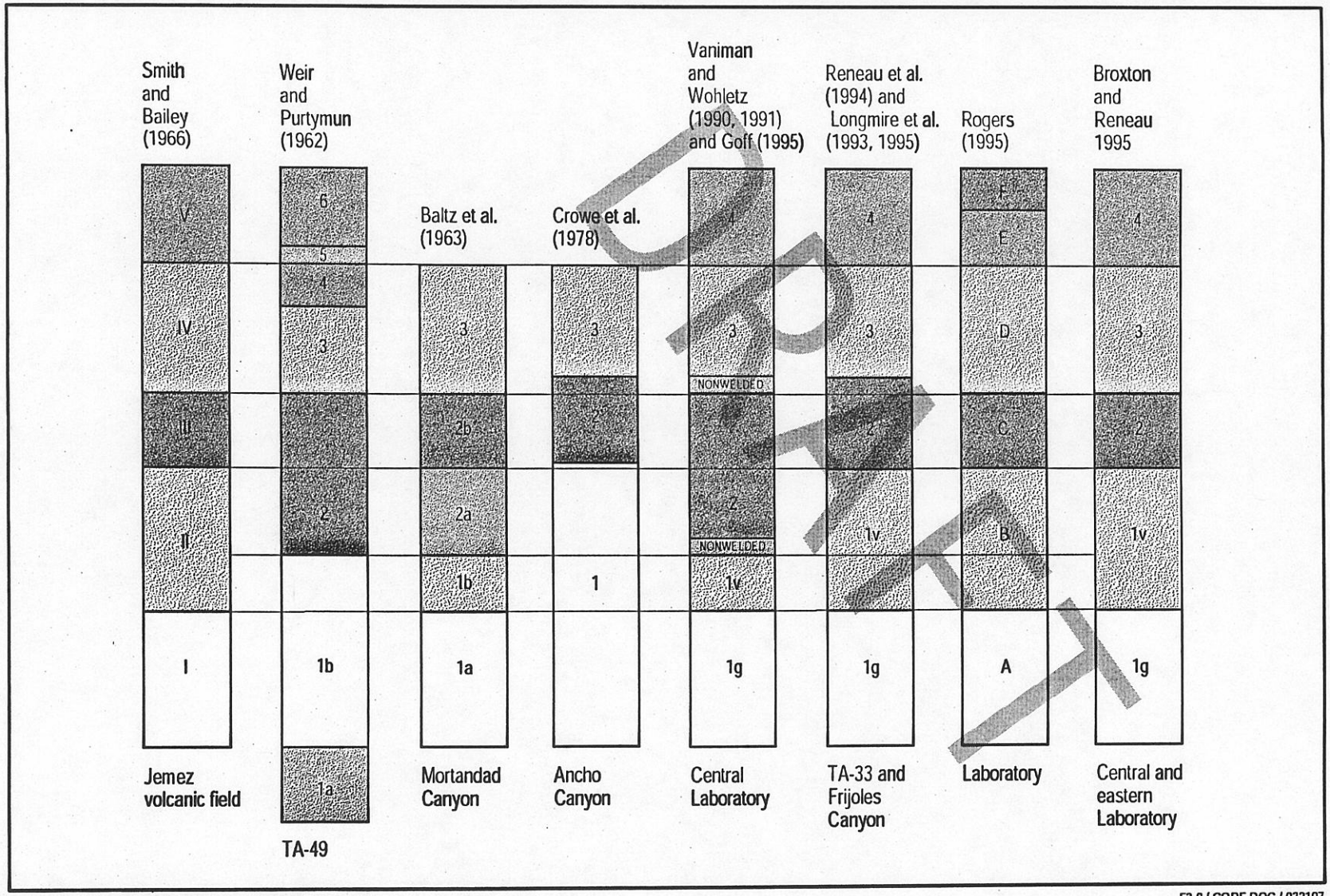
Figure 2-9. Illustration of the Bandelier Tuff weathering profile and unit subdivisions.



Source: Slightly modified from Broxton and Reneau 1995, 49726

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Figure 2-10. Correlation of rock unit names applied to the Tshirege Member of the Bandelier Tuff.

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.

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.

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 that 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 years 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 bottoms.

The alluvial sediments in the canyon bottoms 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 6,000 years, 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 years old (Toyoda et al. 1995, 57001; Reneau et al. 1996, 57002).

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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 United States 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 2-11). The vertical throw on this fault system is over several hundred feet south and west of the Laboratory but decreases northward 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.

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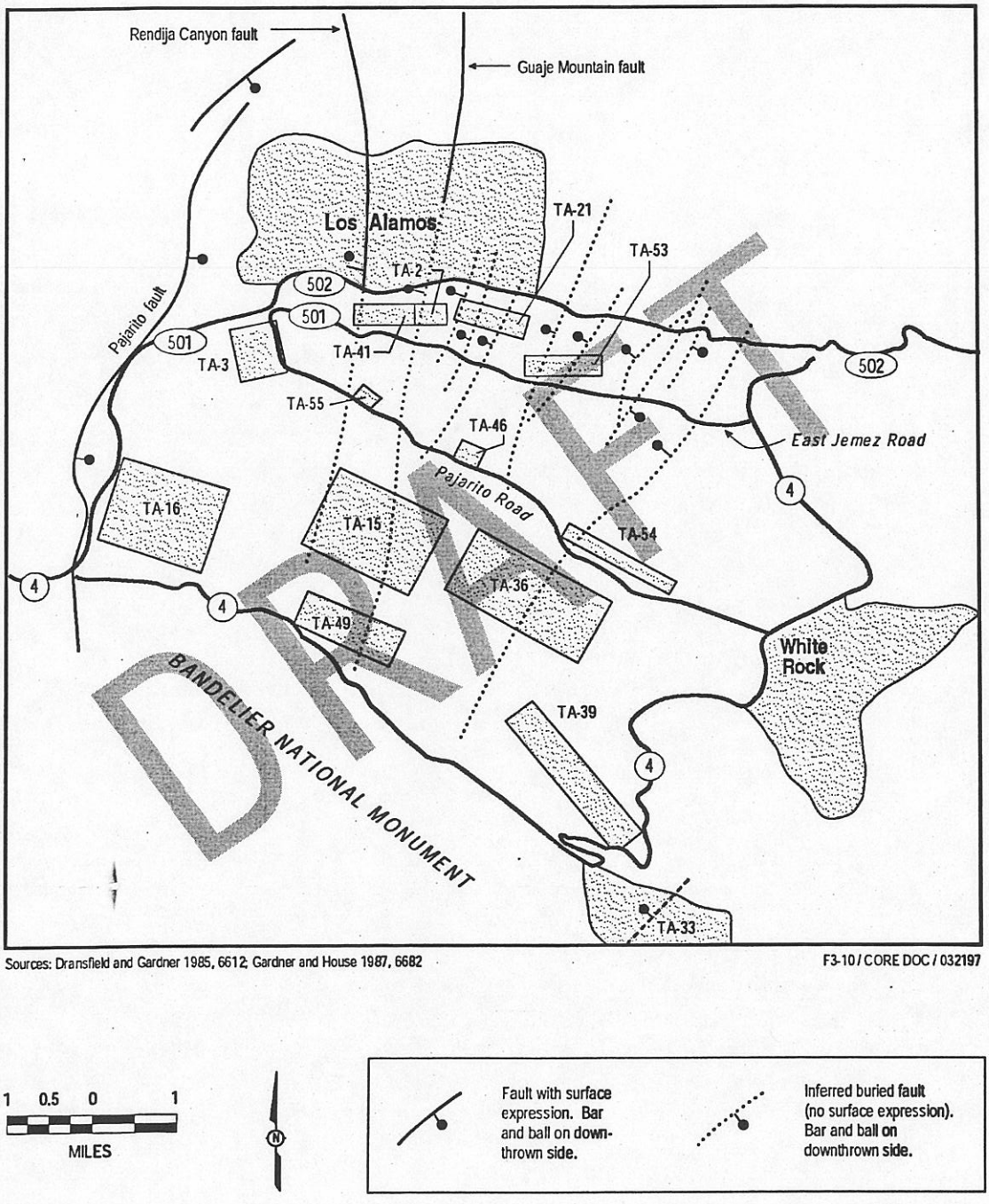

Figure 2-11. Locations of known and inferred faults at the Laboratory and in the surrounding areas.

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 years ago and continued without significant hiatus up through about 50,000 years 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 years 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.

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 what their potential is 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 rockfall and landsliding, (3) colluvial transport on sloping portions of canyon walls, and (4) erosion and deposition of sediments by streams in the canyon bottoms. 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

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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 potential release 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 (4.0-m-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 6,000 years (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 (0.9 to 1.8 m), 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 (1.8 m) 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 pounds 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).

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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 2-12 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 and Cañon de Valle does not reach the western boundary (Stoker 1993, 56021) (see Figure 2-12).

Springs on DOE property near the western Laboratory boundary occur in Pajarito Canyon and Cañon de Valle. Perennial flow has been noted 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.

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 Road 4 as part of the environmental surveillance program. By 1993, flow extended to the Rio Grande (Stoker 1993, 56021). Effluent discharged into Cañada del Buey 2 mi up from the confluence with Mortandad Canyon from the Los Alamos County-operated sanitary wastewater treatment plant in White Rock regularly extends to the Rio Grande (Stoker 1993, 56021). 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).

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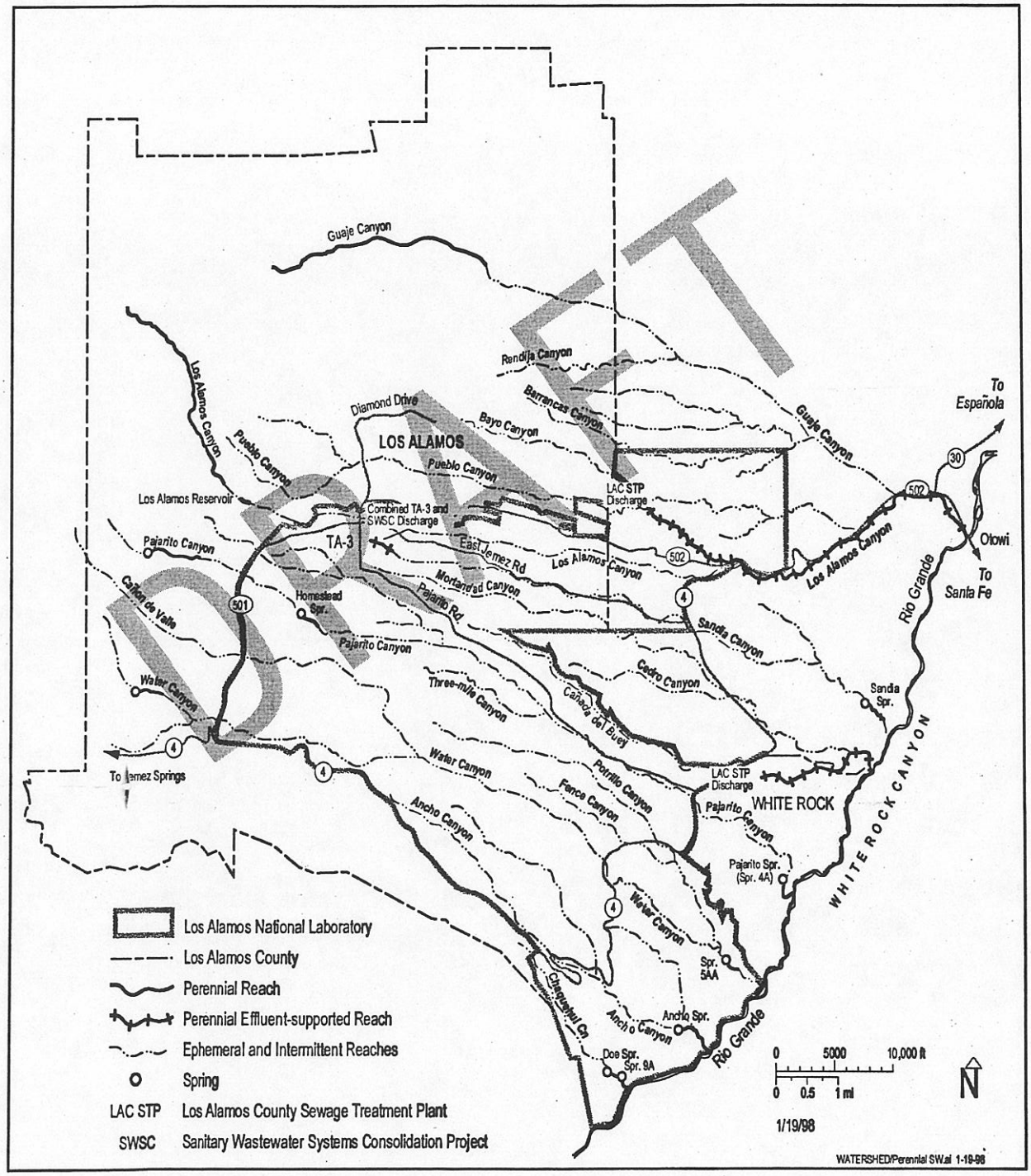

Source for perennial and effluent-supported reaches: Stoker 1993, 56021.

Figure 2-12. Surface water occurrences at Los Alamos.

Eleven drainage areas, with a total area of 82 mi², 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 of greater than 10 mi². Pueblo Canyon has approximately 8 mi²; the rest (Barrancas [a tributary to Guaje Canyon], Bayo, Sandia, Mortandad, Cañada del Buey, Ancho, and Chaquehui Canyons) have less than 6 mi² 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

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 main 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 2-13.

The Laboratory has formulated a comprehensive groundwater protection plan (LANL 1995, 50124) for an enhanced set of characterization and monitoring activities. The Hydrogeologic Workplan (LANL 1998, 59599) details the implementation of extensive groundwater characterization across the Pajarito Plateau within an area potentially affected by Laboratory operations. The locations of the characterization wells and their proposed drilling and sampling plans address many areas of concern, 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 Environmental Restoration Project and environmental surveillance activities, including use of common resources and data collection/retrieval techniques.

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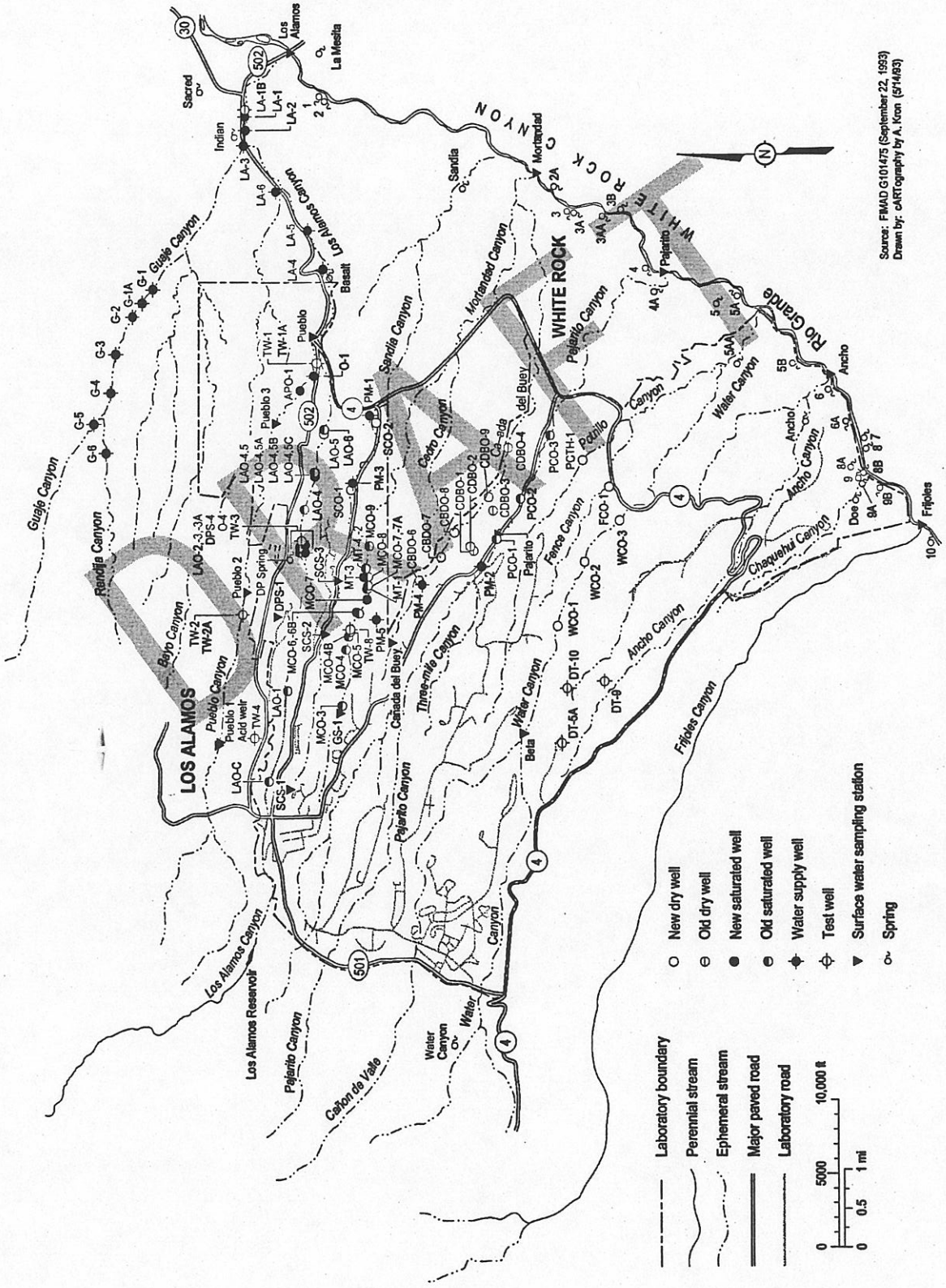

Figure 2-13. Well locations in Los Alamos County and adjacent areas.

Perched Groundwater in Alluvium

Intermittent and ephemeral streamflows in the canyons of the Pajarito Plateau have deposited alluvium that ranges in thickness to as much as 100 ft. 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/s for a sand to 10^{-4} cm/s 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 limit 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).

The water quality in the alluvial perched groundwaters is variable, depending on the location and history of effluent discharges. In Mortandad Canyon, for example, plutonium concentrations fluctuate up and down in response to variations in treatment plant effluent and storm runoff water, which cause some dilution of the shallow alluvial perched groundwater. Tritium concentrations have fluctuated almost in direct response to the average annual concentration of tritium in the TA-50 effluent, with a lag time of about one year (Environmental Protection Group 1992, 7004).

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).

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 bottoms 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

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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 properties 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 (Purtyman 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 most 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.)

Measurements of tritium in perched groundwater at intermediate depths demonstrate that recharge to those depths has occurred during the last several decades. The levels of tritium in those locations are high enough to be attributed to recharge of surface water contaminated by effluent or other releases from Laboratory operations.

These observations have been made at four locations in Pueblo and Los Alamos Canyons. For several years, tritium has been observed in test well 2A in Pueblo Canyon at levels between 2,000 and 3,000 pCi/L. Starting in 1991, low-detection-limit tritium measurements have consistently revealed tritium at levels of about 150 pCi/L in samples from test well 1A, located in lower Pueblo Canyon near its confluence with Los Alamos Canyon, and in Basalt Spring, located in Los Alamos Canyon just downstream from its confluence with Pueblo Canyon. The measure-ments at these three locations are consistent with previous understanding. The intermediate perched groundwater has long been known to be affected by effluents discharged into Pueblo Canyon, starting with measurements made by the USGS in the 1950s and 1960s (Abrahams et al. 1961, 8134).

In 1993, elevated tritium levels were found in intermediate-depth groundwater in well LADP-3 in the middle reach of Los Alamos Canyon, about 1 mi downgradient of TA-2, the Omega Reactor (Broxton et al. 1995, 50119). This perched groundwater occurs at a depth of about 320 to 330 ft,

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above the contact between the Otowi Member and the Puye Formation. Samples of water from that well contained about 6,000 pCi/L tritium in 1993, but concentrations had decreased to <1,000 pCi/L by 1996.

Six zones of saturation were encountered during the drilling of R-9 in Los Alamos Canyon at the eastern Laboratory boundary (Broxton, et al., 1998, 59158.3). Two perched groundwater zones were encountered in Cerros del Rio basalt at depths of 180 and 275 ft. The upper zone was confined, and the water rose in the hole to 137 ft after the top of the zone was penetrated. The saturated thickness of the upper zone is approximately 45 ft. This zone contains 347 pCi/L tritium (analysis by low-level electrolytic enrichment), which is similar to tritium activities detected in alluvial groundwater within upper Los Alamos Canyon. The second perched zone occurs at the base of the Cerros del Rio basalt and is approximately 7 ft thick. This zone contains 106 pCi/L tritium (low-level electrolytic enrichment) and 48.4 parts per billion (ppb) dissolved uranium. Thin zones of saturation were also encountered in the Puye Formation at depths of 579, 615, and 624 ft. These zones, which are of uncertain origin, occur in transmissive zones intercalated in clay-rich tuffaceous sedimentary deposits. These three zones are confined and appear to be hydraulically connected because water levels rose to a depth of 524 ft after the tops of each of the zones were penetrated. Tritium activities in groundwater of the Puye Formation range from 2.71 to 30.3 pCi/L. The deepest groundwater zone was encountered at a depth of 688 ft near the top of basalt in the Santa Fe Group. This deep groundwater is unconfined, and it is almost certainly associated with the regional aquifer. It has a tritium activity of 14.43 pCi/L.

In R-12, located in Sandia Canyon at the eastern Laboratory boundary, perched groundwater system was encountered from depths of 443 to 519 ft in the lower part of the Cerros del Rio basalt and in underlying old alluvium (Broxton et al., 1998, 59665.4). Groundwater in this zone was confined and the water level stabilized at a depth of 424 ft after the top of the zone was penetrated. The confining layer at the top of this zone apparently is massive basalt, and the lower perching layer is a clay-rich lacustrine deposit. The saturated thickness of this groundwater body is approximately 75 ft, making it one of the thickest intermediate-depth perched groundwater bodies yet identified on the Pajarito Plateau. Groundwater from the depths of 443 and 495 ft was found to contain 249.3 to 254.7 pCi/L tritium (analysis by low-level electrolytic enrichment), 31.5 to 33.4 parts per million (ppm) chloride, <0.02 to 0.26 ppm ammonium, 4.9 to 5.5 ppm nitrate, and 2.46 to 2.51 ppb uranium. Groundwater from the depth of 464 ft was found to contain 208.1 pCi/L tritium, 200 ppm chloride, 13.5 ppm ammonium, 0.21 ppm nitrate, and 2.04 ppb uranium.

Some perched water occurs in volcanics on the flanks of the Jemez Mountains offsite 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 years, 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 (unpublished data). Some of these springs are located within canyon bottom alluvium where groundwater return flow to the dry stream channel occurs and 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 may have its source from nearby outfalls. The ER Project and NMED DOE Oversight Bureau (unpublished data) have discovered high-explosives residuals in samples from some of these springs.

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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 1,400 gpm (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 surface of the regional aquifer rises westward from the Rio Grande within the Santa Fe Group into the lower part of the Puye Formation beneath the central and western part of the Pajarito Plateau (Figure 2-14). The depths to groundwater below the mesa tops range from about 1,200 ft along the western margin of the plateau to about 600 ft at the eastern margin. 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 4,300 to 5,000 acre-ft of water annually into White Rock Canyon along an 11-mi reach between Otowi Bridge at State Road 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 2-14). 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.

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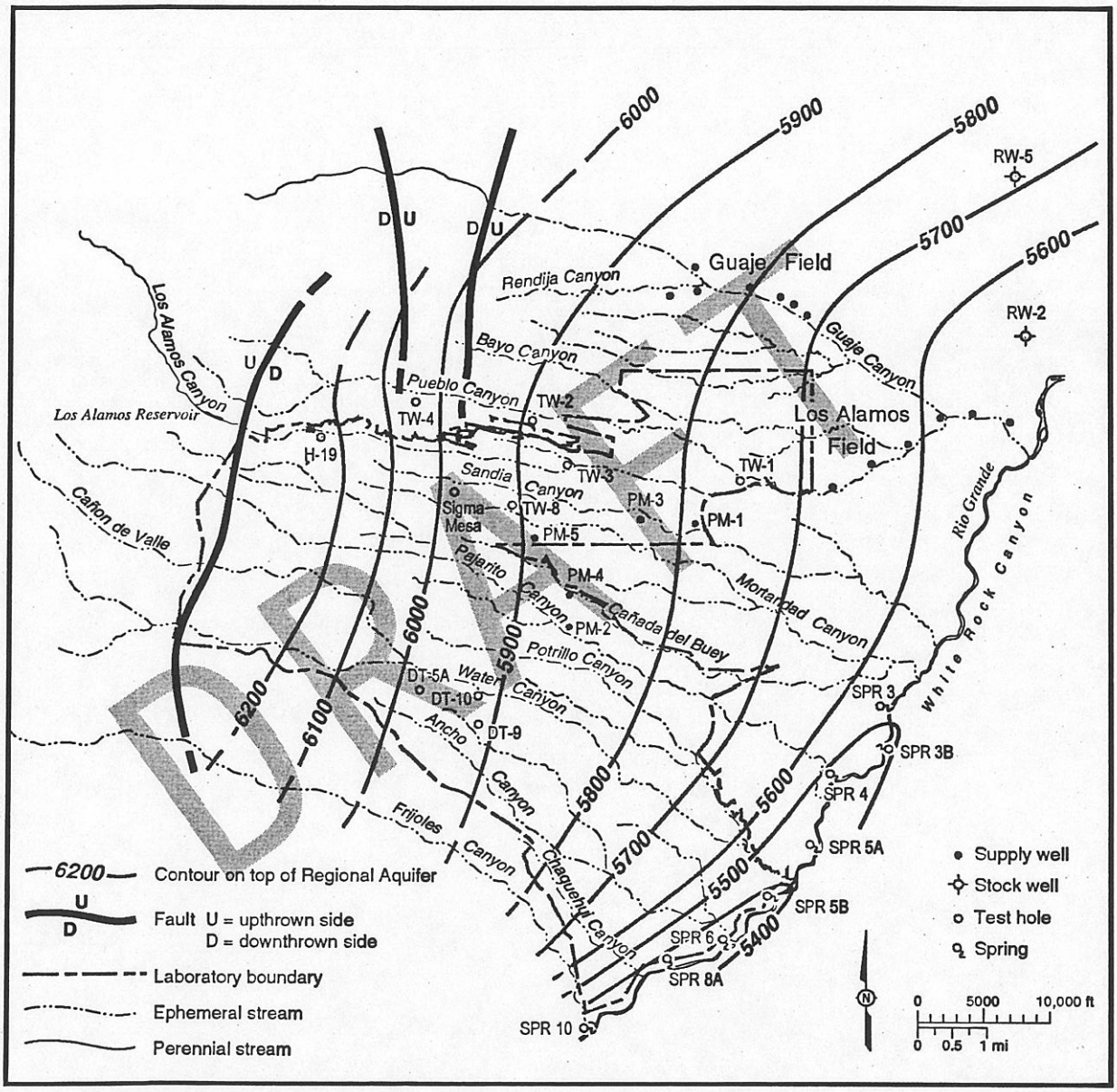

Source: Modified from Purtymun 1984, 6513

Figure 2-14. 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 which had sufficient data. These seven boreholes represent mesa top and canyon bottom 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 Material Disposal Area 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 Pleateau provide compelling evidence of a natural evaporative barrier to vertical liquid flow (Newman 1996, 59731; Newman et al. 1997, 59732).

Apparent canyon bottom 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, the only relatively wet canyon represented. Canyon bottom infiltration rates beneath wetter canyons such as Los Alamos Canyon could be much greater, but no data for those sites are currently available.

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 (F. Goff, unpublished Los Alamos National Laboratory memo 1991; 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 2-13). 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 2-15.

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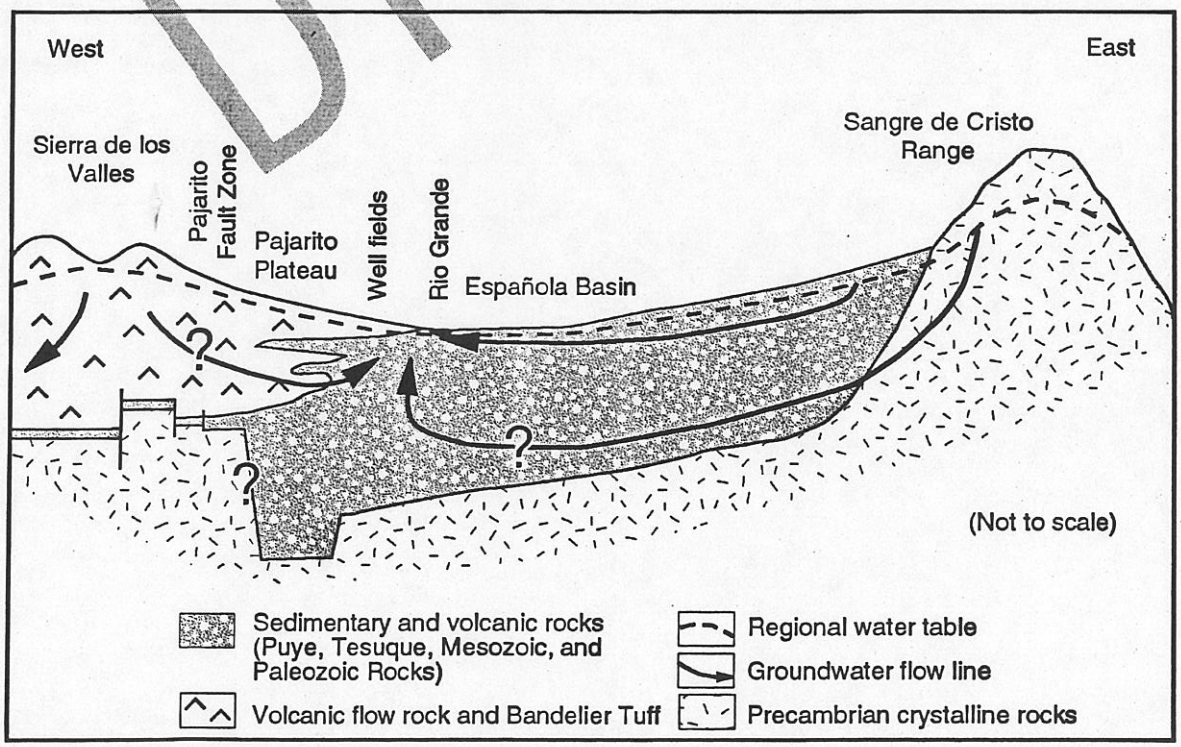

Source: Modified from Stephens et al. 1993, 56863

Figure 2-15. Conceptual sketch of groundwater flow paths in the Española portion of the northern Rio Grande Basin.

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).

The above cited studies regarding sources of recharge are inconclusive and require further investigation. The work being done for the Hydrogeologic Workplan will address recharge issues as part of the characterization of the groundwater system beneath the Pajarito Plateau.

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.

The interpretation of ten carbon-14 analyses indicates that the minimum age of water in the regional aquifer ranges from about 1,000 years under the western portion of the Pajarito Plateau, increasing as it moves eastward, to about 30,000 years 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 2-15). 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 2-16), 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 years. These travel times are far shorter than the 22,000 to 27,000 year difference in the carbon-14 ages for these wells (Rogers et al. 1996, 54714).

Several measurements of tritium by extremely low-detection-limit analytical methods appear to show the presence of some recent recharge (within the last 40 years) in groundwater samples taken from seven locations in the regional aquifer at locations near Los Alamos (Environmental Protection Group 1994, 35363; 1995, 50276; Broxton et al. 1998, 59158.3; Broxton et al. 1998, 59665.4). Another thirty wells show no apparent influence of recent recharge on the regional

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aquifer. The tritium levels measured range from less than a percent to less than a hundredth of a percent of current drinking water standards and are less than levels that could be detected by the EPA-specified analytical methods normally used to determine compliance with drinking water regulations. The locations where tritium measurements clearly indicate the presence of recent surface recharge to the regional aquifer are (1) TW-1 situated in Pueblo Canyon near the confluence with Los Alamos Canyon; (2) TW-3, in Los Alamos Canyon; (3) in old observation and water supply wells LA-1A and LA-2, located in Los Alamos Canyon near its confluence with the Rio Grande; (4) at TW-8, in Mortandad Canyon located about a mile downstream from the outfall of the Radioactive Liquid Waste Treatment Facility at TA-50; (5) in household wells and springs at San Ildefonso Pueblo (Environmental Protection Group 1995, 50276; Blake et al. 1995, 49931); (6) R-9 in Los Alamos Canyon at the eastern Laboratory boundary; and (7) R-12 in Sandia Canyon at the eastern Laboratory boundary.

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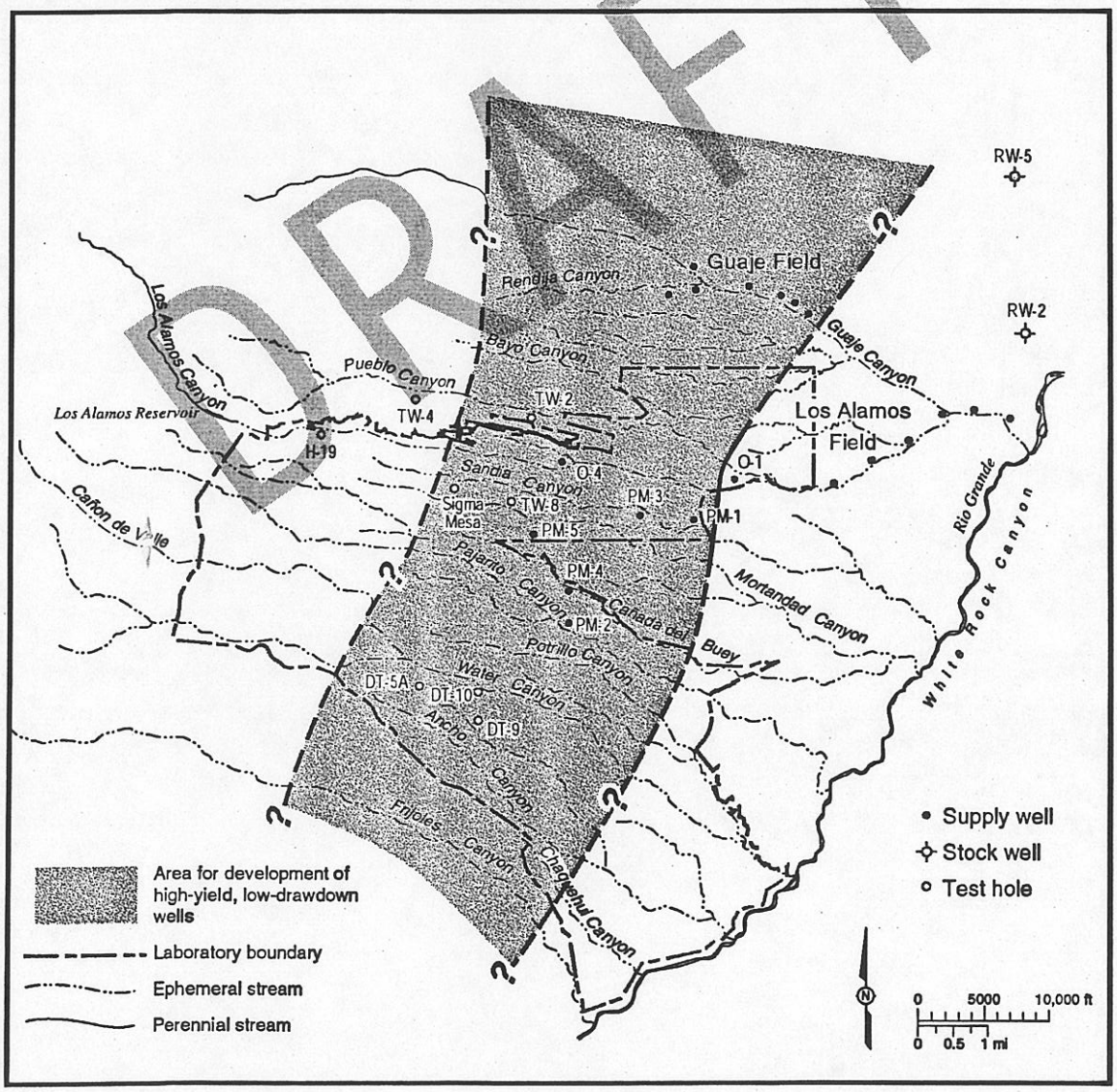

Source: Modified from Purtymun 1984, 6513

Figure 2-16. 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 5,000-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 5,600 to 6,200 ft. The piñon-juniper cover type, generally in the 6,200- to 6,900-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 6,900- to 7,500-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 7,500 to 9,500 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 9,500 to 10,500 ft. Twenty-seven wetlands and several riparian areas enrich the diversity of plant 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.

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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 Surface Water

Under the Resource Conservation and Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments (HWSA) Module of the Laboratory's operating permit, the Environmental Protection Agency (EPA) required a determination of all wetlands located in areas that either lie within Laboratory boundaries or that drain Laboratory land (Figure 2-17).

US Fish and Wildlife personnel mapped the wetlands around Los Alamos, using US Geological Survey (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.

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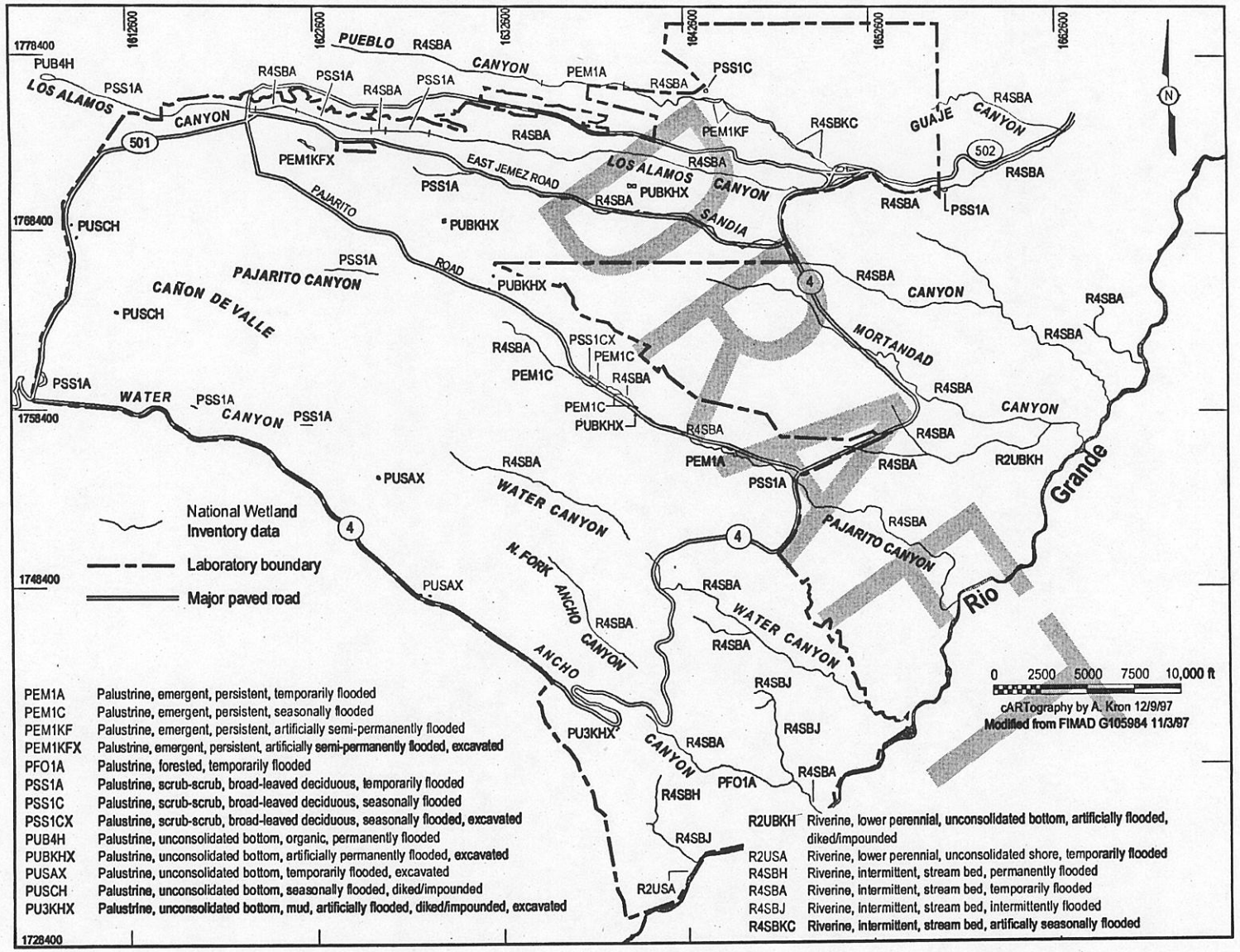

Figure 2-17. Map of wetlands.*

*Figure 2-12 shows perennial and intermittent streams.

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.

2.2.4 Meteorology

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

Los Alamos has a semiarid, temperate mountain climate. Forty percent of the 18-in. annual precipitation normally occurs from thundershowers during July and August. Winter precipitation falls primarily as snow, with accumulations of about 51 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. The climate from 1961 through 1988 had slightly cooler temperatures and higher precipitation than those recorded from 1911 through 1988 (entire record). The only significant difference between the period from 1961 through 1988 and the entire record period is the large amount of snowfall.

Because of complex terrain, surface winds in Los Alamos often vary greatly with time of day and location. With light winds and clear skies, a distinct daily wind cycle often exists: a light southeasterly to southerly upslope wind during the day and a light westerly to northwesterly drainage wind during the night (Figure 2-18, from Environmental Protection Group 1990, 6995). 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.

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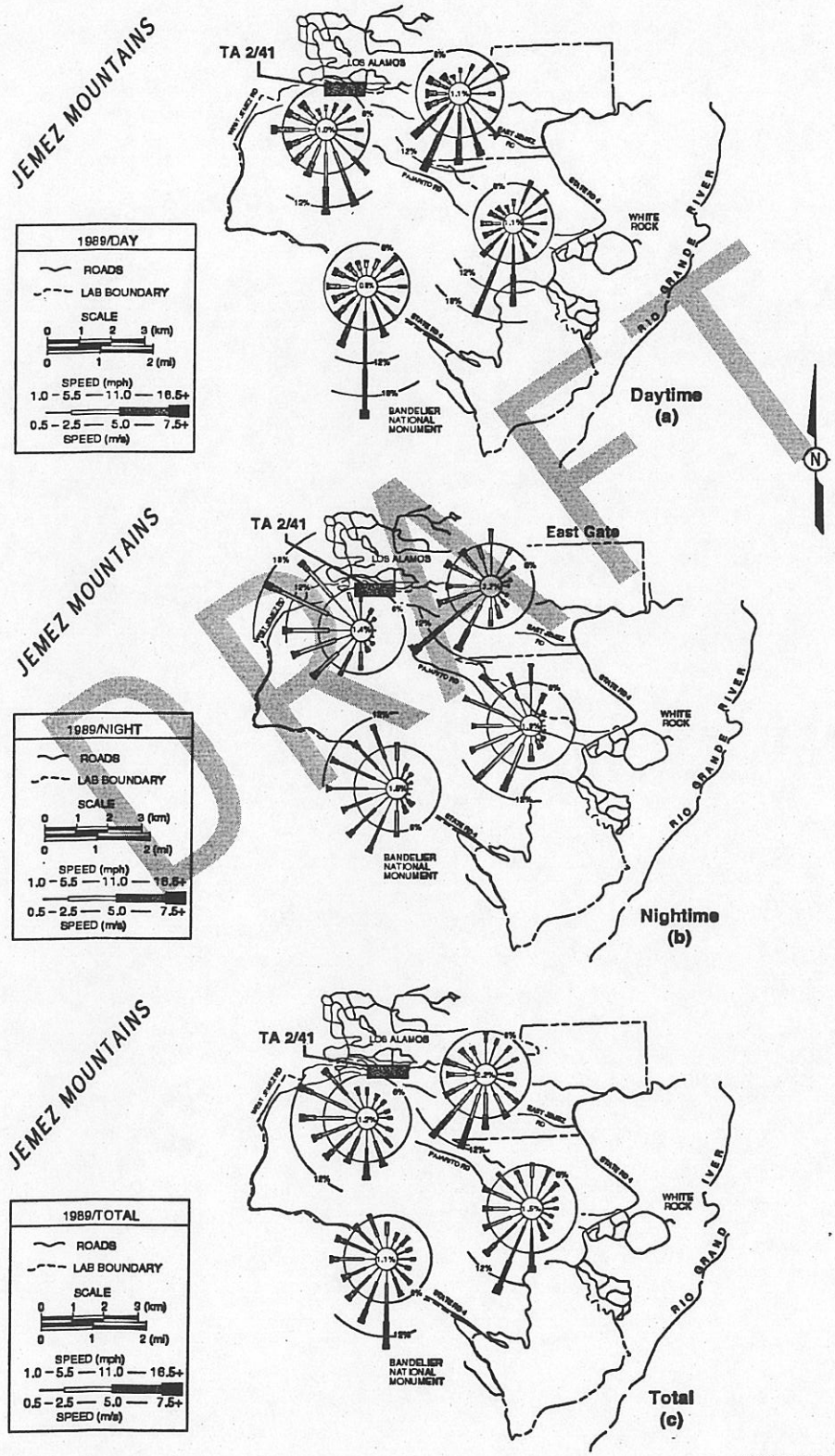

Source: Environmental Protection Group 1990, 6995

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Figure 2-18. Wind roses at Laboratory stations during 1989.

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 3,000 to 6,000 ft above ground level, but the effectiveness of the generally light winds in diluting contaminants horizontally is limited.

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 3,000 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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3.0 QUALITY ASSURANCE PROJECT PLAN

3.1 Background

The Environmental Restoration (ER) Project's approach to implementing the corrective action process at Los Alamos National Laboratory (the Laboratory) is to use a modified version of the US Department of Energy's (DOE's) streamlined approach (DOE 1996, 59598). This approach incorporates elements of data quality objectives (DQOs), risk assessment, and the US Environmental Protection Agency's (EPA's) Superfund Accelerated Cleanup Model to facilitate the rapid cleanup of potential release sites (EPA 1993, 45358). In addition, the Laboratory's corrective action approach is in keeping and consistent with EPA regulations and guidance and the guidance provided by the Hazardous and Radioactive Material Bureau in "New Mexico Environment Department RCRA Permits Management Program Document Requirement Guide" (NMED 1998, 57897).

The following terms specific to ER Project decision processes and risk assessment are used frequently in this chapter.

background level Naturally occurring concentrations of an inorganic chemical (including naturally occurring radionuclides and radionuclides from global fallout) in soil, sediment, and tuff.

background value (BV) The upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. When a UTL cannot be calculated, either the detection limit or the maximum reported value is used as a BV; BVs are used as simple threshold numbers to identify potentially contaminated site sample results that are greater than background levels. All inorganic chemicals and radionuclides have BVs.

chemical Any naturally occurring or man-made substance characterized by a definite molecular composition, including molecules that contain radionuclides.

chemical of potential concern (COPC) Chemical detected at a site that has the potential to adversely affect human and/or ecological receptors due to its concentration, distribution, and mechanism of toxicity. A chemical remains a potential concern until exposure pathways and receptors are evaluated in a site-specific risk assessment.

chemical of potential ecological concern (COPEC) Chemical detected at a site that has the potential to adversely affect ecological receptors due to its concentration, distribution, and mechanism of toxicity. A chemical is identified as a COPEC if it does not pass an ecological screening process.

cleanup level Media-specific target concentrations that reflect a potential risk of contamination and that must be met by a selected corrective action. Cleanup levels are established 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.

ecological screening level (ESL) An organism's exposure-response threshold for a given chemical; the concentration of a substance in a particular medium that corresponds to a hazard quotient (HQ) of 1.0 for a given organism and below which no risk is indicated.

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existing information Archival documents that include maps, engineering drawings, photographs, reports, memos, letters, and similar materials; interviews with Laboratory personnel; and previously collected qualitative and quantitative measurement data.

screening action level (SAL) Medium-specific concentration level for a chemical derived using conservative criteria below 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.

3.1.1 Potential Release Sites

As part of the Hazardous and Solid Waste Amendments (HSWA) requirement for a facility-specific description, EPA Region VI identified 603 potentially contaminated sites at the Laboratory. This list, included in Module VIII of the Laboratory's Hazardous Waste Facility Permit, was drawn from sites that were identified in the solid waste management unit (SWMU) report (International Technology Corporation 1988, 11646; 11647; 11648; 11649). Sites listed in Module VIII were identified based on the following:

- a Resource Conservation and Recovery Act (RCRA) facility assessment conducted by EPA Region VI in 1987 to identify potential SWMUs at the Laboratory,
- subsequent lists from the Comprehensive Environmental Assessment and Response Program's Phase I report (DOE 1987, 8657), and
- internal records searches and interviews.

EPA selected the 603 sites as SWMUs for listing in the original HSWA module based on the agency's preliminary assessment of the sites' potential impact on human health and the environment. The remaining sites were retained within the ER Project for investigation as areas of concern (AOCs). Through the identification of new sites and potential contaminant releases, the ER Project now manages approximately 1,100 sites within the HSWA module and 1,000 sites that are AOCs.

The term "potential release site" (PRS) refers to SWMUs and AOCs collectively. Each PRS bears a unique alphanumeric identifier keyed to the technical area in which it is located. These sites potentially contain hazardous and/or radioactive contamination. If a PRS has radioactive contamination only, it is regulated under DOE but not regulated by the New Mexico Environment Department (NMED) under HSWA. If a PRS is contaminated with hazardous and radioactive waste, the NMED has regulatory authority for the hazardous waste or constituent.

From time to time, as additional data about PRSs at the Laboratory become available, the Laboratory initiates a formal process for modifying the list of potentially contaminated sites named in Module VIII of its Hazardous Waste Facility Permit.

Appendix B is a listing of all current PRSs. As new information becomes available, the list is updated to reflect the current status of each project PRS. The PRSs are discussed in detail in the 24 RCRA facility investigation (RFI) work plans the ER Project prepared between 1990 and 1996;

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these work plans are available in the Laboratory's Public Reading Room and other information repositories.

3.1.2 Notification of New Solid Waste Management Units and Releases

If a new site is identified during the RFI process, environmental surveillance, audits, or other activities, the Laboratory must notify NMED of a proposed new SWMU within fifteen (15) calendar days of its discovery. This notification identifies the new SWMU; the Laboratory then must propose a schedule for corrective action. Guidance is provided in Quality Procedure (QP) "Identification, Documentation, and Reporting of Newly Discovered Potential Release Sites for the Environmental Restoration Program" (LANL-ER-QP-5.8), in accordance with Module VIII, Section G, Part 1, p. 15 of the Laboratory's Hazardous Waste Facility Permit.

Discovery of new releases of hazardous waste or constituents from SWMUs must be reported to NMED within twenty-four (24) hours of discovery. This procedure is described in detail in LANL-ER-QP-5.9, "Reporting of Newly Identified Releases from Solid Waste Management Units," to meet the requirements of Module VIII, Section H, p. 17 of the Laboratory's Hazardous Waste Facility Permit.

3.1.3 RCRA Corrective Action Process

The RCRA corrective action process for the ER Project has three main phases: the RFI, the corrective measures study (CMS), and corrective measures implementation (CMI). The ER Project also considers accelerated cleanup, when appropriate. The requirements for each of these phases are described briefly below.

3.1.3.1 RFI Requirements

The RFI entails preparing a work plan, which must be completed and approved by the Administrative Authority before sampling begins (unless DOE/University of California [UC] decide to proceed at risk), to determine whether a release to the environment has occurred. Specific RFI requirements are described in detail in Module VIII, Task II, of the Laboratory's Hazardous Waste Facility Permit, and EPA provides specific guidance in Volume I of the interim final RFI guidance (EPA 1989, 08794).

Each RFI work plan describes the overall approach, technical and analytical approaches and methods, quality assurance (QA) procedures, and data management procedures. In addition, Module VIII of the Laboratory's Hazardous Waste Facility Permit specifically requires the concurrent development of five companion plans as part of the RFI work plan (the Project Management Plan, the Quality Assurance Project Plan, the Records Management Project Plan, the Health and Safety Project Plan, and the Public Involvement Project Plan); however, it allows the Laboratory to deviate from specific requirements as long as the work plan covers the essential elements discussed above.

The ER Project adheres to Section 2, Volume I, of EPA's RFI guidance document (EPA 1989, 08794) to the extent practicable. DOE/UC RFIs are also consistent with the substantive requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). During the RFI, the ER Project's strategy is to assess sites, using a logical and efficient sampling program that moves from analyzing existing qualitative and/or quantitative data

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to identifying data gaps in conceptual models to finally proposing sampling and analysis plans (SAPs) that are scientifically and technically sound and that accurately characterize Laboratory PRSs. The Laboratory's ER Project has written or will write SAPs for each PRS or PRS aggregate. The Administrative Authority has the opportunity to comment on work plans/SAPs before implementation.

RFI reports are submitted to the Administrative Authority to report a completed phase of sampling or to recommend future sampling before a CMS plan is developed or after a no further action (NFA) determination has been made. This NFA recommendation can be a result of an approved investigation, a modified investigation, or an accelerated cleanup. A modified investigation may be performed without regulatory approval if the fundamental scope of the investigation has not changed; this is considered an insignificant modification. If conceptual planning and modeling drive the development of new DQOs, regulatory approval of the modified investigation should be obtained (or the Laboratory has the option to proceed at risk); this is considered a significant modification to the initial SAP.

The Administrative Authority reviews each RFI report and approves the proposed action, if warranted. When the nature and extent of contamination are found to cause unacceptable risk to human health or to the environment, a CMS can be proposed in the RFI report. If the proposed action is not approved, the Administrative Authority issues a Request for Supplemental Information (RSI) or a Notice of Deficiency (NOD). The Laboratory then provides the additional information requested to address the Administrative Authority's concerns. If the Laboratory believes that certain requirements of the RSI or NOD are not applicable, the specific requirements will be identified and the Administrative Authority will be provided with the rationale for inapplicability. Ultimately, the project will request a permit modification to remove from the Laboratory's Hazardous Waste Facility Permit those sites proposed and approved for NFA.

The ER Project, in conjunction with EPA and NMED, has generated a list of NFA criteria. Each PRS must meet at least one of these criteria before the ER Project can propose it for NFA. Although only the SWMUs listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit are officially removed by means of an NFA proposal and ultimately a permit modification, every PRS at the Laboratory undergoes the same level of investigation before it is removed from further consideration.

The NFA criteria listed below are consistent with those listed in Section II.B.4.a (4).(b), "New Mexico Environment Department RCRA Permits Management Program Document Requirement Guide" (NMED 1998, 57897). A site is considered to satisfy NFA criteria if it meets at least one of the following criteria:

1. The Solid Waste Management Unit/Area of Concern (SWMU/AOC) cannot be located, does not exist, or is a duplicate SWMU/AOC.

2. The SWMU/AOC has never been used for the management (i.e., generation, treatment, storage, and/or disposal) of RCRA solid waste or hazardous wastes and/or constituents or other CERCLA hazardous substances.

3. No release to the environment has occurred or is likely to occur in the future from the SWMU/AOC.

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4. A release from the SWMU/AOC to the environment has occurred, but the SWMU/AOC was characterized and/or remediated under another authority (such as the NMED's Underground Storage Tank or Ground Water Quality Bureaus), which adequately addressed RCRA corrective action, and documentation (such as a closure letter) is available.

5. The SWMU/AOC has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

A determination of NFA will 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, Parts 2 and 3, p. 33 of Section K, "Determination of No Further Action," of the Laboratory's Hazardous Waste Facility Permit.

3.1.3.2 Accelerated Cleanup

The ER Project approach to accelerated cleanup is consistent with the accelerated corrective action approach detailed in Section III.C.2 of the NMED RCRA permits management guidance document (NMED 1998, 57897). The ER Project uses the accelerated cleanup approach when conditions warrant early action or when sites can be remediated rapidly and cost-effectively. The following criteria are used to evaluate candidate sites for the accelerated cleanup process:

- Cleanup levels are based on NMED-approved background concentrations, promulgated standards, or risk-based levels developed in accordance with an NMED-approved risk assessment protocol.
- The potential remedy is obvious and can be readily applied.
- Acceptable knowledge (e.g., adequate previous sampling data and/or other existing information) is available to adequately identify chemicals of potential concern (COPCs).
- Adequate treatment, storage, and disposal capacity is available for all expected waste types.
- The nature, rate, and extent of contamination have been determined.

Cleanups fall into the following two categories:

- those that require minimal review and involvement from the Administrative Authority prior to initiation (i.e., voluntary corrective actions [VCAs]),and
- those that, because of their complexity, location, or site type, require more involvement from the NMED (i.e., voluntary corrective measure s [VCMs]), such as NMED review and approval of an accelerated cleanup plan or NMED personnel present to observe cleanup or to split samples).

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The NMED and the ER Project jointly identify sites that NMED will be involved in, before any activity is initiated. Both types of accelerated cleanups include public involvement.

3.1.3.3 Requirements for Corrective Measures Study

When an RFI report specifies that corrective measures are required, the Laboratory ER Project implements the 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 SWMUs (Proposed Rule, Title 40, 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 hereinafter is referred to as Subpart S. The Laboratory's approach to CMSs is addressed in subsequent sections of this IWP. Table 3-1 crosswalks IWP discussions of CMS requirements to corresponding sections in Subpart S.

TABLE 3-1

CROSSWALK OF CMS REQUIREMENTS

IWP		Subpart S	
3.1.3.3	Requirements for Corrective Measures Study	VI., E., 3.	Scope of Corrective Measures Study
3.1.3.3.1	Corrective Measures Study Plan	VI., E., 4.	Plans for Corrective Measures Study
3.1.3.3.2	Corrective Measures Study	VI., E., 5.	Reports of Corrective Measures Study
3.1.3.3.2.1	Standards for Remedies	VI., F., 2.	General Standards for Remedies
3.1.3.3.2.2	Media Cleanup Levels	VI., F., 5.	Media Cleanup Standards
3.1.3.3.2.3	Demonstration for Compliance with Media Cleanup Levels	VI., F., 7.	Demonstration of Compliance with Media Cleanup Standards
3.1.3.3.2.4	Conditional Remedies	VI., F., 8.	Conditional Remedies
3.1.3.3.3	Corrective Measures Study Final Report	VI., F., 3.	Remedy Selection Decision Factors
3.1.3.3.4	Permit Modification for Selection of Remedy	VI., G.	Permit Modification for Selection of Remedy

When required by NMED, DOE/UC 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 ninety (90) calendar days of notification of the requirement to conduct a CMS. NMED then reviews and approves the CMS plan or issues an RSI or NOD on the plan to DOE/UC.

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3.1.3.3.1 Corrective Measures Study Plan

The first step in the process of selecting alternatives to remedial action is to prepare a CMS plan, which is specific to a PRS or PRS aggregate. CMS plans must be consistent with the scope of work for a CMS, presented in Module VIII, Section R, pp. 56–57 of the Laboratory's Hazardous Waste Facility Permit, and with proposed Subpart S, as applicable.

The CMS is used to identify and develop a scheme for evaluating alternatives for final PRS remediation. A CMS plan must provide sufficient information for the Administrative Authority to adequately review the methods for evaluating potential cleanup alternatives. Each PRS-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,
- definition of the overall objectives of the study,
- description of the specific remedial alternatives to be studied,
- plan for conducting treatability (bench- or pilot-scale) studies, if appropriate, to determine the suitability of alternatives for site restoration,
- plan for evaluating remedial alternatives to ensure compliance with the standards for remedies specified in EPA guidance,
- schedule for conducting the CMS, and
- proposed format for presenting the results (CMS report).

In addition to these requirements, DOE/UC integrate RCRA and National Environmental Policy Act compliance through the CMS process. CMS plans can trigger a determination of the need for an environmental assessment; in such cases, CMS reports can serve that function. If a full environmental impact statement is required, the CMS report serves as a support document for that effort.

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, DOE/UC must initiate the studies within fifteen (15) calendar days. DOE/UC conduct 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,

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- 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 DOE/UC 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.

It may be technically impractical to meet the requirements of a remedy. DOE/UC expect 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, DOE/UC will propose that NMED modify the permit so that additional or alternate methods may be used.

DOE/UC 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,
- DOE/UC'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.

DOE/UC recognize the need for innovative and cost-effective remedial technologies. New technologies developed at the Laboratory could offer distinct advantages over currently available technologies (e.g., downhole monitors and stabilization techniques) not fully developed at the time the remedy is selected. In such cases, DOE/UC may propose that NMED postpone selecting a

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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, DOE/UC may perform immediate risk-reduction activities and consider implementing existing technologies.

3.1.3.3.2 Corrective Measures Study

Before DOE/UC propose and NMED selects a remedy for a PRS, NMED evaluates the proposed alternative to determine whether it meets EPA guidance (EPA 1988, 0295). Because conditions vary from PRS to PRS, decision factors for each proposed remedy may be weighed differently at different PRSs.

3.1.3.3.2.1 Standards for Remedies

The CMS generates data sufficient to evaluate potential remedies based on their ability to meet the following standards:

- protection of human health and the environment,
- attainment of established cleanup levels,
- control of the source of release, and
- compliance with waste management requirements.

These standards are broad and include the major technical requirements for controlling sources, conducting waste management activities, and cleaning up the environment. The Laboratory will comply with media cleanup levels to the extent practicable. In all cases, the Laboratory's overriding concern is protecting human health and the environment.

3.1.3.3.2.2 Media Cleanup Levels

Media cleanup levels include regulatory and risk-based levels that protect human health and the environment and applicable standards that are protective of surface water and groundwater resources. Because existing regulatory levels primarily address drinking water, DOE/UC use health-based risk assessments to determine the effort needed to clean up contaminated media. Technical, regulatory, and other factors are considered on a site-specific basis in determining corrective measures, including media cleanup levels. Technical factors that are considered include but are not limited to contaminant toxicity, proximity of human or ecological receptors, and known or anticipated environmental transport pathways. Regulatory factors influencing the determination of cleanup levels include but are not limited to the nature of contaminants present, the history of the PRS, and the effectiveness of the proposed treatment. Other factors influencing the determination of cleanup levels include but are not limited to land ownership and future land use.

Human health risk-based determinations are consistent with the RCRA corrective action process described in proposed Subpart S (Proposed Rule, Title 40, 264, 265, 270, and 271, "Corrective

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Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities," *Federal Register*, Vol. 55., pp. 30798-30884). These determinations are based on EPA's risk assessment guidance (1991, 58234; 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Final Rule, *Federal Register*, Vol. 55, No. 46), which states that "cleanup standards for carcinogens shall be established at levels which represent an excess upper-bound lifetime individual risk between 1×10^{-4} and1×10^{-6}." Cleanup levels for noncarcinogenic toxicants are established to allow daily exposure without appreciable risk of deleterious effects during the exposure period. Cleanup levels for radionuclides are based on a total effective dose equivalent of 15 mrem/yr above background for residential sites and 30 mrem/yr above background for Laboratory industrial sites (DOE Order 5400.5, "Radiation Protection of the Public and the Environment" [DOE Proposed Rule 10 CFR 834]). A dose limit of 15 mrem/yr also is consistent with the EPA guidance provided in "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (EPA 1997, 58693). It should be noted that the Laboratory ER Project does not use screening action levels (SALs) as target cleanup levels.

A guiding principle for the identification of radionuclide cleanup levels is that the residual dose should be as low as reasonably achievable (ALARA). The target dose limits described above, used in conjunction with reasonably conservative exposure parameters, are intended to result in media cleanup levels that satisfy the ALARA principle within the bounds of each exposure scenario. However, if annual doses lower than 15 or 30 mrem are practically achievable, cost-benefit considerations may lead to the selection of lower cleanup levels. Conversely, cost-benefit considerations under ALARA may lead to the selection of a cleanup level resulting in an annual dose greater than a target level while still complying with the 100 mrem/yr public dose limit of DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE Proposed Rule 10 CFR 834).

Ecological risk-based determinations are consistent with EPA's risk assessment guidance (EPA 1997, 59370), which states on p. 8-3 in Section 8.2.2 that

> "Management of ecological risks must take into account the potential for impacts to the ecological assessment endpoints from implementation of various remedial options. The risk manager must balance: (1) residual risks posed by site contaminants before and after implementation of the selected remedy with (2) the potential impacts of the selected remedy on the environment independent of contaminant effects. ...
>
> "In addition, each remedial option is likely to have its own ecological impact. This impact could be anything from a short-term loss to complete and permanent loss of the present habitat and ecological communities. In instances where substantial ecological impacts will result from the remedy (e.g., dredging a wetland) the risk manager will need to consider ways to mitigate the impacts of the remedy and compare the mitigated impacts to the threats posed by the site contamination.
>
> "... the preferred remedy should minimize the risk of long-term impacts that could result from the remedy and any residual contamination. When the selected remedial option leaves some site contaminants presumed to pose an ecological risk in place, the justification for the selected remedy must be clearly documented.

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> "In short, consideration of the environmental effects of the remedy itself might result in a decision to allow contaminants to remain on site at levels higher than the threshold for effects on the assessment endpoint. Thus, selection of the most appropriate ecologically based remedy can result in residual contamination that presents some risk."

DOE/UC have not yet developed risk-based cleanup concentrations for ecological receptors. The 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 cleanup levels that are protective of ecological resources. It also may be necessary to conduct further investigations in support of a risk assessment to develop cleanup levels.

Cleanup levels may be raised or lowered, depending on site-specific conditions. Such conditions may include a determination that concentrations of some contaminants must be lowered to protect sensitive human and/or ecological populations. Similarly, higher concentrations may be allowed by the Administrative Authority because approved localized background or approved Laboratory-wide background levels are elevated above the approved cleanup levels for residential and industrial exposure scenarios. Additionally, the concentrations permitted in groundwater may exceed drinking-water standards if it is established that such use is not appropriate. The groundwater concentrations permitted will be protective of the appropriate use based on the New Mexico Water Quality Control Commission regulations for groundwater (e.g., human health, domestic water supply, and irrigation). In all instances where the cleanup levels and/or standards have been modified to reflect site-specific conditions, they will remain protective of human health and the environment, including ecological receptors, surface water, and groundwater resources. Other circumstances include determinations that the measures taken to meet specific cleanup levels would themselves cause more harm to human health or to the ecosystem than taking no action. In addition, the technical feasibility of remediation at each site will be taken into account.

DOE/UC will propose for NMED approval the specifics for compliance with established standards. This proposal will address the point of compliance, monitoring and sampling locations, analytical parameters and methods, statistical analyses, and the period required for monitoring restored sites.

Some sites at the Laboratory may require remediation, including soil excavation or some other method that physically removes the contaminant from the environment to appropriate and approved cleanup levels. However, there are sites at the Laboratory from which it would be impractical to physically remove all contaminants. Thus, the definition of cleanup must include remedies that involve controlling contaminant migration from a source.

Cleanup is considered any measure taken to ensure protection of human health and the environment, not necessarily the total removal of a contaminant. It may not be necessary to clean up areas of widespread, very low level contamination. The low levels of risk to human health and the environment resulting from low-level contamination would not be significantly reduced by cleanup because contaminant concentrations may be close to background levels. Thus, cleanup is approached on a case-by-case basis; DOE/UC are responsible for demonstrating to NMED that remediation would not provide a significant reduction in risk.

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3.1.3.3.2.3 Demonstration of Compliance with Media Cleanup Levels

DOE/UC will propose that NMED approve several conditions demonstrating that implementing a remedy complies with cleanup levels. These conditions include identifying the

- location where compliance levels must be achieved,
- SAP that will be used to determine compliance,
- the statistic that will be used to compare to cleanup levels, and
- the length of time that DOE/UC must monitor a site to demonstrate that levels of contamination after cleanup do not exceed standards.

Media cleanup levels will be based upon human and ecological risk evaluations and established with the approval of the Administrative Authority.

The ER Project may provide, subject to NMED approval, innovative and unique methods and instrumentation for monitoring compliance, including a variety of downhole sensors and high-speed analytical units for use in the field. Methods specific to particular PRSs will be proposed in the CMS reports for the individual PRSs.

3.1.3.3.2.4 Conditional Remedies

When NMED cannot select a final remedy or when DOE/UC and NMED agree that it is in the interest of the environment to delay implementation of the final remedy (e.g., to await completion of a promising development or additional disposal capacity), conditional remedies may be proposed and approved. Such remedies include prompt corrective measures that reduce risk and/or partial cleanup when total cleanup is impractical. Conditional remedies are appropriate for actively managed, financially viable facilities such as the Laboratory. When a conditional remedy is used, the site must be revisited after a preestablished period to determine whether the remedy can be considered final and can be certified as complete before the specified schedule of compliance is terminated. Several criteria must be met before implementation. As appropriate, these criteria may include

- protection of human health and the environment,
- achievement of media cleanup levels beyond the facility boundary (with Administrative Authority approval of the selected points of compliance),
- prevention of further environmental degradation,
- implementation of institutional controls,
- continuation of monitoring, and
- compliance with waste management standards.

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The RFI determines site stabilization efforts and the implementation of institutional controls. However, DOE/UC may propose site stabilization and institutional controls as a conditional remedy for some of the large material disposal areas (MDAs) from which no environmental transport is likely. Remediating these MDAs could be complex and unnecessarily risky. Furthermore, MDA contaminant concentrations that qualify for conditional remedies do not currently threaten human health or the environment, and institutional controls, which provide long-term access control and prevent potential exposure of Laboratory workers, could be viable options at these sites. Therefore, DOE/UC believe that a conditional remedy for these sites will optimally protect human health and the environment. Long-term monitoring will be conducted as necessary. When the results of the RFI support a single obvious remedy, which could include extensive pilot testing, a formal CMS is not needed; however, the proposed remedy must be presented to NMED either as part of an RFI report or in a separate plan. Based on the results of RFIs that support the use of conditional remedies, DOE/UC may request that the permit be modified. Upon NMED approval, DOE/UC prepare a CMI plan that contains information adequate to design and implement the remedy, maintenance plans, schedule, QA program, progress reports, and proposal for determining a complete and final remedy.

DOE/UC intend to propose in-place stabilization with long-term monitoring and institutional controls as a remedial alternative for some PRSs. To ensure compliance, sensitive and dependable instruments will be required for long-term monitoring. DOE/UC have initiated several efforts to develop appropriate equipment such as polymer film field sensors, optical fiber-flow optrode, fieldable Raman with fiber optics, and tritium plume detectors.

DOE/UC also realize that conditional remedies may not be final remedies. The remedy decision is reviewed after a period of implementation to compare the performance of the conditional remedy with established remedy standards. The conditional remedy may be declared the final remedy at that time or NMED may require further corrective action to supplement or replace the conditional remedy. Final selection of the remedy and termination of the permit must comply with the procedures described below.

3.1.3.3.3 Corrective Measures Study Final Report

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. 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 as described in Module VIII.

The primary purpose of the CMS report is to enable DOE/UC 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;

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- short-term effectiveness;
- implementability; and
- cost.

NMED will approve the remedy proposed by DOE/UC 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 PRSs. Each 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 considers comments received from EPA and the public. DOE/UC incorporate comments received from NMED within thirty (30) calendar days of receipt.

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3.1.3.3.4 Permit Modification for Selection of Remedy

When a remedy is selected, the permit will be modified to include the remedy and a schedule of compliance. NMED can modify the permit to specify remedies selected through the CMS process. The permit modification must be conducted according to the procedure established in Section O, pp. 35–36, of Module VIII of the Laboratory's Hazardous Waste Facility Permit. The modification process includes a formal public comment and revision period before written notice of the permit modification is issued.

Although the specified remedy may be separated into phases, the proposed modification must include

- a description of the technical features of the remedy;
- media cleanup levels established through the CMS process;
- requirements for achieving compliance with media cleanup levels;
- requirements for final disposition of the equipment used during remedy implementation;

- schedule and major milestones for remedy implementation, including submission of the CMI plan; and
- reports and documentation to be submitted by DOE/UC during remedy implementation.

3.1.3.4 Requirements for Corrective Measures Implementation

DOE/UC will prepare CMI plans after approval of the CMS plan and upon NMED request. The Laboratory's approach to CMI is addressed in subsequent sections of this IWP.

Table 3-2 crosswalks IWP discussions of CMI requirements to corresponding sections in Subpart S.

TABLE 3-2

CROSSWALK OF CMI REQUIREMENTS

IWP		Subpart S	
3.1.3.4	Requirements for Corrective Measures Implementation	VI., H.	Implementation of Remedy
3.1.3.4.1	Remedy Design	VI., H., 1.	Remedy Design
3.1.3.4.2	Corrective Measures Progress Reports	VI., H., 2.	Progress Reports
3.1.3.4.3	Review of Remedy Implementation	VI., H., 3.	Review of Remedy Implementation
3.1.3.4.4	Completion of Remedies	VI., H., 4	Completion of Remedies

The standard outline for DOE/UC 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.

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3.1.3.4.1 Remedy Design

CMI plans include detailed construction plans for implementing 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 PRSs,
- criteria for a performance assessment,
- implementation and long-term maintenance plans,
- major milestones,
- project schedule, and
- a QA plan for construction.

NMED will approve a CMI plan or request a revision. DOE/UC implement the remedies as approved. Approved plans are placed in the Laboratory's Outreach Center and Reading Room. DOE/UC 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.

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3.1.3.4.2 Corrective Measures Progress Reports

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 (RPF) 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 PRS. 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.

3.1.3.4.3 Review of Remedy Implementation

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.

3.1.3.4.4 Completion of Remedies

CMI plans contain the criteria used to demonstrate completion of remedies. Upon completion of a remedy, DOE/UC submit a request for termination of the schedule of compliance for the corrective action. The request contains a certification that DOE/UC have met all criteria established for this purpose. The request to NMED will include verification that

- all media cleanup levels have been achieved,
- actions required for source control have been satisfied, and
- procedures for final disposition of equipment and materials associated with the remedial action have been followed.

NMED then reviews the request, along with public comments, to determine whether a remedy has been completed in accordance with the requirements of Module VIII of the Laboratory's Hazardous Waste Facility Permit and CMI plan. After such determination, NMED modifies Module VIII to terminate the schedule of compliance for the corrective action.

3.1.3.5 Special Situations in the Corrective Action Process

3.1.3.5.1 Interim Measures

Section J, Part 2, p. 32, of Module VIII of the Laboratory's Hazardous Waste Facility Permit lists nine (9) factors that may be considered in determining the need for interim measures. If NMED determines that a release or potential release of hazardous waste or constituents poses an imminent threat to human health or the environment, it can mandate that DOE/UC implement interim remedial measures to mitigate the risk. NMED can also specify a schedule (by modifying Module VIII) for implementing the interim measure and can require the Laboratory to prepare and submit a plan for approval before action is initiated. No interim measures have been taken to date because no imminent threats to human health or the environment have been identified. However, in the event that NMED requires an interim measure in the future, DOE/UC will modify any plan already in place or submit a plan for newly identified interim measures. At that time, DOE/UC may request that NMED modify the schedule of compliance for the corrective action.

In determining the need for interim measures based on health risks, at least the following factors should be considered:

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- the time required to develop and implement a final remedy,
- actual and potential exposure of human and environmental receptors,
- actual and potential contamination of drinking water supplies and sensitive ecosystems,
- the potential for further degradation of the medium – absent interim measures,
- the presence of hazardous waste in containers that may pose a threat of release,
- the presence of hazardous wastes and/or constituents in soil that have the potential to migrate to groundwater or surface water,
- weather conditions,
- risks of fire, explosion, or accident, and
- other situations that may pose threats to human health and the environment.

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Other kinds of interim remedial measures referred to in Module VIII of the Laboratory's Hazardous Waste Facility Permit are triggered by institutional need. Module VIII states, "If, for institutional reasons not related to permit work, i.e., routine construction, an interim measure is required, the permittee will submit appropriate documentation to the Administrative Authority for approval." DOE/UC will conduct interim measures based on institutional needs consistent with the provisions of proposed Subpart S.

3.1.3.5.2 Coordination of Corrective Actions with RCRA Closures

Several SWMUs listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit are subject to both the corrective action and closure provisions of RCRA. A newly promulgated final rule (*Federal Register*, Vol. 63, 56710) allows authorized states the discretion to use corrective action requirements, rather than closure requirements, to address regulated units. The promulgated rule is consistent with the preamble to proposed Subpart S, which states EPA's intent to allow extension of closure deadlines as necessary to complete corrective actions. Although New Mexico has not adopted this final rule (*Federal Register*, Vol. 63, 56710), the ER Project proposes to adopt this approach.

3.1.4 Site Prioritization

Each year, in cooperation with NMED, DOE/UC reevaluate prospective field work for a given year. To prioritize field work, PRSs are evaluated according to several considerations that include but are not limited to the following:

- NMED concerns,
- human and environmental risk,
- regulatory compliance requirements,
- public interest/involvement, and
- the ER Project mission.

Based on these criteria, DOE/UC generate a draft work schedule for the current fiscal year and shares it with NMED. Upon NMED concurrence or agreed-upon modifications, DOE/UC submit the work schedule, included in this document as Appendix D of the IWP.

3.2 Assessment Strategy

The Laboratory ER Project approach to planning, collecting, and evaluating data for environmental restoration is based on the EPA DQO process (EPA 1994, 44324) and on EPA and NMED guidance for risk-based decision making (EPA 1989, 08021; EPA 1997, 59370; EPA 1998, 59600); NMED 1998, 57761). This approach recognizes that focusing characterization of a site on the data needs required to support a series of well-defined decision criteria streamlines the decision-making process.

The Laboratory's corrective action approach uses the decision framework illustrated in Figure 3-1. Decision points in the general framework depend on a number of risk-based technical assumptions that are detailed in Section 3.2.2 below.

3.2.1 Corrective Action Process Decisions

Decision-Oriented Approach

To implement the RCRA corrective action process, the ER Project follows a decision-oriented approach based on the EPA DQO process (EPA 1994, 44324). The DQO process

- focuses data collection to support risk-management decisions;
- identifies acceptable levels of uncertainty before data are collected, ensuring data usability before data-collection resources are expended; and
- streamlines the corrective action process by identifying data that have the most value in terms of assessing present and potential future impacts of contamination on human health and the environment.

Once these assessments are made, corrective actions can be proposed to minimize risk.

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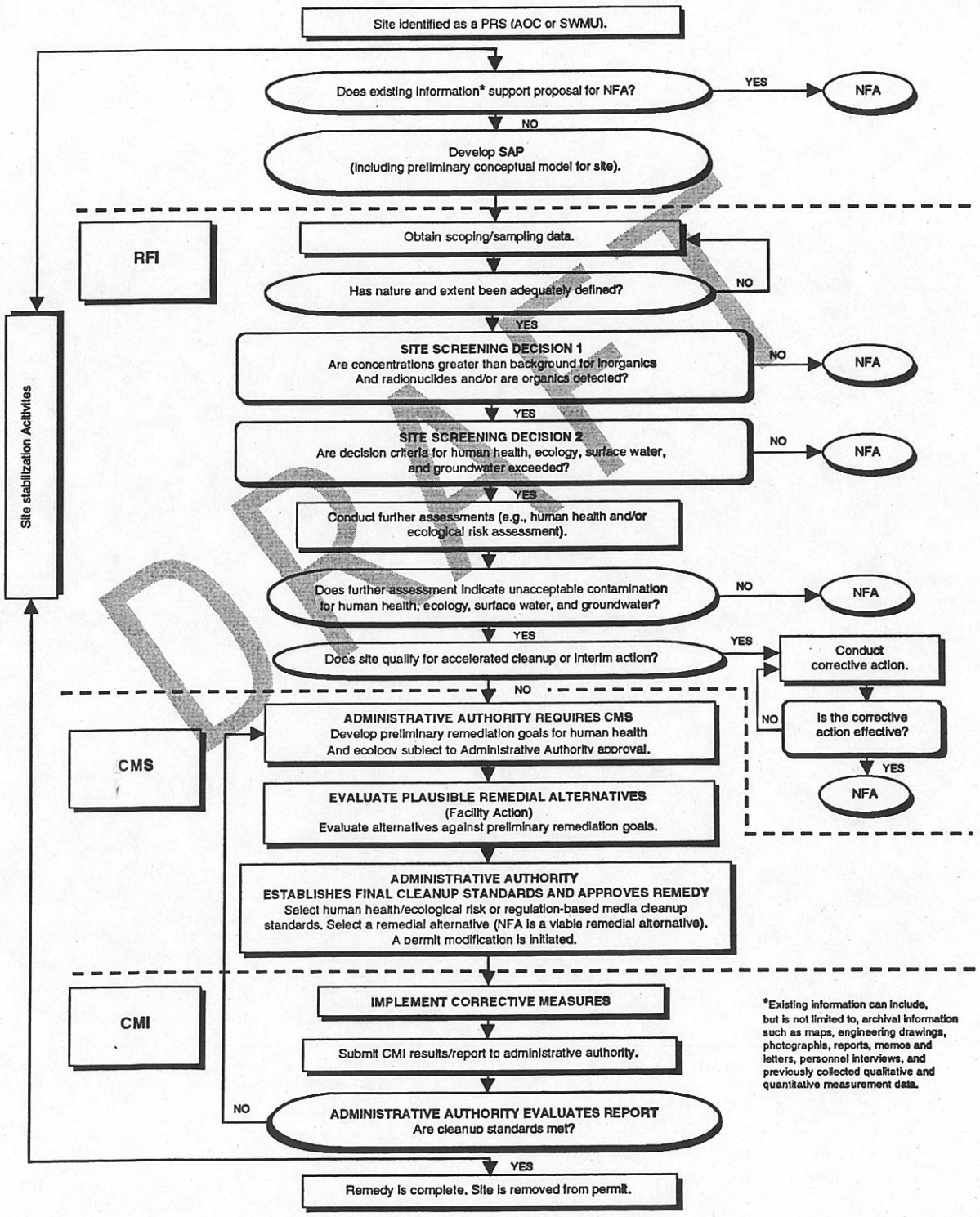

Figure 3-1. RCRA Corrective Action Process Decision Framework.

Several decision points during the RFI and CMS processes demarcate progress during the RCRA corrective action process. Many of these decisions require collecting and assimilating environmental data. The Laboratory's technical approach to corrective action begins with decision criteria that are sufficiently explicit to guide the design of field investigations and the evaluation of the resulting data. Decisions required during the RFI include determining whether

- contaminants have been released to the environment and, if so, to what extent (the site-screening decision),
- corrective action is required for the site (a risk-based decision that may be made before or after a CMS has been initiated), and
- accelerated cleanup is possible or whether a formal CMS is required to evaluate, select, and design an appropriate corrective action.

The first step in this decision-oriented approach is to develop a site conceptual model and technical approach based on existing information. Depending on the complexity of the site and the quality of existing information, the site may be proposed for NFA. The remaining sites fall into the following categories:

- sites where accelerated cleanup (Section 3.1.3.2 of this document) under a VCA/VCM is possible, and
- sites where CMS and CMI are expected, and
- sites for which existing information is not adequate to support a decision about potential outcomes that include proposal for NFA, accelerated cleanup, or CMS/CMI; therefore, further investigation is required.

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If initial review of historical information identifies a site as a possible candidate for an accelerated cleanup, CMS, or CMI, an initial investigation is conducted to collect data supporting one of these activities. For many sites, existing information is not adequate to make this decision. The initial investigation then involves collecting data to support a screening assessment or risk management decision. For sites that are likely candidates for proposing NFA, the screening investigation focuses on confirming or denying the existence of a release to the environment. A risk-based investigation focuses on assessing risk to human health and the environment.

Designs for data collection to support screening decisions generally use biased sampling to determine the presence of chemicals at levels of potential concern. Samples taken from areas deemed most likely affected by historical activities are analyzed for a broad range of potential contaminants. The most frequent criterion used for the screening decision is the presence of chemicals in environmental media above human health SALs or ecological screening levels (ESLs).

Additional information for the initial analysis is obtained by maximizing the use of field screening instruments. When appropriate, sampling designs make extensive use of field screening techniques such as geophysics, remote sensing, and field analytical instruments to focus sampling, ensure the site is adequately investigated, and reduce the number of samples needed for laboratory analysis.

Sites that are not eligible for NFA proposal (based on the results of initial investigations or accelerated cleanup) may require a baseline risk assessment to determine whether a significant risk to human health or the environment exists. Baseline risk assessments focus on chemicals at a site identified as COPCs during initial review of historical information or results from initial investigation. Current and future land-use scenarios for each site are evaluated to identify the most likely receptor populations. Realistic exposure scenarios relevant to those populations are derived to complete the risk assessment.

Future Land-Use Planning

The Laboratory is an active DOE facility managed by the University of California (UC). DOE/UC are responsible for determining future land use within the Laboratory boundaries specified in the long-range Site Development Plan (LANL 1995, 57224). DOE/UC are sensitive to the land-use concerns of involved stakeholders, including tribal neighbors, and are presently seeking their input about future land use.

Although the Laboratory's mission requires the continued use of most of its 43 mi^2 for the foreseeable future, certain nonmission critical parcels are being considered for transferring control from DOE/UC to Los Alamos County or San Ildefonso Pueblo. The result of such a transfer could reduce certain Laboratory sites (primarily buffer areas) by as much as 6.5 mi^2 over the next 10 years.

Future land uses currently designated by DOE/UC include but are not limited to industrial, recreational, and residential. (These land-use designations signify intended use only; they do not represent city planning zones.) Solely for the purpose of land transfer, DOE/UC are considering the following additional potential land uses: commercial development and cultural, historical, or environmental preservation.

Human exposure scenarios developed for risk assessments can be considered under individual land use categories. Exposure scenarios include, but are not limited to, industrial, recreational, and residential. These scenarios describe and determine the human health risk approach used at a PRS; therefore, they determine in part the potential remediation goals for the site. NMED has approval authority for the cleanup level or acceptable risk level. In addition, a Native American exposure scenario may be appropriate at certain sites. This exposure scenario is being developed in cooperation with the Accord Tribes, which consist of San Ildefonso, Santa Clara, Cochiti, and Jemez Pueblos. The Native American exposure scenario will apply to areas where there is potential impact to pueblo populations (e.g., the canyon regions).

As part of final actions, institutional controls and deed restrictions may be required for selected land-use designations (except residential). For PRSs remediated to other than background concentrations or residential cleanup levels, a deed restriction or equivalent land-use restriction will be entered with the appropriate authority and submitted to the Administrative Authority during the HSWA permit-modification process. A statement addressing the requirements of CERCLA Section 120(h)(3) will be attached to the deed or transfer document.

Land use also may impact ecological receptors by affecting the type and availability of habitat. Information about the type of vegetative community and the associated fauna within an area can be used in an ecological risk assessment to predict the presence of particular species (including threatened and endangered species). For example, if the designation for a mature forest community of mixed conifer is changed from industrial to residential, the replacement of forest

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with areas of residential lawn could cause the elimination of the Mexican spotted owl due to a change of habitat. Potential changes in land use must be evaluated in estimating a site's potential ecological risk and remediation goals.

To evaluate risk to human and ecological receptors, risk assessments consider site-specific land-use assumptions and exposure scenarios. These factors also are used to establish preliminary goals and media cleanup standards to estimate the reduction of risk associated with a potential corrective action. Target risk and dose levels to human and ecological receptors are set following Administrative Authority and DOE guidance.

3.2.2 Approach to Data Collection and Evaluation

Site-Screening Decisions

The approach for making site-screening decisions follows NMED's risk-based decision tree (NMED 1998, 57761). Sites having existing information of sufficient quantity and quality to document that the site does not pose a threat to human health or the environment (including identification of surface and groundwater pathways) are proposed for NFA without additional RFI fieldwork (see Figure 3-1).

Sites not having sufficient existing information to propose NFA undergo characterization to determine whether a release has occurred. A SAP that includes a preliminary conceptual model is developed for the site. Using information about processes previously used at that site, investigators focus on sampling and analysis of chemicals associated with those processes. When information on historical processes indicates that certain contaminants were never handled at a site, analyses for those chemicals are not performed. Sampling plans for site-screening decisions may incorporate purely random sampling approaches. Directed sampling based on professional judgment and/or the results of field surveys also may be used. Results from field surveys using adequate techniques and instruments may be used to bias the location and number of samples needed for site characterization in order to increase the probability of detecting contaminants rather than using purely random sampling approaches.

To determine whether a release has occurred at a particular PRS, it is necessary to establish whether maximum concentrations or 95% upper confidence limits (UCLs) of the mean for potential contaminants at the PRS are at or above background levels and/or fallout concentrations for that site. Background values and fallout concentrations are described in "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory" (LANL 1998, 58093).

Inorganic and radionuclide COPCs are identified by comparing the maximum concentration or the 95% UCL of the mean of a chemical with background values to determine whether these chemicals are present at levels exceeding background and/or fallout concentrations. Statistical comparisons of site data to background data sets may be conducted to determine if site data are indistinguishable from background. Comparisons with background values are documented in standard operating procedures (SOPs): LANL ER-SOP-15.12, "Performing Background Value Comparisons for Inorganic Chemicals," and LANL ER-SOP-15.13, "Performing Background Value Comparisons for Radionuclides." The statistical methods used in comparing site data with background data are detailed in the LANL ER paper, "Statistical Methods for Background

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Comparison" (LANL 1998, 59596). During the data review process, chemicals whose concentrations are statistically indistinguishable from background are not identified as COPCs.

Organic COPCs are identified by determining the detection status of organic chemicals. Organic chemicals not detected in any sample generally are not included in the screening assessment when sample-specific detection limits do not exceed the standard EPA detection limit for that analytical method. If no COPCs are identified in the data review process, no release has occurred and the PRS can be recommended for NFA, provided there are no other potential concerns. Some chemicals such as polycyclic aromatic hydrocarbons may be associated with non-PRS-related sources (e.g., asphalt paving or tarred roofs). Chemicals associated with non-PRS-related sources are evaluated with respect to their proximity to these and other sources to determine whether additional consideration is warranted.

Chemicals identified as COPCs in the data review process are moved forward to human health and ecological screening assessments. In a human health screening assessment, potential risk to human health is estimated by calculating cancer risk, annual dose rate, and/or hazard quotients (HQs)/hazard indices (HIs). During this process maximum COPC concentrations or 95% UCLs of the means of COPCs in soil are compared to SALs. Appropriate water quality standards are used as SALs for comparing maximum COPC concentrations or 95% UCLs of the mean of COPCs in surface and/or groundwater. In an ecological screening assessment, risk to ecological receptors is estimated by calculating hazard quotients/indices and estimating doses to ecological receptors that potentially indicate toxic effects. Maximum COPC concentrations or 95% UCLs of the means of COPCs are compared in soil and/or water to appropriate ESLs or water quality standards. The ecological screening methodology used by the Laboratory ER Project is detailed in the paper, "Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory" (Kelly et al. 1998, 57916). When a SAL/ESL cannot be calculated due to insufficient chemical toxicity information, the chemical may be retained as a COPC requiring further evaluation (e.g., included in a baseline risk assessment). Or, if appropriate, the maximum concentration or 95% UCL of the mean may be compared to the SAL/ESL of a similar chemical. When screening shows that maximum chemical concentrations or 95% UCLs of the mean are at levels below SALs or ESLs, further analyses of these chemicals are not necessary.

SALs are developed for surface soils, but may be appropriate (though conservative) for subsurface soils and sediments if adequate consideration of fate and transport is presented. 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 SALs adheres to the process detailed in Appendix C of this document.

- 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 (1991, 58234), where risks at or below 10^{-6} are considered

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negligible. 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. 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. In a screening assessment, SALs for noncarcinogens are divided by 10 when two or more noncarcinogenic COPCs are identified. 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.

- 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 field screening and/or laboratory analysis 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 body weight, intake rate, exposure duration, etc. 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.

- The target dose level used for radionuclide SAL calculations is 10 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" [DOE Proposed Rule 10 CFR 834]). Further investigation of sites exceeding 10 mrem/yr is consistent with DOE regulatory guidance.

For most ecological applications, risk-related 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, weights of consumption, and diet) and toxicity information are available. The target dose level used for calculation of radionuclide ESLs is 0.1 rad/day. ESLs for nonradionuclides are derived from literature values for no

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observable adverse effect levels/concentrations or lowest observable adverse effect levels/concentrations. The methodology for calculating ESLs is detailed in Kelly et al. 1998 (57916).

- 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 is considered an indicator of potential adverse effects to biota. If a COPC has an HQ greater than 1, it is identified as a chemical of potential ecological concern (COPEC).

- 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). Chemicals that contribute more than 0.1 to an HI that exceeds 1 are identified as COPECs.

The ER Project screening-assessment process includes an uncertainty analysis that qualitatively and/or quantitatively addresses potential impacts of human health and ecological screening or risk assessment assumptions and parameters on their estimated numerical results. As a result, the level of confidence in numerical risk can be determined for a PRS. The quantitative estimates of potential human health and ecological screening risks are conditional estimates that include a considerable number of assumptions about exposure and toxicity. Uncertainty about the numerical results is generally high (i.e., at least 1 order of magnitude or greater). Consequently, to place the risk estimates in proper perspective, it is important to specify the assumptions and uncertainties inherent in the 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 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,

- inherent in the exposure assessment for individual chemicals and individual exposures,

- associated with exposure to two or more chemicals, and

- associated with multiple-pathway exposure.

Further Action

Selection of a further action is based on the outcome of the human health and ecological screening assessments (if performed). Selection also is dependent upon surface water and groundwater assessments and whether implementation of a proposed remedial action might result in adverse impacts to natural resources or to the ecosystem rather than leaving the contaminants in place. Other applicable assessments (e.g., requirements for underground storage tanks, air

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quality, and solid waste) also are considered, if relevant. Further action is determined on a case-by-case basis, and may include the following:

- Further evaluation. This process includes more in-depth analysis of available data, if the data are sufficient; the collection and analysis of additional data; or evaluation of the relative impact of a given remedy selection to natural resources. For example, in-depth analysis may result in the modification of exposure assumptions based on site-specific information. Results of these further evaluations could be proposal for NFA, accelerated cleanup, human health and/or ecological baseline risk assessment, or a CMS.

- Risk assessment. If a site fails its screening assessment (i.e., maximum concentrations or 95% UCLs of the mean are above SALs/ESLs) using existing data and information, a human health and/or ecological risk assessment may be conducted to determine if corrective action is required. Additional information and site-specific data may be required for a human health and/or ecological baseline risk assessment if the available data are not adequate to support a risk-management decision.

- Accelerated cleanup. Accelerated cleanup can proceed without further evaluation and/or a human health risk and/or ecological baseline risk assessment under the following conditions:

  - Cleanup levels are based on one of the following criteria: NMED-approved background concentrations, promulgated standards, or risk-based levels developed in accordance with an NMED-approved human health and/or ecological risk-assessment protocol.

  - The potential remedy is obvious and can be readily applied.

  - The remedy is the final resolution needed to prevent releases or future migration of contaminants from the site.

  - Acceptable information (e.g., previous sampling data and/or other existing information) is available to adequately identify and quantify COPCs.

  - Adequate treatment, storage, and disposal capacity is available for all expected waste types.

  - The nature, rate, and extent of contamination have been determined.

  - The remedy selected does not adversely impact the ecosystem, natural resources, worker safety, or public health.

  - Uncertainties can be handled by contingencies in the accelerated cleanup plan, and stopping criteria are defined; confirmatory sampling verifies that the intent of the corrective action has been met; confirmatory sampling and guidelines for stopping criteria are specific to the relevant VCA/VCM plan.

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- The estimated cost of remediation is expected to be less than the cost of moving forward with further data collection and/or data analysis and human health and/or ecological risk assessment.

The Administrative Authority may require and/or the Laboratory may request enhanced regulatory involvement for some accelerated actions. These actions are referred to as VCMs. Enhanced involvement by the Administrative Authority includes review and approval of the VCM plan and VCM report.

Accelerated actions not requiring enhanced regulatory involvement are referred to as VCAs. The Administrative Authority will be informed of VCA activities.

- Stabilization. Sites may be considered for on-site and off-site stabilization if all the following are true:

  - Sufficient information about contaminants and the environmental setting are known, but the site fails one or more of the specific accelerated action criteria listed above.
  - Near-term opportunities exist for significant risk reduction, prevention of further contamination, and/or long-term cost savings.
  - Appropriate stabilization technologies (e.g., silt fencing, jute matting, berming, temporary capping, construction of slurry walls) are available to deal with the known contaminants.
  - Proposed action will not impede or be inconsistent with the expected approach for the final remedy.
  - 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 (including mixed waste if applicable).

Risk-Based Decisions

Further decisions about a site (i.e., beyond screening decisions for which NFA, interim measures, or accelerated cleanup may be proposed) must take into account risks to human health and the environment posed by contamination at the site. Decisions made after comparison of the maximum detected chemical concentrations to a SAL/ESL are based on generic, conservative assumptions. Because available information is not site-specific, conclusions associated with screening assessments have a high degree of uncertainty. The subsequent investigation, if warranted, is designed to obtain more site-specific information, including the collection of additional data, to reduce the level of uncertainty. Therefore, a site-specific human health and/or ecological risk assessment may lead to less stringent risk estimates and conclusions than the original, non-site-specific screening assessment because of modifications in exposure assumptions and parameter values.

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Estimation of risks to human health and the environment must be based on reasonable site-specific land use and exposure assumptions. Risks associated with the use of alluvial aquifers and surface waters (e.g., canyon bottoms with perennial stream flow, permanent alluvial aquifers, and outfalls to canyons) are considered for sites when these waters may be impacted and potential exposures may occur. Currently, individual PRSs may be aggregated to adequately evaluate potential human health and ecological risks from neighboring, contiguous, and related PRSs. An approach for more complex site aggregation will be developed in cooperation with the Administrative Authority.

The groundwater exposure pathway is not considered for most mesa-top sites because the depth to the regional aquifer is about 800 to 1,100 ft. However, potential contaminant migration to groundwater may be modeled at mesa-top sites where deep subsurface contamination is detected and where the potential for transport to groundwater exists. The decision to evaluate groundwater contamination will be determined on a case-by-case basis.

Baseline risk assessments are conducted following EPA's human health and ecological risk assessment guidance documents (EPA 1989, 08021; EPA 1997, 59370; EPA 1998, 59600). Baseline risk assessments may provide a basis for proposal of final actions at sites where COPCs have been identified, as in the following examples:

- If the total carcinogenic and noncarcinogenic risk thresholds are not exceeded for human receptors, the Laboratory may propose the site for human health NFA. Carcinogenic risk thresholds are established on a case-by-case basis within the range of 10^{-4} to 10^{-6} excess cancers per lifetime. The noncarcinogenic risk threshold is equivalent to an HQ of 1.

- 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) or 30 mrem/yr above background (for sites retained under DOE control), DOE/UC may propose the site for human health NFA. 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 1997, 58693) establish the rationale for adopting these dose levels.

- If the total risk thresholds for ecological receptors at a PRS are not exceeded, the Laboratory may propose the site for ecological NFA. Ecological risk thresholds are established on a case-by-case basis and may be based on HQs/HIs greater than 1, the relationship of the stressor level to the magnitude of response, and/or the evaluation of the variability in exposure/effects to receptor populations.

Exposure estimates are based on the distribution of contamination throughout areas or volumes of contaminated media and over time periods that are consistent with land-use assumptions. 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; e.g., a residential exposure unit may be equivalent to an average lot size (500 m^2) and an ecological exposure unit may be equivalent to the home range of an ecological receptor. The 95% UCL of the mean is used for the exposure point concentration in the areas or volumes in which reasonable maximum exposure might take place. Alternative statistics, if appropriate, provide estimates of reasonable maximum

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exposure. For example, when a chemical has a low detection frequency (i.e., a large number of undetected values) the 95% UCL 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 will approve alternative statistical methods for calculating exposure point concentrations prior to use.

3.3 Field Sampling

The Laboratory ER Project undertakes many sampling activities, including environmental 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 intermediate field decisions,
- delineating the extent 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.

To ensure environmental data quality, the EPA DQO process is used to establish clear problem descriptions for all data collection activities. This process ensures that the environmental decisions to be made for a PRS are known before any data are collected. The results of the planning and problem-definition process are documented in the SAP.

3.3.1 Objectives

Field sampling is undertaken to obtain measurement data for revising and/or refining the site conceptual model, defining the nature and extent of contamination, and identifying the chemical and physical aspects of the environmental fate and transport of potential contaminants.

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 incorrect interpretation of measurements. Data quality concerns include, but are not limited to

- collecting a sufficient number of samples adequate to support the decision;
- selecting sample locations that adequately define the nature and extent of contamination;

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- selecting measurement techniques and methods that are selective, sensitive, and precise enough to distinguish target analyte concentrations from prespecified threshold levels;
- limiting contamination of samples to insignificant levels; and
- maintaining the desired degree of data comparability to allow statistically valid evaluation or pooling of the data.

The result of the DQO planning process is a list of criteria that are expected to increase the likelihood that data of the right type, quantity, and quality are collected to support PRS decisions. These criteria include identifying

- a focused list of environmental variables to be measured or collected (e.g., analytes, concentrations/radioactivities, physicochemical parameters, and exposure model parameters),
- decision or action levels (e.g., SALs and the basis for deriving them),
- geographical boundaries of each PRS or PRS aggregate,
- a geographical area for which the conclusions and decisions will apply,
- temporal considerations that affect the time during which data can be collected, and
- sample matrices of interest.

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The ways in which the data collected 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.

3.3.1.1 Data Collection

(a) Sample Location and Frequency

The SAP details the following sample location and frequency information

- the number, or frequency of collection, for each type of sample (e.g., composite, grab, integrated) to be collected;
- the sampling network design (e.g., rectangular or triangular grid, stratification) and the assumptions underlying the design;
- the locations of the sampling points (preferably marked on a map);
- 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 sample points are to be selected during field activities;
- a description of the portion of each medium that will be collected for analysis;
- the classification of all measurements as critical (i.e., required to achieve SAP objectives) or noncritical (included for information purposes only);
- references to all administrative procedures and SOPs that will be used to carry out the work under the SAP;
- design for well installation, as needed. The criteria for well installation design should be explained with reference to the well types and installation criteria described in Section 4.1.1 of the hydrogeologic work plan (LANL 1998, 59599).

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(b) Sample Designation

In accordance with LANL-ER-SOP-1.04, "Sample Control and Field Documentation," 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 location and number of samples needed for site characterization. SOPs are developed for all field screening and field analytical techniques. All field measurements are conducted in accordance with the SOP appropriate to the method used. If field measurements are used to guide fixed laboratory sampling locations and to support site decisions, correlation to laboratory measurements are verified statistically.

ER Project SOPs exist for the following field-screening techniques: test kits for PCBs, total hydrocarbons, RDX, and TNT; HE spot test kit; and field-portable XRF. Field measurements for

radioactivity are addressed in LANL-ER-SOP-10.07, "Field Monitoring for Surface and Volume Radioactivity Levels," and LANL-ER-SOP-10.10, "Radiation Scoping Surveys."

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. Requirements for the control of measurement and test equipment are described in LANL-ER-QP-5.2, "Control of Measuring and Test Equipment."

3.3.3 Sampling Equipment and Procedures

3.3.3.1 Sampling Procedures

Samples are collected in accordance with appropriate SOPs. 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-inch depth of entire PRS),
- 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 demanded 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, 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. Sampling and preservation methods recommended in EPA SW-846 Method 5000 (EPA 1997, 57589) are used by the ER Project whenever practicable.

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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). During site characterization, filtered water samples are collected (in addition to unfiltered samples) in order to evaluate contaminant fate and transport. Filtered inorganic groundwater samples are also obtained 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.

Ultimate authority and responsibility for field operations lies with the responsible focus area leader. However, responsibility for corrective actions in the field that address deviations from sampling procedures and other field-work-related contingencies may rest with the field team leaders who report to a focus area leader.

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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 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. Requirements for QA/QC samples are specified in ER-SOP-1.05, "Field Quality Control Samples."

3.3.3.3 Equipment Decontamination

Nondisposable sampling equipment is decontaminated in accordance with LANL-ER-SOP-1.08, "Field Decontamination of Drilling and Sampling Equipment."

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 as delineated in LANL-ER-SOP-1.04, "Sample Control and Field Documentation." Chain-of-custody records are initiated at the time of sample collection and remain active until final disposition of the sample.

Requirements for selecting sample volumes, containers, holding times, and preservatives for samples are presented in LANL-ER-SOP-1.02, "Sample Container and Preservation." All ER Project samples are classified as hazardous or nonhazardous before shipment pursuant to International Air Transportation Association, Department of Transportation regulations (49 CFR 171-173). LANL-ER-SOP-1.03, "Handling, Packaging and Shipping of Samples,"

provides hazard status determination, packaging requirements, and shipping/transport requirements for samples.

All analytical services are coordinated through the Field Support Facility (FSF). All samples submitted through the FSF 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.

Nonroutine analytical services are any that are not specified in the ER Project statement of work for analytical services. Nonroutine anaytical services are procured in accordance with LANL-ER-QP-7.1, "Procurement."

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 SAL/ESL concentrations can be detected. SW-846 methods (EPA 1997, 57589) 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 PRS investigation requires the measurement of analyte concentrations less than the lowest concentrations measured by routine analytical methods, the technical team selects an appropriate analytical method that will provide lower detection limits, if practicable.

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Although toxicity characteristic leaching procedures (TCLPs) are not used in risk assessments or to confirm sampling, the ER Project does use TCLPs to characterize waste and determine disposal options. TCLPs are 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 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.

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. This process results in validation reports used to direct focused validations. Focused validations are required to evaluate the data's usability.

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. The qualifier is intended not to reject data but to ensure that the relative quality of the data is understood, so that the data may be used appropriately.

A focused data validation may be required as a follow-up to the routine validation process. The purpose of a focused validation is to determine the technical adequacy of measurement data 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 field-sampling 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 developing 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.

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3.4.1 Site Access and Security

The Laboratory maintains responsibility for all access and security measures required to gain access to the Laboratory. Site security at PRSs 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 monthly by the Hazardous and Solid Waste Group (ESH-19) to the Hazardous and Radioactive Material Bureau. 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 Plans

The development of contingency strategies is necessary for the successful and timely completion of ER operations at the Laboratory. If a problem or interruption occurs during field activities, the appropriate ER Project personnel are notified and consulted before implementation of alternate strategies (depending upon the importance of the problem). In case of major deviation, the Administrative Authority is contacted to discuss the alternative action. Certain reasonably anticipated contingencies are addressed in site-specific health and safety plans. Other reasonably anticipated contingencies are addressed in site-specific SAPs.

3.4.5 Record Keeping

ER Project-wide requirements for documentation and records are detailed in Chapter 4.0 of this document. They also are described in LANL-ER-QP-4.3, "Procedure for LANL ER Records Management," and LANL-ER-QP-4.4, "Distribution of Controlled Documents." 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 Sample Management Office, 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.

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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 Department of Energy (DOE) and the University of California (UC) by establishing general guidelines for records management, including technical data. Specific actions for managing project records are implemented through quality procedures (QPs), standard operating procedures (SOPs), and management guidance documents. The guidelines have been developed in cooperation with the ER Project's quality assurance staff and the Laboratory's Computing, Information, and Communication (CIC) Division staff.

The Records Management Plan interfaces with other chapters of this Installation Work Plan mandated by the Hazardous and Solid Waste Amendments (HSWA) Module of DOE/UC's permit to operate the Laboratory under the Resource Conservation and Recovery Act (RCRA) (EPA 1994, 44146). This plan contains four 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's Records-Processing Facility (RPF) and Facility for Information Management, Analysis, and Display (FIMAD) are described in Section 4.3. Section 4.4 describes how records management is coordinated with the quality program, project management, and public involvement activities.

4.1.1 Regulatory Mandate

The development and implementation of this plan are mandated by the HSWA Module. General requirements for data management are presented in Task II, Section B, of the HSWA Module, 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 and intended function of the data and documentation submitted to the New Mexico Environment Department (NMED) and the Environmental Protection Agency (EPA). The ER Project's records also include the publicly accessible documentation that make up portions of the administrative record (AR) file as well as parts of the facility operating record.

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 the HSWA Module;
- 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.

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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 Community Relations Office, the NMED, EPA Region 6, DOE, 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 projectwide 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" includes 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—auditable quality 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 and the public while providing records protection through a documented process of change control.

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4.2.2 Implementation

Transmittal of Records

ER Project participants must transmit their records to the RPF. Records must be transmitted in accordance with LANL-ER-QP-4.3, "LANL ER Records Management," and LANL-ER-QP-4.5, "Transmittal of Records to the Records-Processing Facility." ER records normally are used to make a decision or they document the normal and routine course of conducting ER 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 RCRA facility investigation reports or similar records documenting project decisions.

Participants are required to review their records to determine whether the information represents an ER record as defined in procedures LANL-ER-QP-4.3 and LANL-ER-QP-4.5. 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;
- enters the microfilm roll number and box number globally in the ER 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 and are queriable on bibliographic and indexing information in the RPF's home page on the internal Web site (http://erproject.lanl.gov/rpfdata/new/query.asp).

Use of Approved Procedures

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

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records originating outside the ER Project that have been transmitted in accordance with the records management procedure.

Administrative Record

An AR is the body of documentation that forms the basis for making a decision about a site. It also acts as a vehicle to support public participation in the process of making a decision. There is a difference between ARs and AR files. To avoid the impression that a body of documentation is complete, it is called an "administrative record file" before completion of decisions and an "administrative record" upon their completion. The AR continues to serve as a historical record of the response selection. A queriable listing of documents referred to as the AR Electronic Index is accessible on the RPF's home page at http://erproject.lanl.gov/rpfdata/new/query.asp. Public access is available at the Laboratory's Reading Room.

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 potential release sites (PRSs). Original transmittals and a micrographic copy are sent to the Laboratory's CIC Division or a similar long-term 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 file and works closely with the Laboratory's Community Relations Office to fill records requests by the public sector. The RPF 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, PRSs, and structures.

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 is focused on data that are spatial in nature (location of buildings, roads, rivers, sample sites, boreholes, etc.);

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- 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.

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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 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.

4.4 Coordination

4.4.1 Quality Program

LANL-ER-QP-4.3 and LANL-ER-QP-4.5, approved by the quality program project leader, are used for managing ER Project records. The procedures and subsequent updates are written in accordance with LANL-ER-QP-4.1, "Quality Procedures Development." The procedures are used uniformly throughout the ER Project to achieve the objectives of this plan and to fulfill the obligations defined in the HSWA Module.

4.4.2 Project Planning and Control Team

The ER Project Planning and Control Team (PP&C) coordinates, summarizes, and maintains the information in the performance measurement baseline in compliance with DOE-Albuquerque Environmental Restoration Division and DOE-Los Alamos Area Office guidance and the principles outlined in DOE Order 430.1, "Life Cycle Asset Management." The performance measurement baseline includes information on project assumptions, cost estimating, scheduling, time-phased budgets, and important project milestones and deliverables. Selected PP&C documents and the monthly reports that document project decisions are submitted to DOE, with copies transmitted to the RPF. Approved changes to the performance measurement baseline are incorporated by the PP&C team through the baseline change control process. These changes and the subsequent documentation are also copied to the RPF.

The software packages used by the PP&C staff analyze the data and generate the reporting documents required by the ER Project and DOE. The platform used for baseline development and management consists of Primavera Project Planner for scheduling and establishment of the performance measurement baseline, Excel for performance reporting, and G2 for estimating. The structure is characterized by a risk-based graded approach to system design. In addition, the system as a tool is quite robust and reflects a conscious effort to accomodate different management styles and techniques. The three basic elements consist of baseline development, performance reporting, and change control.

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4.4.3 Public Involvement Program

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.

Public Information Repositories. The Laboratory and ER Project maintain several information repositories for public use in Los Alamos and surrounding communities. These repositories are listed in Section 7.2.2. In general, they contain ER Project plans and reports expected to be of interest to the public, whereas, the RPF contains the backup documentation. Detailed information on the kinds of materials available in the public information repositories may be obtained from the points of contact given in Section 7.2.2.

Sensitive Documents. Documents not subject to public access are those that fall under sensitive categories (such as attorney work product, attorney-client privileged documents, and personal information) and documents that have no direct relevance to making a decision. However, even documents that are unavailable for public review are listed in the AR Electronic Index for the public's information at the Laboratory's Community Relations Office and Reading Room. In the case of legally privileged or otherwise sensitive records, it may be necessary to summarize these records. These actions are taken with the advice and cooperation of the Laboratory's Legal Counsel Office and the Security and Safeguards Division.

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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 1998, 58714) 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 projectwide.

This Chapter 5 of the 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, (2) the HASP contains several appendices that are cited in this chapter but have not been included in the IWP, and (3) to meet new requirements and changing project needs, the HASP is continuously updated; the IWP will be updated to reflect changes that occur in the HASP.

In addition to the generic guidance published in this chapter, a site-specific health and safety plan (SSHASP) will be 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 potential release site (PRS) or group of PRSs. 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 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 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 Part 1910 of Title 29 of the Code of Federal Regulations [CFR]). 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.

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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 should be brought to the attention of the contract administrator and the focus area 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 3.5 of the HASP 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 appendices containing forms and procedures. It has also provided a model SSHASP. Both the HASP and the completed SSHASP for each project shall be kept readily available for reference by individuals performing ER field operations and shall govern the conduct of work at the applicable site(s).

5.1.2 Review and Approval

Before any work is initiated, the project team shall submit 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 shall serve 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 shall return 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 shall sign 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.

5.2 Personnel

5.2.1 Organization

The policies and personnel roles and responsibilities provided in this section have been established by the Laboratory to clarify expectations of ER participants and to comply with the requirements of 29 CFR 1926.65(b)(2), "Hazardous Waste Operations and Emergency Response."

5.2.1.1 Project Team

(a) Line Managers

Focus Area Project Leader

The FAPL is a member of the Laboratory's staff and reports to the manager of the ER Project. The FAPL is the line manager for his/her focus area and may direct one or more field team managers or field team leaders.

The FAPL is responsible for ensuring that provisions of the HASP, SSHASP, and other applicable H&S regulations are observed for field operations under his/her management. In addition, specific

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health and safety responsibilities of the FAPL, or his/her delegate, include

- managing H&S activities of his/her focus area;
- serving as the final authority for resolving H&S issues concerning his/her focus area;
- ensuring that the necessary SSHASPs for his/her focus area are developed and that the comments of the focus area H&S representative and any other appropriate parties have been incorporated;
- ensuring that each individual performing ER work at his/her focus area is qualified in accordance with applicable H&S requirements;
- ensuring that on-site personnel abide by applicable H&S programs, procedures, plans, and applicable regulations;
- having the authority to ban personnel who do not abide by applicable H&S requirements from performing field operations;
- conducting inspections as required by Section 12.1 in the ER HASP; and
- ensuring the submittal of appropriate field project H&S records to the Laboratory's Records-Processing Facility (RPF).

Field Team Manager

The field team manager, who may be either a Laboratory staff member or contractor, reports to the FAPL and is the line manager of one or more field teams. Specific H&S responsibilities of the field team manager, or delegate, include

- coordinating with the FAPL to ensure that provisions of the HASP, SSHASP, and other applicable H&S regulations are implemented for assigned field operations;
- ensuring that all known tasks and personnel have been identified sufficiently in the SSHASP;
- coordinating with the FAPL to ensure that each concerned party has reviewed the SSHASP for accuracy and adequacy in accordance with Section 5.1.2, that review comments are resolved, and that the SSHASP is signed before any field activities are begun;
- coordinating with the FAPL to ensure that only personnel qualified in accordance with applicable H&S requirements are used to perform ER Project work;
- coordinating with the FAPL and the focus area H&S representative to select qualified H&S and health physics personnel;
- coordinating with the FAPL to ensure that the necessary permits have been obtained before commencing field operations;

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- conducting inspections as required by Section 12.1 in the ER HASP;
- coordinating with the FAPL to ensure that necessary H&S records are produced and kept in accordance with the SSHASP; and
- coordinating with the FAPL to provide necessary H&S records to the FAPL at the close of the project.

Field Team Leader

The field team leader, who may be either a Laboratory staff member or a contractor, reports to the field team manager (or in some cases directly to the FAPL, in which case, the responsibilities of the field team manager should be delegated to the field team leader by and at the discretion of the FAPL). This person is the line manager for his/her field team. He/she oversees the work of one or more supervisors assigned to the field teams, the field team members, and the site safety officer. The field team leader or delegate

- coordinates with the field team manager and/or FAPL to ensure that the provisions of the HASP, SSHASP, and other applicable H&S regulations are implemented for assigned field operations;
- coordinates with the field team manager and/or FAPL to ensure that only field team members and support personnel qualified in accordance with applicable H&S requirements are allowed to perform field operations;
- coordinates with the field team manager and/or FAPL to ensure that field team members attend H&S briefings and daily H&S tailgate meetings before beginning field operations;
- coordinates with the field team manager and/or FAPL to ensure that the necessary preventive planning and employee training for emergency situations has occurred before beginning field operations (Section 3.2.1.3 of the HASP);
- coordinates with the field team manager and/or FAPL to ensure that site control measures and hazard prevention and mitigation controls are implemented accordingly,
- ensures that a log of field activities is maintained, especially noting site personnel and visitors who enter and exit the site;
- notifies appropriate parties when action levels are reached and when personnel exposures exceed occupational exposure levels;
- 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; and
- coordinates with the field team manager and/or FAPL to ensure that modifications to the SSHASP have been prepared and approved before initiating any operational changes.

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Other On-site Supervisory Personnel

For field teams involving multiple employers, each employer's on-site supervisory representative is responsible for ensuring that provisions of the HASP, SSHASP, and other applicable H&S requirements are observed by his/her employees during field operations. These supervisors are responsible for cooperating with the field team leader and site safety officer to resolve H&S matters that affect site personnel and/or operations.

(b) Field Teams

Field team members are responsible for performing their work in a safe and healthful manner. They also are responsible for abiding by the requirements of the HASP, SSHASP, 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 may unreasonably compromise the safety or health of an individual or the environment, such a concern should be brought to the attention of an immediate supervisor, the site safety officer, or the field team leader. When an H&S concern is not resolved adequately by field supervisors, the matter should be brought to the attention of the field team manger or focus area H&S representative, and, subsequently, the FAPL if necessary. If adequate resolution still has not been achieved, team members are encouraged to call the Laboratory's ESH Division hotline at 665-5010 or to contact the Los Alamos DOE Area Office at 1(800) 688-5713, where they may file a complaint form. DOE has a policy that employees who report a health and safety problem are protected from reprisal.

5.2.1.2 Health and Safety Personnel

Site Safety Officer

The site safety officer assists the field team leader in seeing that the provisions of the HASP, SSHASP, and other applicable H&S requirements are observed in the field and serves as the primary contact in the field for H&S matters. The site safety officer shall be qualified, on a project-specific basis, to recognize and evaluate hazards and to minimize and mitigate occupational H&S hazards. The site safety officer may perform other duties on the field team, provided that these duties do not compromise the performance of his/her site safety officer duties. The specific responsibilities of the site safety officer are to

- assist with developing the SSHASP;
- verify that on-site personnel have current certification of the applicable training and medical surveillance requirements of Sections 10 and 11 of the HASP and SSHASP (Sections 10 and 11);
- assist the field team leader in effectively implementing the HASP and SSHASP in accordance with applicable federal, state, and local H&S regulatory requirements;
- notify the field team 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 in accordance with applicable H&S requirements;

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- notify the field team manager and, subsequently, the focus area 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 in the SSHASP;
- ensure that copies of the HASP, SSHASP, and any modification forms are current and that these documents are readily accessible on-site and as needed for ER work occurring elsewhere;
- assess the necessity of and arrange for monitoring employee exposures to H&S hazards and convey the results and known implications to the field team leader;
- notify the field team leader, the focus area H&S representative, and affected employee's supervisors of the results of monitoring employee exposures (Section 5.8);
- monitor the levels and effectiveness of personal protective equipment and verify proper storage and maintenance of equipment;
- perform and document inspections of site operations; 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 field team manager as necessary before close of the project.

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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 a site safety officer and, with the approval of the FAPL, someone to whom the site safety officer 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 who, in accordance with 29 CFR 1910.146, "Permit-Required Confined Spaces," is capable of identifying existing and predictable hazards in the surroundings or working conditions involving trenching or excavation that are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them [29 CFR 1926.650(b)]. This person shall 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.).

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," evoked by the Laboratory, Occupational Safety and Health Act (OSHA) uses the terms "competent" and "qualified" to denote specially trained and knowledgeable individuals who are required to perform certain functions. These specific standards are cited as applicable throughout the HASP and SSHASP. Whenever requirements exist in these standards for participation of a competent or qualified person, the person shall be trained and knowledgeable about the particular regulated subject matter in accordance with the health and safety provisions of 29 CFR 1926.32(f) or (m), the applicable regulatory standard.

5.2.1.3 Health Physics Personnel

Health physics personnel include radiological screening personnel, health physics technicians, and radiological control technicians. These field team members are the primary source of information and guidance about radiation protection. They shall ensure compliance with the radiological requirements of the SSHASP and conduct monitoring per the radiological surveillance authorization agreement issued by the Laboratory's Health Physics Operations Group (ESH-1) and the terms of the SSHASP. If non-ESH-1 personnel perform these roles, ESH-1 must preapprove personnel and issue a radiological surveillance authorization agreement before any work is performed.

Radiological Screening Personnel

Radiological screening personnel are responsible for providing health physics monitoring support for the field team. Each radiological screening person is responsible for performing health physics monitoring support in accordance with his/her radiological surveillance authorization agreement. Specific responsibilities include

- performing and documenting radiological surveys,
- performing conditional equipment release 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 ESH-1 when an employee has been contaminated above action levels,
- providing ESH-1 personnel who oversee the ER Project with a daily verbal summary of site radiological conditions and copies of all radiological survey documentation, and
- notifying ESH-1 when action levels defined in the SSHASP have been reached.

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Health Physics Technician and Radiological Control Technician

In addition to the responsibilities of the radiation screening personnel, the responsibilities of the health physics technician and the radiological control technician include

- preparing, ensuring compliance with, and closing out radiological work permits;
- stopping work and revising the site radiological work permit when the radiological controls required do not provide adequate worker protection or contamination control;
- providing guidance on radiological decontamination of equipment and personnel; and
- performing "unconditional release" surveys for equipment (radiological control technician only).

5.2.1.4 Project Support

Contractor/Subcontractor Representative

A contractor/subcontractor representative is a management or health and safety 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 modification forms and to see that employees of his/her employer abide by these terms. Additional responsibilities include

- interfacing with field project line managers, other employer's 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 employees performing ER work, particularly those issues involving discrepancies between policies of multiple employers represented on-site and site-specific H&S requirements.

Focus Area H&S Representative

The focus area H&S representative may be either a Laboratory employee or a contract employee who is assigned to one or two FAPLs as a technical advisor. This person provides H&S support to personnel performing ER work involving the assigned focus area(s). This person serves as liaison between the focus area personnel and the Environment, Safety and Health (ESH) Division of the Laboratory and arranges for provision of technical assistance by ESH personnel concerning industrial hygiene, operational safety, and health physics matters. This person may also be responsible on behalf of the Laboratory for implementing the ER/H&S Oversight Program for focus area(s) as assigned by Industrial Hygiene and Safety Group (ESH-5) management. In addition to the responsibilities of the contractor/subcontractor representative, the focus area H&S representative has responsibilities that include

- ensuring that SSHASPs for his/her focus area(s) are reviewed by appropriate ESH groups;

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- 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;

- reviewing and approving SSHASPs and modification forms for ER work at his/her assigned focus area(s); and

- verifying that field operations associated with his/her focus area(s) are conducted in accordance with applicable H&S programs, plans, and regulatory requirements.

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] of Subpart P, Excavations).

ESH-1 Personnel

ESH-1 will designate ESH-1 personnel to provide radiological control support to the ER Project. In cases requiring immediate involvement by ESH-1 personnel, the field team leader or delegate may request direct ESH-1 participation. Such participation may include site visitation, the frequency of which will depend on the specific operations and radiological conditions occurring at the site. The responsibilities of the ESH-1 representative include

- performing reviews to ensure that the radiological safety program is in compliance with the Laboratory's Radiological Control Manual (LANL 1994, 59928) and applicable Laboratory requirements;

- ensuring that survey methods and equipment are appropriate for the type of radiological contamination expected and for current site conditions;

- providing direct support to field health physics personnel, when requested;

- ensuring that radiological controls are implemented in accordance with the radiological work permit (if any), the SSHASP, the Laboratory's Radiological Control Manual (LANL 1994, 59928), and any other applicable Laboratory requirements;

- ensuring that radiological surveys are performed and documented in accordance with required ESH-1 procedures;

- performing radiological surveys before the start and at the completion of field activities;

- providing guidance for radiological decontamination of equipment and personnel;

- taking the actions indicated in Table 4-3 and Section 6 of the SSHASP upon notification that the action levels given in the table have been reached;

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- reviewing radiological work permits for the site;
- determining and, in some cases, providing appropriate radiological postings; and
- meeting notification and reporting requirements as specified in DOE Order 232.1A, "Occurrence Reporting and Processing of Operations Information."

These responsibilities may be performed by designated contract personnel, provided ESH-1 has approved the subcontractor's radiological safety program to perform this work, which must be submitted to the Laboratory for approval during the prebid qualification or contract negotiation period, as required, or according to applicable requirements.

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 shall have the necessary training to perform their assigned task(s) and associated responsibilities. Before the field team leader tasks a field team member with performing an ER field duty, the site safety officer shall verify 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 shall receive training that meets the requirements of Section 10 of the HASP before they are permitted to engage in Hazardous Waste Operations and Emergency Response (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 shall be 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 shall be qualified to instruct employees about the subject matter that they are presenting. Trainers shall have the academic credentials and instructional experience necessary for teaching the subject(s) or shall have completed a training program for teaching the subject(s). Instructors shall demonstrate competent instructional skills and knowledge of the subject matter.

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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 shall not be required to provide the initial training requirements of Sections 10.5.3 or 10.5.4 of the HASP. They shall 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 field work for periods determined by expected exposure:
  - initial 40 hours of training and 24 hours of supervised field work (for areas in which contaminant concentrations may exceed exposure limits) or
  - initial 24 hours of training and 8 hours of supervised field work (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.

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Emergency Response Training

If a 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), "Hazardous Waste Operations and Emergency Response," the site safety officer shall conduct training on the contents of the SSHASP before field work 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 shall cover the contents of the SSHASP and applicable portions of the HASP.

Daily Tailgate H&S Meetings

Before beginning field work each day, the site safety officer and field team leader shall 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 shall be documented. During these tailgate meetings, field team members shall be 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, shall 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, "Safety and Health Regulations for Construction," and/or 29 CFR 1910, "Occupational Safety and Health Standards"), 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 shall 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,

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- Radiological Worker II training, and
- waste generator and waste management training.

5.2.3 Medical Surveillance

Before the field 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 shall be specified in Section 11 of the SSHASP.

A written medical surveillance program that complies with the requirements of this section shall 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 PRS(s).

5.4 Hazard Assessment

Hazard assessment is the process of identifying and evaluating the hazards associated with operational activities. Evaluation and identification of hazards should occur

- during pre-operational planning of ER field work,
- 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.

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The Laboratory has provided a method for evaluating and rating hazards (ER Project Heath and Safety Manual, Environmental Restoration Project 1995, 55423). A list of several assessment methods is provided by the DOE (Health and Safety Plan [HASP] Guidelines, DOE 1994, 59928). 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 shall 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 shall be identified in the SSHASP by the role (job title) and task(s) they are expected to perform. Then each anticipated task-specific hazard shall be 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 shall be included in the SSHASP, unless there are none. Of the wide variety of potential chemicals of 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, shall be provided in Appendix C of the SSHASP. Corresponding detection methods, protective measures, and response actions shall 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

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chemical are included in Table 4-3 of the SSHASP. This table shall also 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; and animal attacks. These hazards have been assessed by ESH-5 with input from the Laboratory's Occupational Medicine Group (ESH-2), assuming variable exposure conditions on a projectwide 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" 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, shall be provided in Table 5 of the SSHASP. Site maps required by OSHA shall be included in Appendix A of the SSHASP to show the intended locations of the specified

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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 shall document these locations in his/her daily logbook.

Section 5 of the SSHASP also shall 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 1910.145, "Specifications for Accident Prevention Signs and Tags") shall be specified.

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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, "Safety and Health Regulations for Construction,") 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.

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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 shall be submitted to the focus area 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 shall 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 focus area H&S representative for distribution to the appropriate ESH group(s).

Visitor Policy

A visitor (e.g., regulatory personnel, property owners, field auditors, and the public) is anyone who arrives at the work site who is not identified as a field team member or who does not appear in

Table 3-1 of the SSHASP. When a visitor arrives, the site safety officer, field team leader, or delegate, should meet with him/her to ascertain the purpose of the visit.

Visitors are not permitted to enter controlled work zones where access has been limited applicable regulations;

- having the authority to ban personnel who do not abide by applicable H&S requirements from performing field operations;
- conducting inspections as required by Section 12.1 in ER HASP; and
- ensuring the submittal of appropriate field project H&S records to the Laboratory's Records-Processing Facility.

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). Site-specific administrative and engineering requirements shall be included in the SSHASP.

5.4.2.3 Communication

Health and safety is communicated to the worker by the SSHASP, which may be revised at any time to include new information and changes that make the SSHASP more useful (e.g., new site data based on contaminant sampling and monitoring, recent survey information, and changes in site conditions or work practices). Once the SSHASP has been approved, revisions will be tracked using the SSHASP modification form (Appendix B of the HASP).

Other forms of communication include but are not limited to tailgate meetings, where information is disseminated as needed on the job site; special-issue meetings that are called as needed and can occur on or off the job site; and various forms of placarding, signage, and posting. On-site communication can also include 2-way radios, cellular phones, and alarm systems.

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 should be 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.

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Site-specific exposure-monitoring strategies, including action levels, that meet applicable DOE and OSHA requirements shall be specified in Section 6 of the SSHASP for each project task having different requirements. Exposure-monitoring strategies, including establishment of action levels, should be 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 radioactive substances of concern. This information shall be included in Appendix C of the SSHASP for the chemical substances of occupational concern included in Table 4-2 of the SSHASP and is included 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 shall include use of direct-reading instruments, personal dosimetry, 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], "Hazardous Waste Operations and Emergency Response") 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. These methods are provided in the ER Project's Health and Safety Activities Manual (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 shall be specified in Section 6 of the SSHASP. Project managers 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 shall 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 shall use radiological instrumentation calibrated and maintained by the Health Physics Measurement Group (ESH-4). Subcontractors shall 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 shall be monitored for release in accordance with the health physics representative's radiological surveillance authorization agreement.

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Requirements for personal dosimetry of radiation exposure shall 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's Health and Safety Activities 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's Health and Safety Activities 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 for chemical contamination should be 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 being analyzed for radiological contamination should be analyzed by the Laboratory's health physics analytical laboratory or a mobile extension thereof or as indicated in the contractor's radiological safety program, which has been approved by the Laboratory.

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 shall 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 shall not be 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 (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) are to be used at sites contaminated by radiation. 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 shall be provided in Section 7 of the SSHASP.

Furthermore, personnel who use personal protective equipment to perform a job shall be trained to recognize the limitations of the equipment and to properly select, fit, use, inspect, maintain, and store the equipment. Such training shall 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,

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inspection, and maintenance of personal protective equipment (ER Project's 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 shall be specified, as applicable, in Section 7 of the SSHASP. Personnel who use ANTI-Cs shall 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 shall be reassessed by the site safety officer, and a SSHASP modification form shall 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 should make it a practice not to use personal protective equipment that shows signs of compromised integrity. The site safety officer shall monitor individuals in areas where personal protective equipment is required to ensure that they are properly attired.

Respiratory Protective Equipment

Use of respiratory protection shall occur 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 shall be specified, as applicable, in Section 7 of the SSHASP. Personnel required to use respirators shall have certification of current training, medical fitness, and respirator fit testing in accordance with these requirements, which are listed below and are summarized in Section 7.1 of the HASP. Contractors whose employees use respiratory protective equipment to perform ER Project work shall provide documentation to support compliance with each aspect of the mandated standards:

- designated qualified person,
- implementation of administrative and engineering controls,
- use of approved equipment,
- SOPs,
- respirator user's medical status,
- training,
- fit testing,
- work area surveillance,
- cleaning and disinfection,
- inspection and repair,

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- storage, and
- quality assurance.

Employers of personnel who wear respirators to perform ER Project work shall maintain and implement a current written respiratory protection program, which addresses the requirements described in Section 7.1 of the HASP. A contractor's respiratory protection program shall be submitted to the focus area 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 shall be submitted similarly for review and approval by appropriate ESH personnel.

5.6 Decontamination

Decontamination involves physically removing contaminants from personnel and equipment and/or chemically converting them into innocuous waste substances. 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 should be conspicuously marked and should have restricted entry and exit points. Personnel shall 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 shall monitor decontamination activities to determine their effectiveness. If procedures are found to be ineffective, these individuals shall take steps to correct any deficiencies and shall 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 shall 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 shall 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 should be taken to avoid generating mixed waste during decontamination operations.

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- Rinse water and waste generated on-site shall 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 shall be included in Section 9 of the SSHASP. Any deviations or exceptions to this section shall be described in Section 9 of the SSHASP.

This section has been developed to meet the requirements of 29 CFR 1926.24 and 1926.65(l), and, as applicable, 29 CFR 1926.65(q) or 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's Health and Safety Activities 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 field work, 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 field team leader, assisted by the site safety officer, shall direct and coordinate 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 only allowed to

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take defensive actions for which they have been trained and are equipped in accordance with this section.

The field team leader, assisted by the site safety officer, shall 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 shall 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) shall be posted at a location on-site where personnel may readily access the information. This site-specific information shall be included in Appendix D of the SSHASP.

Emergency Alerting and Site Evacuation Procedures

The field team leader and site safety officer shall determine 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 shall be communicated by the site safety officer or field team leader 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) 1996 North American Emergency Response Guidebook (DOT 1996, 59927) provides information for determining the extent of and safe distances for evacuation, which shall 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 shall be specified in Section 9 of the SSHASP and shall be established at the work site in accordance with 29 CFR 1926.65(l)(3)(vi) and 1926.159. Section 9 of the SSHASP shall also include means and methods for alerting contact personnel at adjacent facilities of on-site events that could pose a threat to offsite facilities and for designated personnel at adjacent offsite 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 shall 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,

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- 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's 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 focus area H&S representative. In the event of an occurrence necessitating medical care, the field team leader shall arrange for notification of the key personnel listed in Appendix D of the SSHASP (i.e., other line managers, the focus area 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, shall 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 shall keep a daily record of H&S-related events in a bound logbook and shall verify employee training and medical surveillance records in accordance with Section 13.2 of the HASP. Health physics personnel shall 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 shall be provided to the field team manager at the close of the project, who will provide them to the FAPL for storage at the RPF.

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) for access to employee

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exposure and medical records. Medical records shall not include medical examination or test results but shall 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 shall be retained in accordance with the following requirements, as well as any other applicable requirements:

- To the extent permitted by law, the employer shall maintain and keep in confidence records for each employee.
- The employer shall maintain medical records for each employee for the duration of employment plus 30 years (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 year and who have seen the records before termination).
- The employer shall maintain exposure records for each employee monitored per Table 6-2 of the SSHASP for 30 years.
- The employer shall ensure that each employee, upon his/her request, has access to his/her records.
- At an employee's written request, the employer shall 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 shall 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 shall 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 shall 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 shall not charge for an initial request for a copy of new information that has been added to a record which was previously provided.

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For purposes of follow-up investigation of an accident or incident, the employee's consent for the investigator(s) to access his/her records shall 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's 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 shall provide a copy of the notification form to the subject employee and to his/her supervisor. These records shall be maintained in confidence in accordance with the requirements of Section 5.8. The original form shall be retained with other original site records. When it is necessary to communicate the results of exposure monitoring to others, it shall 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 shall be processed as specified in Section 9.4 of the ER Project HASP.

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References for Chapter 5

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)

DOE (US Department of Energy), June 1996. "Handbook for Occupational Safety and Health During DOE Hazardous Waste Activities, Office of Environmental Management, Washington, DC. (DOE 1996, 59930)

DOT (US Department of Transportation), October 1996. "1996 North American Emergency Response Guidebook," Research and Special Programs Division, Office of Hazardous Materials Training and Initiatives (DHM-50), Washington, DC. (DOT 1996, 59927)

Environmental Restoration Decommissioning Project, July 1995. "Health and Safety Activities Manual," Los Alamos National Laboratory, Los Alamos, New Mexico. (Environmental Restoration Decommissioning Project 1995, ER ID 55423)

LANL (Los Alamos National Laboratory), December 23, 1994. "Radiological Control Manual," LM107-01.1, Los Alamos, New Mexico. (LANL 1994, 59928)

LANL (Los Alamos National Laboratory), March 1998. "Environmental Restoration Project Health and Safety Plan," Los Alamos National Laboratory report, Los Alamos, New Mexico. (LANL 1998, ER ID 58714)

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6.0 WASTE MANAGEMENT PLAN

6.1 Introduction

The Environmental Restoration (ER) Project generates waste during the corrective action processing 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, become regulated wastes. Removal of contaminants resulting from the above described activities lead to the generation of various types of waste regulated by the Resource Conservation and Recovery Act (RCRA), Toxic Substance 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).

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 the 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.

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 Environment, Safety, and Health [ESH] Division) for review and waste classification before waste is generated. 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, Chapter 4, Part

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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"; therefore, typically, RCRA hazardous and mixed wastes are transported to permitted or interim status facilities on-site at the Laboratory or to off-site commercial facilities for subsequent management.

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 permitted TSD facility. In some instances, these wastes are temporarily shipped to the Laboratory's permitted or interim status hazardous and mixed waste facilities at Technical Area 54 before final shipment to a commercial 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)(s) to render these toxic 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 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; ash from historical burning of high explosives in areas now 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 formerly treated hazardous wastes 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 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

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include packaging, labeling, characterization, short-term storage, generator treatment, and shipment of wastes.

The remaining parts of this section contain descriptions of common waste generating operations, definitions for commonly generated wastes, and a description of the record keeping procedures.

6.3.1 Waste Types

Wastes are generated from several primary ER 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 the 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 wastes, which are placed in containers and characterized based on direct sampling results and/or acceptable knowledge to determine the waste classification and appropriate management approach. Wastewaters that have been sampled 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 used, 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 soil contamination 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

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protect human health and the environment. Remediation waste is brokered through the Laboratory's Solid Waste Operations Group (currently in ESH 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 either investigation or remedial action activities. A radioactive waste is defined as waste that has been determined to contain added (or concentrated) Naturally Occurring Radioactive Material (NORM), radioactive material, or activation products by either monitoring and analysis or acceptable knowledge, or both, or 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 Department of Energy Order 5820.2A, "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 years and concentrations greater than 100 nCi/g at the time of assay and that have atomic numbers greater than 92. Low-level radioactive wastes are currently disposed on-site at the Laboratory's low-level radioactive waste disposal facility. Disposal of large volumes of radioactive wastes generated in the future may be shipped off-site for commercial disposal. This decision will be based on the available volume of the on-site facility.

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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. These areas are used for the temporary storage of hazardous or mixed wastes in quantities greater than 55 gallons of hazardous waste or 1 quart of acutely hazardous 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 gallons of hazardous mixed waste or 1 quart 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 will be 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) LDR 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 will be archived for each potential release site (PRS). 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 activities.

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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). 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 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,
- 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

- 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

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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.

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7.0 PUBLIC INVOLVEMENT PLAN

7.1 Introduction

Role of Public Involvement in the Environmental Restoration Project

Under the Hazardous and Solid Waste Amendments (HSWA) portion (the HSWA Module) of Los Alamos National Laboratory's (Laboratory's) permit to operate under the Resource Conservation and Recovery Act (RCRA), the Environmental Restoration (ER) Project must adopt a community relations plan. The first edition of the ER Project's Installation Work Plan (IWP) (LANL 1990, 7517; 7518; 7519) included the original plan. That plan has evolved into a public involvement plan, which addresses the requirements specified in Section Q, Task II,D of the HSWA Module. This plan emphasizes early public participation in developing recommendations for ER Project activities.

The goal of public involvement is to provide the public with the opportunity to advise the ER Project on its cleanup activities. To create trust in the community, public involvement efforts must build long-term relationships based on accessibility and open communication. Key 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 has the lead responsibility for presenting understandable and consistent information to interested parties during the investigation and cleanup of ER Project sites. The team keeps the Laboratory's Community Relations Office and Public Affairs Office apprised of ER efforts and works with them on related public involvement efforts.

In 1993, the DOE, the Laboratory, and the ER Project created a working group to look at ways of increasing public participation in the ER Project. In February 1994, the working group invited members of the public to brainstorm informally about ways to obtain more effective public participation. Many of their ideas and suggestions were implemented, and in 1995, the "Plan for Increasing Public Participation in Cleanup Decisions for the Los Alamos National Laboratory" was finalized.

The specific objectives of the public participation plan are to

- give the public the information it needs to understand the ER Project's cleanup issues and provide informed input;
- make information readily available to the public;

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- increase contacts with the public in ways that encourage interaction, such as establishing dialogues with members of community organizations, chambers of commerce, church groups, and the Citizens Advisory Board, as well as Laboratory employees outside the ER Project;
- involve the public in the cleanup process before decisions are made;
- ask for assistance from community members and use them as experts on their communities' concerns;
- coordinate public involvement activities for the ER Project with other related land use activities,
- develop alternatives for determining cleanup levels and site prioritization, and
- evaluate the effectiveness and efficiency of public participation activities.

The methods described in the 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, develop recommendations. These recommendations include cleanup actions and recommendations 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. Tax dollars spent in cleanup must also be considered. The ER Project needs the public's help in weighing these factors for 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 potential release sites (PRSs) that are the subject of the activity, to describe the sampling and the data obtained on PRSs 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 such as core 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 the HSWA Module. Comments obtained at such meetings are forwarded to the New Mexico Environment Department (NMED) for consideration in deciding whether to accept the ER Project's proposals.

As recommendations for PRS actions are developed, ER Project personnel will discuss with the public the ramifications of cleanup to residential, recreational, and industrial standards. With the

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public's involvement, the ER Project will prioritize PRSs 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 consist of progress reports; news releases; informal handouts for tours; and information sheets that include history when appropriate, 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 team maintains a home page 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 citizens may participate more knowledgeably in the decision-making process. The ER Project maintains communication with the public in several ways. The team notifies the public of community meetings, tours, and related programs through mailings from the Laboratory's facility mailing list (to be updated annually); public service announcements on local radio stations; publications in local newspapers (*Albuquerque Journal North, Santa Fe New Mexican, Rio Grande Sun, Taos News, and Los Alamos Monitor);* and information on the World Wide Web site. Dialogue with members of the public is provided through meetings of the Northern New Mexico Citizens' Advisory Board and meetings with various civic organizations.

The Laboratory's Public Reading Room in Los Alamos (phone: 505-665-4400 or 800-508-4400) is a repository for documents about the Laboratory's activities that are of interest to the public, including documents pertaining to the ER Project. 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, and the Office of the Governor of the San Ildefonso Pueblo.

Other information provided to members of the public includes notification of newly discovered off-site releases that might impact members of surrounding communities (e.g., San Ildefonso Pueblo). 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 has replaced formal meetings, except when required by regulation, with less formal meetings with community members, such as round-table discussions, site tours, 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

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associations, Laboratory employees, media associations, local government, local schools and universities, and church groups. The primary goals of these meetings are personal engagement and informal group dialogue. Ideally, a two-person team consisting of a technical representative of the ER Project and an individual from the public affiliated with the community group being visited will attend these meetings. Selected Laboratory specialists also attend, as appropriate.

7.2.2.2 Tours

Tours help acquaint the public with the ER Project and specific PRSs as these PRSs are addressed throughout the corrective action process, especially prior to initiation of 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 and 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.

7.2.3 Public Input

Throughout the public involvement process, the ER Project asks people whether they would like to participate more actively in developing recommendations for cleanup decisions and invites such people to working meetings for this purpose. If there is a large response, the ER Project works with all volunteers to develop a fair mechanism for selecting a workable number of participants. The documentation of this process will be sent to NMED.

Public Involvement in the Budget Process

DOE provides budget information to the public through the "Accelerating Cleanup: Paths to Closure" document, which contains projections of proposed budgets through the completion of the ER Project. The document is available at the Laboratory's Public Reading Room in Los Alamos and the Outreach Centers in Española and Santa Fe.

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References for Chapter 7

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, ER ID 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, ER ID 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, ER ID 7519)

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Descriptions of Technical Areas at Los Alamos National Laboratory

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DESCRIPTIONS OF TECHNICAL AREAS AT LOS ALAMOS NATIONAL LABORATORY

The locations of the technical areas (TAs) operated by Los Alamos National Laboratory (the Laboratory) in Los Alamos County are shown in Chapter 2, Figure 2-2. The brief descriptions of activities conducted at the various TAs are from the Laboratory's 1990 Site Development Plan (Facilities Engineering Division Planning Group et. al. 1990, 57223).

Development Areas

Most Laboratory functions, about three-fifths of the land, and 93% of the population are concentrated in the following eight development areas. Each is composed of various TAs as indicated below.

Core Area and Two-Mile Mesa North
(TAs 3, 43, 58, 59, 62)
This development area includes the central technical, administrative, and physical support facilities of the Laboratory as well as experimental science and theoretical/computational science land uses.

Two-Mile Mesa South
(TAs 6, 22, 40)
This development area is presently used for the research and testing of special detonators and high-explosive systems and as a buffer zone for this function. Large portions of this development area therefore remain undeveloped.

Pajarito Corridor West
(TAs 35, 48, 50, 52, 55, 63, 64, 66)
Experimental science and special nuclear materials (SNM) land uses, which include radiochemistry, nuclear safeguards studies, analytical chemistry, reactor development, waste management, and plutonium processing occur in this development area.

Pajarito Corridor Central
(TAs 18, 46, 51, 65)
This development area includes experimental science land uses where research is performed in chemistry, photochemistry, solar energy, biological exposure effects, and nuclear chain reaction behavior.

East Jemez Corridor and Sigma Mesa
(TAs 2, 41, 60, 61)
This development area is used primarily for physical support and infrastructure land use activities and is the site of the existing sanitary landfill. The Omega West reactor is located in Los Alamos Canyon, as are special nuclear materials land uses involving the engineering design of nuclear components. It is also the location of lands leased to construction contractors and the privately owned Royal Crest Trailer Park.

Weapons Engineering
(TA-16)
This development area is dedicated to high-explosives research, development, and testing land uses. Functions at this site include engineering design, prototype manufacture, processing, and environmental testing of nuclear weapon warhead systems. Because TAs 11, 28, and 37 are not the focus of growth, they are not included in this development area, but are discussed elsewhere in this plan.

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Dynamic Testing
(TAs 8, 9, 14, 15, 22, 36, 39, 40, 67, 68)
This extensive area is reserved specifically for high-explosives research, development, and testing land uses.

LAMPF
(TA-53)
The primary facility in this development area is the Los Alamos Meson Physics Facility, a linear particle accelerator used for basic physics research, material studies, and isotope production. Other facilities at TA-53 are also accelerator-related.

Other Technical Areas

Numerous other technical areas are spread throughout the site. These technical areas usually have small populations or are remote. They are not the focus of anticipated future growth and development. These include

TA-0, Los Alamos townsite: The Laboratory leases approximately 116,000 square feet in eight buildings primarily for training and support functions.

TA-5: This large area south of East Jemez Road is mostly undeveloped. It contains some physical support functions, several archaeological sites, and environmental monitoring and buffer areas.

TA-11, K-Site: Located in the high-explosives area, facilities in this technical area test explosive systems and components under a variety of conditions.

TA-21, DP-Site: This former radioactive materials processing facility has a problematic location, because its only access route is through Los Alamos townsite. The location is also inconveniently remote from other Laboratory facilities. Currently, decontamination and decommissioning (D&D) of several structures is under way. A study of future use options for TA-21 is also ongoing.

TA-28, Magazine Area: This is an explosives storage area.

TA-33, HP-Site: An old tritium handling facility located here is being phased out. This site is remote, constrained by limited utility service, and contains substandard structures. It has, however, proven ideal for experiments not requiring daily oversight, or those requiring isolation or that are sensitive to electromagnetic interference. Consequently, there has been increased activity at TA-33 recently. The technical area is also the location of the National Radio Astronomy Observatory's Very Large Baseline Array telescope, a prominent landmark.

TA-37, Magazine Area C: This is an explosives storage area.

TA-49: This site is currently restricted to carefully selected functions given its location near Bandelier National Monument and past use in high-explosives and radioactive materials experiments.

TA-54: The main function of this site is radioactive solid and hazardous chemical waste management. This technical area is discussed within the environment, safety, and health element of this plan.

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TA-57, Fenton Hill Site: This technical area is located west of the Laboratory in the Jemez Mountains. It is the site of the geothermal energy recovery (Hot Dry Rock) project. The Laboratory may decide to convert this demonstration operation to a seismic research facility.

TA-69: Located at the entry to TAs 6, 8, 9, 22, and 58, this technical area is suitable for future physical support and experimental science uses that have close functional ties to those technical areas. This area also provides an environmental buffer.

TAs 70 and 71: These undeveloped buffer areas are located southwest of White Rock between the Rio Grande and New Mexico Route 4. They are reserved for future large-scale experimental science.

TA-72: This undeveloped land along East Jemez Road and NM 502 may offer expansion opportunities for TA-53 related projects.

TA-73: This is the Los Alamos Airport and an adjacent buffer area along the south side of East Road.

TA-74, Otowi Tract: This large area, bordering San Ildefonso Pueblo on the east, is isolated form most of the Laboratory and contains significant concentrations of archaeological sites and an endangered species breeding area.

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Reference for Appendix A

Facilities Engineering Division Planning Group (ENG-2), ICF Kaiser Engineers, Inc., and Royston Hanamoto Alley & Abey Landscape Architects/Planners, September 1990. "Los Alamos National Laboratory Site Development Plan—Technical Site Information." (Facilities Engineering Division Planning Group et al. 1990, ER ID 57223)

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Potential Release Sites at Los Alamos National Laboratory

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Table B-1	Los Alamos Environmental Restoration Potential Release Sites Under Investigation	B-1
Table B-2	Los Alamos Environmental Restoration Potential Release Sites Investigation Complete and Removed from Project	B-34

Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1	00-001	Yes	Sediment Traps, Mortandad	Canyon	1049
2	00-003	Yes	Container storage, Western Steam Plant	Remedial Action	1071
3	00-004	No	Container storage, 6th St. Warehouses	Remedial Action	1071
4	00-005	Yes	Landfill	Remedial Action	1071
5	00-010(b)	No	Surface disposal site, 6th St. Warehouses	Remedial Action	1071
6	00-011(a)	Yes	Mortar impact area	Remedial Action	1071
7	00-011(c)	Yes	Mortar impact area	Remedial Action	1071
8	00-011(d)	Yes	Mortar impact area	Remedial Action	1071
9	00-011(e)	Yes	Mortar impact area	Remedial Action	1071
10	00-012	Yes	Underground tank, Western Steam Plant	Remedial Action	1071
11	00-016	Yes	Firing range	Remedial Action	1071
12	00-017	Yes	Waste lines	Remedial Action	1071
13	00-018(a)	Yes	Sludge bed, wastewater treatment plant, Pueblo (decommissioned)	Remedial Action	1071
14	00-018(b)	No	Sludge bed, wastewater treatment plant, Bayo (active)	Remedial Action	1071
15	00-019	Yes	Wastewater treatment plant, Central	Remedial Action	1071
16	00-027	No	Storage area, DP Road	Remedial Action	1071
17	00-028(a)	Yes	Effluent discharge, golf course	Remedial Action	1071
18	00-028(b)	Yes	Effluent discharge, ball fields	Remedial Action	1071
19	00-029(a)	No	Transformer	Remedial Action	1071
20	00-029(b)	No	Transformer	Remedial Action	1071
21	00-029(c)	No	Transformer	Remedial Action	1071
22	00-030(a)	Yes	Septic system, DP Road	Remedial Action	1071
23	00-030(b)	Yes	Septic system 6th St	Remedial Action	1071
24	00-030(c)	No	Septic system	Remedial Action	1071
25	00-030(d)	No	Septic system	Remedial Action	1071
26	00-030(e)N	No	Septic system	Remedial Action	1071
27	00-030(e)S	No	Septic system	Remedial Action	1071
28	00-030(f)	No	Septic system	Remedial Action	1071
29	00-030(g)	Yes	Septic system (near old Catholic Church parking lot)	Remedial Action	1071
30	00-030(h)	No	Septic system (near new Catholic Church)	Remedial Action	1071
31	00-030(i)	No	Septic system	Remedial Action	1071
32	00-030(j)	No	Septic system	Remedial Action	1071
33	00-030(k)	No	Septic system	Remedial Action	1071
34	00-030(l)	Yes	Septic system, 6th St. Warehouses	Remedial Action	1071
35	00-030(m)	Yes	Septic system, 6th St. Warehouses	Remedial Action	1071
36	00-030(n)	No	Septic system	Remedial Action	1071
37	00-030(o)	No	Septic system	Remedial Action	1071
38	00-030(p)	No	Septic system	Remedial Action	1071
39	00-030(q)	No	Septic system	Remedial Action	1071
40	00-031(a)	No	Soil contamination beneath former service station	Remedial Action	1071
41	00-031(b)	No	Soil contamination beneath former motorpool (two USTs)	Remedial Action	1071
42	00-032	No	Soil contamination beneath former motorpool (UST for used motor oil)	Remedial Action	1071
43	00-033(a)	Yes	Warehouses, 6th Street (UST removal)	Remedial Action	1071
44	00-033(b)	No	Outlet piping 6th Street Warehouse	Remedial Action	1071
45	00-034(a)	No	Landfill, Eastern Area	Remedial Action	1071
46	00-034(b)	No	Landfill, Western Area	Remedial Action	1071
47	00-039	Yes	Underground tanks	Remedial Action	1071
48	01-001(a)	Yes	Septic tank 134	Remedial Action	1078

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
49	01-001(b)	Yes	Septic tank 135	Remedial Action	1078
50	01-001(c)	Yes	Septic tank 137	Remedial Action	1078
51	01-001(d)	Yes	Septic tank 138 (hillside)	Remedial Action	1078
52	01-001(e)	Yes	Septic tank 139	Remedial Action	1078
53	01-001(f)	Yes	Septic tank 140 (hillside)	Remedial Action	1078
54	01-001(g)	Yes	Septic tank 141	Remedial Action	1078
55	01-001(h)	Yes	Septic tank 142	Remedial Action	1078
56	01-001(i)	Yes	Septic tank 143	Remedial Action	1078
57	01-001(j)	Yes	Septic tank 149	Remedial Action	1078
58	01-001(k)	Yes	Septic tank 268	Remedial Action	1078
59	01-001(l)	Yes	Septic tank 269	Remedial Action	1078
60	01-001(m)	Yes	Septic tank 275	Remedial Action	1078
61	01-001(n)	Yes	Septic tank 276	Remedial Action	1078
62	01-001(o)	Yes	Ind. or san. wastewater treat.	Remedial Action	1078
63	01-001(s)	Yes	Septic system waste line	Remedial Action	1078
64	01-001(t)	Yes	Septic system	Remedial Action	1078
65	01-001(u)	Yes	Septic system waste line	Remedial Action	1078
66	01-002	Yes	Outfall TA1 SWMU to be in TA45	Remedial Action	1078
67	01-003(a)	Yes	Landfill	Remedial Action	1078
68	01-003(b)	No	Surface disposal site	Remedial Action	1078
69	01-003(c)	No	Surface disposal site	Remedial Action	1078
70	01-003(d)	Yes	Surface disposal site (can dump)	Remedial Action	1078
71	01-003(e)	Yes	Surface disposal site	Remedial Action	1078
72	01-006(a)	Yes	Drain lines and outfall	Remedial Action	1078
73	01-006(b)	Yes	Drain lines and outfall	Remedial Action	1078
74	01-006(c)	Yes	Drain lines and outfall	Remedial Action	1078
75	01-006(d)	Yes	Drain lines and outfall	Remedial Action	1078
76	01-006(e)	No	Drain lines and outfall	Remedial Action	1078
77	01-006(g)	No	Drain lines and outfall	Remedial Action	1078
78	01-006(h)	Yes	Drain lines and outfall	Remedial Action	1078
79	01-006(n)	Yes	Drain lines and outfall	Remedial Action	1078
80	01-006(o)	Yes	Drain lines and outfall	Remedial Action	1078
81	01-006(p)	No	Drain lines and outfall	Remedial Action	1078
82	01-007(a)	Yes	Soil contamination area	Remedial Action	1078
83	01-007(b)	Yes	Soil contamination area	Remedial Action	1078
84	01-007(c)	Yes	Soil contamination area	Remedial Action	1078
85	01-007(d)	Yes	Soil contamination area	Remedial Action	1078
86	01-007(e)	Yes	Soil contamination area	Remedial Action	1078
87	01-007(i)	No	Soil contamination area	Remedial Action	1078
88	01-007(j)	Yes	Soil contamination area	Remedial Action	1078
89	01-007(k)	No	Soil contamination area	Remedial Action	1078
90	01-007(l)	Yes	Soil contamination area	Remedial Action	1078
91	01-007(p)	No	Soil contamination area	Remedial Action	1078
92	02-003(a)	No	Reactor facility	Canyon	1098
93	02-003(b)	No	Reactor facility	Canyon	1098
94	02-003(c)	No	Reactor facility	Canyon	1098
95	02-003(d)	No	Reactor facility	Canyon	1098
96	02-003(e)	No	Holding tank (near reactor water boiler)	Canyon	1098
97	02-004(a)	No	Reactor facility	Canyon	1098
98	02-004(b)	No	Reactor facility effluent storage tank TA 2-54	Canyon	1098
99	02-004(c)	No	Reactor facility effluent storage tank TA 2-55	Canyon	1098
100	02-004(d)	No	Reactor facility effluent storage tank	Canyon	1098

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
			TA 2-56		
101	02-004(e)	No	Reactor facility acid pit TA 2-53	Canyon	1098
102	02-004(f)	No	Reactor facility equipment building	Canyon	1098
103	02-004(g)	No	Aboveground tank	Canyon	1098
104	02-005	Yes	Systematic leak, cooling tower blowdown, Cr	Canyon	1098
105	02-006(a)	Yes	Ind. or san. wastewater treat.	Canyon	1098
106	02-006(b)	Yes	Ind. or san. wastewater treat.	Canyon	1098
107	02-006(c)	No	Waste line	Canyon	1098
108	02-006(d)	No	Waste line	Canyon	1098
109	02-006(e)	No	Waste line	Canyon	1098
110	02-007	Yes	Septic system	Canyon	1098
111	02-008(a)	Yes	Outfall	Canyon	1098
112	02-008(b)	Yes	Ind. or san. wastewater treat.	Canyon	1098
113	02-008(c)	No	Outfall	Canyon	1098
114	02-009(a)	Yes	Non-intentional release	Canyon	1098
115	02-009(b)	Yes	Non-intentional release	Canyon	1098
116	02-009(c)	Yes	Non-intentional release	Canyon	1098
117	02-009(d)	No	Non-intentional release	Canyon	1098
118	02-009(e)	No	Reactor facility	Canyon	1098
119	02-010	No	Building	Canyon	1098
120	02-011(a)	No	Storm drain and outfall	Canyon	1098
121	02-011(b)	No	Storm drain and outfall	Canyon	1098
122	02-011(c)	No	Storm drain and outfall	Canyon	1098
123	02-011(d)	No	Storm drain and outfall	Canyon	1098
124	02-011(e)	No	Storm drain and outfall	Canyon	1098
125	02-012	No	Underground tanks, former TA 2-29 and former 2-67 replaced w 2-1	Canyon	1098
126	03-001(a)	Yes	<90 day storage	Remedial Action	1114
127	03-001(b)	Yes	Satellite accumulation area	Remedial Action	1114
128	03-001(c)	Yes	<90 day storage	Remedial Action	1114
129	03-001(d)	No	Satellite accumulation area	Remedial Action	1114
130	03-001(e)	No	<90 day storage	Remedial Action	1114
131	03-001(f)	No	<90 day storage	Remedial Action	1114
132	03-001(g)	No	Satellite accumulation area	Remedial Action	1114
133	03-001(h)	No	Satellite accumulation area	Remedial Action	1114
134	03-001(i)	No	Satellite accumulation area	Remedial Action	1114
135	03-001(j)	No	Satellite accumulation area	Remedial Action	1114
136	03-001(k)	Yes	Storage pad	Remedial Action	1114
137	03-001(l)	No	<90 day storage	Remedial Action	1114
138	03-001(n)	No	Satellite accumulation area	Remedial Action	1114
139	03-001(o)	No	Waste container	Remedial Action	1114
140	03-001(q)	No	Satellite accumulation area	Remedial Action	1114
141	03-001(s)	No	Satellite accumulation areas	Remedial Action	1114
142	03-001(t)	No	Satellite accumulation area	Remedial Action	1114
143	03-001(u)	No	Satellite accumulation area	Remedial Action	1114
144	03-001(v)	No	Satellite accumulation area	Remedial Action	1114
145	03-001(w)	No	Satellite accumulation area	Remedial Action	1114
146	03-001(x)	No	Satellite accumulation area	Remedial Action	1114
147	03-001(y)	No	Satellite accumulation area	Remedial Action	1114
148	03-002(a)	Yes	Container storage area	Remedial Action	1114
149	03-002(b)	Yes	Storage area	Remedial Action	1114
150	03-002(c)	Yes	Storage area	Remedial Action	1114
151	03-002(d)	Yes	Container storage area	Remedial Action	1114

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
152	03-003(a)	Yes	Storage area	Remedial Action	1114
153	03-003(b)	Yes	Storage area	Remedial Action	1114
154	03-003(c)	Yes	Equipment storage area	Remedial Action	1114
155	03-003(d)	No	Storage area (transformers)	Remedial Action	1114
156	03-003(e)	No	Storage area (transformers)	Remedial Action	1114
157	03-003(f)	No	Storage area (transformers)	Remedial Action	1114
158	03-003(g)	No	One-time spill (transformer)	Remedial Action	1114
159	03-003(h)	No	Storage area (transformers)	Remedial Action	1114
160	03-003(i)	No	Storage area (transformer)	Remedial Action	1114
161	03-003(j)	No	Storage area (transformers)	Remedial Action	1114
162	03-003(k)	No	Storage area (transformer)	Remedial Action	1114
163	03-003(l)	No	Storage area	Remedial Action	1114
164	03-003(m)	No	Storage area (capacitor banks)	Remedial Action	1114
165	03-003(n)	No	Storage area	Remedial Action	1114
166	03-003(o)	No	Storage area (capacitor bank)	Remedial Action	1114
167	03-003(p)	No	Storage area	Remedial Action	1114
168	03-004(a)	No	Container storage	Remedial Action	1114
169	03-004(b)	No	Container storage	Remedial Action	1114
170	03-004(c)	No	Storage area	Remedial Action	1114
171	03-004(d)	No	Storage area	Remedial Action	1114
172	03-004(e)	No	Storage area	Remedial Action	1114
173	03-004(f)	No	Storage area	Remedial Action	1114
174	03-006(a)	No	Burn site	Remedial Action	1114
175	03-007	No	Firing site	Remedial Action	1114
176	03-008(a)	No	Firing site	Remedial Action	1114
177	03-008(b)	No	Firing site	Remedial Action	1114
178	03-009(a)	Yes	Surface disposal (soil fill)	Remedial Action	1114
179	03-009(b)	Yes	Surface disposal	Remedial Action	1114
180	03-009(c)	Yes	Surface disposal	Remedial Action	1114
181	03-009(d)	Yes	Surface disposal site	Remedial Action	1114
182	03-009(e)	Yes	Surface disposal	Remedial Action	1114
183	03-009(f)	Yes	Surface disposal - landfill	Remedial Action	1114
184	03-009(g)	Yes	Surface disposal	Remedial Action	1114
185	03-009(h)	Yes	Surface disposal	Remedial Action	1114
186	03-009(i)	Yes	Surface disposal site	Remedial Action	1114
187	03-009(j)	Yes	Surface disposal site	Remedial Action	1114
188	03-010(a)	Yes	Vacuum repair shop (former location), systematic release site	Remedial Action	1114
189	03-011	Yes	Systematic product release	Remedial Action	1114
190	03-012(a)	Yes	One-time spill	Remedial Action	1114
191	03-012(b)	Yes	Operational release and outfall	Remedial Action	1114
192	03-013(a)	Yes	Operational release	Remedial Action	1114
193	03-013(b)	No	Operational release	Remedial Action	1114
194	03-014(a)	Yes	Wastewater treatment facility	Remedial Action	1114
195	03-014(a2)	No	Wastewater treatment facility	Remedial Action	1114
196	03-014(b)	Yes	Wastewater treatment facility	Remedial Action	1114
197	03-014(b2)	No	Outfall	Remedial Action	1114
198	03-014(c)	Yes	Wastewater treatment facility	Remedial Action	1114
199	03-014(c2)	No	Outfall	Remedial Action	1114
200	03-014(d)	Yes	Wastewater treatment facility	Remedial Action	1114
201	03-014(e)	Yes	Wastewater treatment facility	Remedial Action	1114
202	03-014(f)	Yes	Wastewater treatment facility	Remedial Action	1114
203	03-014(g)	Yes	Wastewater treatment facility	Remedial Action	1114
204	03-014(h)	Yes	Wastewater treatment facility	Remedial Action	1114

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
205	03-014(i)	Yes	Wastewater treatment facility	Remedial Action	1114
206	03-014(j)	Yes	Wastewater treatment facility	Remedial Action	1114
207	03-014(k)	Yes	Wastewater treatment facility	Remedial Action	1114
208	03-014(l)	Yes	Wastewater treatment facility	Remedial Action	1114
209	03-014(m)	Yes	Wastewater treatment facility	Remedial Action	1114
210	03-014(n)	Yes	Wastewater treatment facility	Remedial Action	1114
211	03-014(o)	Yes	Wastewater treatment facility	Remedial Action	1114
212	03-014(p)	Yes	Wastewater treatment facility	Remedial Action	1114
213	03-014(q)	Yes	Wastewater treatment facility	Remedial Action	1114
214	03-014(r)	Yes	Wastewater treatment facility	Remedial Action	1114
215	03-014(s)	Yes	Wastewater treatment facility	Remedial Action	1114
216	03-014(t)	Yes	Wastewater treatment facility	Remedial Action	1114
217	03-014(u)	Yes	Wastewater treatment facility	Remedial Action	1114
218	03-014(v)	No	Wastewater treatment facility	Remedial Action	1114
219	03-014(w)	No	Wastewater treatment facility	Remedial Action	1114
220	03-014(x)	No	Wastewater treatment facility	Remedial Action	1114
221	03-014(y)	No	Wastewater treatment facility	Remedial Action	1114
222	03-014(z)	No	Wastewater treatment facility	Remedial Action	1114
223	03-015	Yes	Outfall	Remedial Action	1114
224	03-016(a)	No	Septic system	Remedial Action	1114
225	03-016(b)	No	Septic system	Remedial Action	1114
226	03-016(c)	No	Septic system	Remedial Action	1114
227	03-016(d)	No	Septic system	Remedial Action	1114
228	03-016(e)	No	Septic system	Remedial Action	1114
229	03-016(f)	No	Septic system	Remedial Action	1114
230	03-018	Yes	Septic system	Remedial Action	1114
231	03-019	Yes	Septic tank	Remedial Action	1114
232	03-020(a)	Yes	Disposal pit	Remedial Action	1114
233	03-021	Yes	Surface disposal site	Remedial Action	1114
234	03-022	No	Sump	Remedial Action	1114
235	03-023	No	Sump	Remedial Action	1114
236	03-025(a)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
237	03-025(b)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
238	03-025(c)	No	Tank and/or assoc. equipment	Remedial Action	1114
239	03-026(a)	No	Sump	Remedial Action	1114
240	03-026(b)	Yes	Sumps	Remedial Action	1114
241	03-026(c)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
242	03-026(d)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
243	03-027	No	Separation site	Remedial Action	1114
244	03-028	Yes	Surface impoundment	Remedial Action	1114
245	03-029	Yes	Landfill	Remedial Action	1114
246	03-030	No	Surface impoundment	Remedial Action	1114
247	03-031	Yes	Tank and/or assoc. equipment	Remedial Action	1114
248	03-032	Yes	Tank and/or assoc. equipment	Remedial Action	1114
249	03-033	Yes	Sump	Remedial Action	1114
250	03-034(a)	Yes	Tank and/or assoc. equipment, radioactive liquid waste tanks	Remedial Action	1114
251	03-034(b)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
252	03-035(a)	Yes	Underground tank	Remedial Action	1114
253	03-035(b)	Yes	Underground storage tank	Remedial Action	1114
254	03-036(a)	Yes	Aboveground tanks	Remedial Action	1114
255	03-036(b)	No	Aboveground tanks	Remedial Action	1114
256	03-036(c)	Yes	Aboveground tanks	Remedial Action	1114
257	03-036(d)	Yes	Aboveground tanks	Remedial Action	1114

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Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
258	03-036(e)	No	Aboveground tank	Remedial Action	1114
259	03-036(f)	No	Aboveground tank	Remedial Action	1114
260	03-036(g)	No	Aboveground tank	Remedial Action	1114
261	03-036(h)	No	Aboveground tanks	Remedial Action	1114
262	03-036(i)	No	Aboveground tank	Remedial Action	1114
263	03-036(j)	No	Aboveground tanks	Remedial Action	1114
264	03-037	Yes	Underground tank	Remedial Action	1114
265	03-038(a)	Yes	Acid tank	Remedial Action	1114
266	03-038(b)	Yes	Acid tank	Remedial Action	1114
267	03-038(c)	No	Waste lines	Remedial Action	1114
268	03-038(d)	No	Waste lines	Remedial Action	1114
269	03-038(e)	No	Waste lines	Remedial Action	1114
270	03-038(f)	No	Waste lines	Remedial Action	1114
271	03-039(a)	Yes	Silver recovery unit	Remedial Action	1114
272	03-040(a)	No	Storage area	Remedial Action	1114
273	03-040(b)	No	Storage area	Remedial Action	1114
274	03-041	No	Underground tank	Remedial Action	1114
275	03-042	No	Sump	Remedial Action	1114
276	03-043(a)	No	Aboveground tank	Remedial Action	1114
277	03-043(b)	No	Aboveground tank	Remedial Action	1114
278	03-043(c)	Yes	Tank and/or assoc. equipment	Remedial Action	1114
279	03-043(d)	No	Aboveground tank	Remedial Action	1114
280	03-043(e)	Yes	Underground tank	Remedial Action	1114
281	03-043(f)	No	Aboveground tank	Remedial Action	1114
282	03-043(g)	No	Aboveground tank	Remedial Action	1114
283	03-043(h)	No	Aboveground tank	Remedial Action	1114
284	03-043(i)	No	Aboveground tank	Remedial Action	1114
285	03-044(a)	Yes	Container storage	Remedial Action	1114
286	03-045(a)	Yes	Outfall (Ind. or san. wastewater treatment)	Remedial Action	1114
287	03-045(b)	Yes	Ind. or san. wastewater treatment	Remedial Action	1114
288	03-045(c)	Yes	Outfall	Remedial Action	1114
289	03-045(e)	Yes	Outfall (Ind. or san. wastewater treatment)	Remedial Action	1114
290	03-045(f)	Yes	Outfall from drain (Ind. or san. wastewater treatment)	Remedial Action	1114
291	03-045(g)	Yes	Storm Drain	Remedial Action	1114
292	03-045(h)	Yes	Outfall (Ind. or san. wastewater treatment)	Remedial Action	1114
293	03-045(i)	Yes	Outfall (Ind. or san. wastewater treatment)	Remedial Action	1114
294	03-046	Yes	Aboveground storage tank (physical, chem. &/or bio. treat.)	Remedial Action	1114
295	03-047(a)	No	Storage area	Remedial Action	1114
296	03-047(b)	No	Storage area	Remedial Action	1114
297	03-047(c)	No	Drum storage	Remedial Action	1114
298	03-047(d)	No	Storage area	Remedial Action	1114
299	03-047(e)	No	Storage area	Remedial Action	1114
300	03-047(f)	No	Storage area	Remedial Action	1114
301	03-047(g)	No	Drum storage	Remedial Action	1114
302	03-047(h)	No	Storage area	Remedial Action	1114
303	03-047(i)	No	Satellite accumulation area	Remedial Action	1114
304	03-047(j)	No	Drum storage	Remedial Action	1114
305	03-047(k)	No	Drum storage	Remedial Action	1114
306	03-048	No	Satellite accumulation area	Remedial Action	1114
307	03-049(a)	Yes	Outfall	Remedial Action	1114
308	03-049(b)	Yes	Operational release	Remedial Action	1114
309	03-049(c)	Yes	Outfall	Remedial Action	1114

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Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
310	03-049(d)	Yes	Outfall	Remedial Action	1114
311	03-049(e)	Yes	Outfall	Remedial Action	1114
312	03-050(a)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
313	03-050(b)	No	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
314	03-050(c)	No	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
315	03-050(d)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
316	03-050(e)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
317	03-050(f)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
318	03-050(g)	Yes	Exhaust emissions, off-gas scrubber of HEPA filter sys.	Remedial Action	1114
319	03-051(a)	No	Soil contamination (oil from leaking compressor)	Remedial Action	1114
320	03-051(b)	No	Soil contamination (oil from leaking compressor)	Remedial Action	1114
321	03-051(c)	No	Soil contamination (vacuum pump leaking)	Remedial Action	1114
322	03-051(d)	No	Soil contamination (oil from leaking compressor)	Remedial Action	1114
323	03-052(a)	Yes	Storm drainage	Remedial Action	1114
324	03-052(b)	No	Storm drainage	Remedial Action	1114
325	03-052(c)	Yes	Storm drainage	Remedial Action	1114
326	03-052(d)	No	Storm drainage (non-PCB transformers/capacitors)	Remedial Action	1114
327	03-052(e)	Yes	Storm drainage	Remedial Action	1114
328	03-052(f)	Yes	Storm drainage	Remedial Action	1114
329	03-053	No	Operational facility	Remedial Action	1114
330	03-054(a)	Yes	Outfall	Remedial Action	1114
331	03-054(b)	Yes	Outfall	Remedial Action	1114
332	03-054(c)	Yes	Outfall	Remedial Action	1114
333	03-054(d)	Yes	Outfall	Remedial Action	1114
334	03-054(e)	Yes	Outfall	Remedial Action	1114
335	03-055(a)	Yes	Outfall	Remedial Action	1114
336	03-055(c)	Yes	Outfall	Remedial Action	1114
337	03-055(d)	Yes	Outfall	Remedial Action	1114
338	03-056(a)	Yes	Storage area	Remedial Action	1114
339	03-056(b)	No	Container storage area	Remedial Action	1114
340	03-056(c)	Yes	Transformer storage area	Remedial Action	1114
341	03-056(d)	Yes	Drum storage	Remedial Action	1114
342	03-056(e)	No	Satellite accumulation area	Remedial Action	1114
343	03-056(f)	No	Drum storage	Remedial Action	1114
344	03-056(g)	No	Satellite accumulation area	Remedial Action	1114
345	03-056(h)	No	Transformer storage area	Remedial Action	1114
346	03-056(i)	No	Drum storage	Remedial Action	1114
347	03-056(j)	No	Storage area	Remedial Action	1114
348	03-056(k)	No	Container storage area	Remedial Action	1114
349	03-056(l)	Yes	Drum storage	Remedial Action	1114
350	03-056(m)	Yes	Drum storage	Remedial Action	1114
351	03-056(n)	Yes	Drum storage	Remedial Action	1114
352	03-057	No	Sump/Grease trap	Remedial Action	1114

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
353	03-058	No	Container storage	Remedial Action	1114
354	03-059	Yes	Storage area	Remedial Action	1114
355	04-001	Yes	Firing site	Remedial Action	1129
356	04-002	Yes	Surface disposal	Remedial Action	1129
357	04-003(a)	Yes	Outfall	Remedial Action	1129
358	04-003(b)	Yes	Outfall	Remedial Action	1129
359	04-004	No	Soil contamination beneath bldgs.	Remedial Action	1129
360	05-001(a)	Yes	Firing site	Remedial Action	1129
361	05-001(b)	Yes	Firing site	Remedial Action	1129
362	05-001(c)	No	Firing site	Remedial Action	1129
363	05-002	Yes	Canyonside disposal	Remedial Action	1129
364	05-003	Yes	Calibration chamber	Remedial Action	1129
365	05-004	Yes	Septic system	Remedial Action	1129
366	05-005(a)	Yes	French drain	Remedial Action	1129
367	05-005(b)	Yes	Outfall	Remedial Action	1129
368	05-006(b)	Yes	Soil contamination beneath bldgs.	Remedial Action	1129
369	05-006(c)	Yes	Soil contamination beneath bldgs.	Remedial Action	1129
370	05-006(e)	Yes	Soil contamination beneath bldgs.	Remedial Action	1129
371	05-006(h)	Yes	Soil contamination beneath bldgs.	Remedial Action	1129
372	06-001(a)	Yes	Septic system	Remedial Action	1111
373	06-001(b)	Yes	Septic system	Remedial Action	1111
374	06-002	Yes	Septic system	Remedial Action	1111
375	06-003(a)	Yes	Firing site	Remedial Action	1111
376	06-003(c)	Yes	Firing site	Remedial Action	1111
377	06-003(d)	Yes	Firing site	Remedial Action	1111
378	06-003(e)	Yes	Firing site	Remedial Action	1111
379	06-003(f)	Yes	Firing site	Remedial Action	1111
380	06-003(g)	Yes	Firing site & building	Remedial Action	1111
381	06-003(h)	Yes	Firing site	Remedial Action	1111
382	06-005	Yes	Firing site (pit)	Remedial Action	1111
383	06-006	Yes	Storage area	Remedial Action	1111
384	06-007(a)	Yes	Material disposal area (MDA F)	Remedial Action	1111
385	06-007(b)	Yes	Landfill	Remedial Action	1111
386	06-007(c)	Yes	Landfill	Remedial Action	1111
387	06-007(d)	Yes	Landfill	Remedial Action	1111
388	06-007(e)	Yes	Landfill	Remedial Action	1111
389	06-007(f)	Yes	Surface disposal	Remedial Action	1111
390	06-007(g)	Yes	Building & surface disposal	Remedial Action	1111
391	06-008	No	Underground tank	Remedial Action	1111
392	07-001(a)	Yes	Firing site	Remedial Action	1111
393	07-001(b)	Yes	Firing site	Remedial Action	1111
394	07-001(c)	Yes	Firing site	Remedial Action	1111
395	07-001(d)	Yes	Firing site	Remedial Action	1111
396	07-003(c)	Yes	Never existed	Remedial Action	1111
397	07-003(d)	Yes	Never existed	Remedial Action	1111
398	08-001(a)	No	Buildings	Remedial Action	1157
399	08-001(b)	No	Buildings	Remedial Action	1157
400	08-002	Yes	Firing site	Remedial Action	1157
401	08-003(a)	Yes	Septic system	Remedial Action	1157
402	08-003(b)	Yes	Septic system	Remedial Action	1157
403	08-003(c)	Yes	Septic system	Remedial Action	1157
404	08-004(a)	Yes	Floor drain	Remedial Action	1157
405	08-004(b)	Yes	Drain line	Remedial Action	1157
406	08-004(c)	Yes	Floor drain	Remedial Action	1157

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
407	08-004(d)	Yes	Drain	Remedial Action	1157
408	08-005	Yes	Container storage area	Remedial Action	1157
409	08-006(a)	Yes	Material disposal area (MDA Q) Land fill	Remedial Action	1157
410	08-006(b)	Yes	Landfill [duplicate of 8-006(a) (MDA Q)]	Remedial Action	1157
411	08-007	Yes	Silver recovery unit	Remedial Action	1157
412	08-009(a)	Yes	Ind. or san. wastewater treat.	Remedial Action	1157
413	08-009(c)	No	Storm drain and outfall	Remedial Action	1157
414	08-009(d)	Yes	Ind. or san. wastewater treat.	Remedial Action	1157
415	08-009(e)	Yes	Ind. or san. wastewater treat.	Remedial Action	1157
416	08-009(f)	No	Outfall	Remedial Action	1157
417	09-001(a)	Yes	Firing sites	Remedial Action	1157
418	09-001(b)	Yes	Firing sites	Remedial Action	1157
419	09-001(c)	Yes	Firing sites	Remedial Action	1157
420	09-001(d)	Yes	Firing sites	Remedial Action	1157
421	09-002	Yes	Burn pit	Remedial Action	1157
422	09-003(a)	Yes	Settling tank	Remedial Action	1157
423	09-003(b)	Yes	Settling tank	Remedial Action	1157
424	09-003(c)	Yes	Electric manhole	Remedial Action	1157
425	09-003(d)	Yes	Settling tank	Remedial Action	1157
426	09-003(e)	Yes	Settling tank	Remedial Action	1157
427	09-003(f)	Yes	Settling tank	Remedial Action	1157
428	09-003(g)	Yes	Settling tank	Remedial Action	1157
429	09-003(h)	Yes	Settling tank	Remedial Action	1157
430	09-003(i)	Yes	Settling tank	Remedial Action	1157
431	09-004(a)	Yes	Settling tank	Remedial Action	1157
432	09-004(b)	Yes	Settling tank	Remedial Action	1157
433	09-004(c)	Yes	Settling tank	Remedial Action	1157
434	09-004(d)	Yes	Settling tank	Remedial Action	1157
435	09-004(e)	Yes	Settling tank	Remedial Action	1157
436	09-004(f)	Yes	Settling tank	Remedial Action	1157
437	09-004(g)	Yes	Settling tank	Remedial Action	1157
438	09-004(h)	Yes	Settling tank	Remedial Action	1157
439	09-004(i)	Yes	Settling tank	Remedial Action	1157
440	09-004(j)	Yes	Settling tank	Remedial Action	1157
441	09-004(k)	Yes	Settling tank	Remedial Action	1157
442	09-004(l)	Yes	Settling tank	Remedial Action	1157
443	09-004(m)	Yes	Settling tank	Remedial Action	1157
444	09-004(n)	Yes	Settling tank	Remedial Action	1157
445	09-004(o)	Yes	Settling tank	Remedial Action	1157
446	09-005(a)	Yes	Septic system	Remedial Action	1157
447	09-005(b)	Yes	Septic system	Remedial Action	1157
448	09-005(c)	Yes	Septic system	Remedial Action	1157
449	09-005(d)	Yes	Septic system	Remedial Action	1157
450	09-005(e)	Yes	Septic system	Remedial Action	1157
451	09-005(f)	Yes	Septic system	Remedial Action	1157
452	09-005(g)	Yes	Septic system	Remedial Action	1157
453	09-005(h)	Yes	Septic system	Remedial Action	1157
454	09-006	Yes	Septic system	Remedial Action	1157
455	09-007	Yes	Basket pit	Remedial Action	1157
456	09-008(b)	Yes	Surface impoundment	Remedial Action	1157
457	09-009	Yes	Surface impoundment	Remedial Action	1157
458	09-010(a)	No	Storage area	Remedial Action	1157
459	09-010(b)	No	Storage area	Remedial Action	1157
460	09-011(b)	No	Storage area	Remedial Action	1157

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Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
461	09-011(c)	No	Storage area	Remedial Action	1157
462	09-012	No	Disposal pit	Remedial Action	1157
463	09-013	Yes	Material disposal area (MDA M)	Remedial Action	1157
464	09-014	No	Firing site	Remedial Action	1157
465	10-001(a)	Yes	Firing site	Remedial Action	1079
466	10-001(b)	Yes	Firing site	Remedial Action	1079
467	10-001(c)	Yes	Firing site	Remedial Action	1079
468	10-001(d)	Yes	Firing site	Remedial Action	1079
469	10-002(a)	Yes	Disposal pit	Remedial Action	1079
470	10-002(b)	Yes	Disposal pit	Remedial Action	1079
471	10-003(a)	Yes	Disposal pit	Remedial Action	1079
472	10-003(b)	Yes	Disposal pit	Remedial Action	1079
473	10-003(c)	Yes	Disposal pit	Remedial Action	1079
474	10-003(d)	Yes	Disposal pit	Remedial Action	1079
475	10-003(e)	Yes	Disposal pit	Remedial Action	1079
476	10-003(f)	Yes	Disposal pit	Remedial Action	1079
477	10-003(g)	Yes	Manholes	Remedial Action	1079
478	10-003(h)	Yes	Manholes	Remedial Action	1079
479	10-003(i)	Yes	Septic tank	Remedial Action	1079
480	10-003(j)	Yes	Tank	Remedial Action	1079
481	10-003(k)	Yes	Tank	Remedial Action	1079
482	10-003(l)	Yes	Tank	Remedial Action	1079
483	10-003(m)	Yes	Waste line	Remedial Action	1079
484	10-003(n)	Yes	Leach field	Remedial Action	1079
485	10-003(o)	Yes	Leach field	Remedial Action	1079
486	10-004(a)	Yes	Septic system	Remedial Action	1079
487	10-004(b)	Yes	Septic system	Remedial Action	1079
488	10-005	Yes	Surface disposal	Remedial Action	1079
489	10-006	Yes	Burn site	Remedial Action	1079
490	10-007	Yes	Landfill	Remedial Action	1079
491	10-008	No	Tree rimmed firing point, Bayo Canyon	Remedial Action	1079
492	10-009	No	Former Bayo Landfill	Remedial Action	1079
493	11-001(a)	Yes	Firing site	Remedial Action	1082
494	11-001(b)	Yes	Firing site	Remedial Action	1082
495	11-001(c)	Yes	Firing site	Remedial Action	1082
496	11-002	Yes	Burn site	Remedial Action	1082
497	11-003(b)	No	Firing range	Remedial Action	1082
498	11-004(a)	Yes	Drop tower	Remedial Action	1082
499	11-004(b)	Yes	Drop tower	Remedial Action	1082
500	11-004(c)	Yes	Drop tower	Remedial Action	1082
501	11-004(d)	Yes	Drop tower	Remedial Action	1082
502	11-004(e)	Yes	Drop tower	Remedial Action	1082
503	11-004(f)	No	Drop tower	Remedial Action	1082
504	11-005(a)	Yes	Septic system	Remedial Action	1082
505	11-005(b)	Yes	Septic system	Remedial Action	1082
506	11-005(c)	Yes	Ind. or san. wastewater treat.	Remedial Action	1082
507	11-006(a)	Yes	Sump	Remedial Action	1082
508	11-006(b)	Yes	Tank and/or assoc. equip.	Remedial Action	1082
509	11-006(c)	Yes	Tank and/or assoc. equip.	Remedial Action	1082
510	11-006(d)	Yes	Tank and/or assoc. equip.	Remedial Action	1082
511	11-007	Yes	Surface disposal - landfill	Remedial Action	1082
512	11-009	Yes	Material disposal area (MDA S)	Remedial Action	1082
513	11-011(a)	Yes	Ind. or san. wastewater treat.	Remedial Action	1082
514	11-011(b)	Yes	Ind. or san. wastewater treat.	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
515	11-011(c)	Yes	Ind. or san. wastewater treat.	Remedial Action	1082
516	11-011(d)	Yes	Ind. or san. wastewater treat.	Remedial Action	1082
517	11-012(a)	No	Building	Remedial Action	1082
518	11-012(b)	No	Building	Remedial Action	1082
519	11-012(c)	No	Building	Remedial Action	1082
520	11-012(d)	No	Building	Remedial Action	1082
521	12-001(a)	Yes	Firing site, steel lined chamber	Remedial Action	1085
522	12-001(b)	Yes	Firing site (former)	Remedial Action	1085
523	12-002	Yes	Open burning ground	Remedial Action	1085
524	12-004(a)	No	Radiation test facility	Remedial Action	1085
525	12-004(b)	No	Pipe	Remedial Action	1085
526	13-001	Yes	Firing site	Remedial Action	1082
527	13-002	Yes	Landfill	Remedial Action	1082
528	13-003(a)	Yes	Septic tank same as 16-005(i)	Remedial Action	1082
529	13-003(b)	No	Septic system	Remedial Action	1082
530	13-004	Yes	Disposal pit	Remedial Action	1082
531	14-001(a)	No	Firing site	Remedial Action	1085
532	14-001(b)	No	Firing site	Remedial Action	1085
533	14-001(c)	No	Firing site	Remedial Action	1085
534	14-001(d)	No	Firing site	Remedial Action	1085
535	14-001(e)	No	Firing site	Remedial Action	1085
536	14-001(f)	No	Firing site-Bullet Test Facility	Remedial Action	1085
537	14-001(g)	No	Firing site (active)	Remedial Action	1085
538	14-002(a)	Yes	Firing site	Remedial Action	1085
539	14-002(b)	Yes	Firing site	Remedial Action	1085
540	14-002(c)	Yes	Building	Remedial Action	1085
541	14-002(d)	Yes	Firing site	Remedial Action	1085
542	14-002(e)	Yes	Firing site	Remedial Action	1085
543	14-002(f)	Yes	Firing site	Remedial Action	1085
544	14-003	Yes	Open burning ground	Remedial Action	1085
545	14-004(b)	Yes	Storage area	Remedial Action	1085
546	14-005	Yes	Incinerator (active)	Remedial Action	1085
547	14-006	Yes	Tank and/or assoc. equip.	Remedial Action	1085
548	14-007	Yes	Septic system	Remedial Action	1085
549	14-009	Yes	Surface disposal site	Remedial Action	1085
550	14-010	Yes	Sump	Remedial Action	1085
551	15-001	No	Surface disposal	Remedial Action	1086
552	15-002	Yes	Disposal pit and burn site	Remedial Action	1086
553	15-003	Yes	Firing site (still active)	Remedial Action	1086
554	15-004(a)	Yes	Firing site C	Remedial Action	1086
555	15-004(b)	Yes	Firing site A	Remedial Action	1086
556	15-004(c)	Yes	Firing site B	Remedial Action	1086
557	15-004(d)	No	Firing site C	Remedial Action	1086
558	15-004(f)	Yes	Machine firing site E-F, non-RCRA hazard but VCA uranium	Remedial Action	1086
559	15-004(g)	Yes	Machine firing site	Remedial Action	1086
560	15-004(h)	No	Firing site	Remedial Action	1086
561	15-004(i)	Yes	Detonation ground	Remedial Action	1086
562	15-005(b)	No	Storage area	Remedial Action	1086
563	15-005(c)	No	Storage area (R-41)	Remedial Action	1086
564	15-006(a)	Yes	Firing site PHERMEX (still active)	Remedial Action	1086
565	15-006(b)	Yes	Firing site Ector (still active)	Remedial Action	1086
566	15-006(c)	Yes	Firing site R-44	Remedial Action	1086
567	15-006(d)	Yes	Firing site R-45	Remedial Action	1086

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
568	15-006(e)	No	I-J site, not in TA-15, @TA-36 part of 36-004(e), duplicate of C-36-006(e)	Remedial Action	1130
569	15-007(a)	Yes	Material disposal area (MDA N) Landfill	Remedial Action	1086
570	15-007(b)	Yes	Material disposal area (MDA Z) Landfill	Remedial Action	1086
571	15-007(c)	Yes	Shaft	Remedial Action	1086
572	15-007(d)	Yes	Shaft	Remedial Action	1086
573	15-008(a)	Yes	Surface disposal E/F site	Remedial Action	1086
574	15-008(b)	Yes	Surface disposal	Remedial Action	1086
575	15-008(c)	Yes	Surface disposal	Remedial Action	1086
576	15-008(d)	Yes	Surface disposal (still active)	Remedial Action	1086
577	15-008(f)	No	I-J Firing Site mounds	Remedial Action	1130
578	15-008(g)	No	Surface disposal	Remedial Action	1086
579	15-009(a)	Yes	Septic system	Remedial Action	1086
580	15-009(b)	Yes	Septic system	Remedial Action	1086
581	15-009(c)	Yes	Septic tank	Remedial Action	1086
582	15-009(e)	Yes	Septic system E/F site	Remedial Action	1086
583	15-009(f)	Yes	Septic tank	Remedial Action	1086
584	15-009(g)	Yes	Septic tank (still active)	Remedial Action	1086
585	15-009(h)	Yes	Septic tank	Remedial Action	1086
586	15-009(i)	Yes	Septic tank	Remedial Action	1086
587	15-009(j)	Yes	Septic tank	Remedial Action	1086
588	15-009(k)	Yes	Septic tank	Remedial Action	1086
589	15-010(a)	Yes	Septic system	Remedial Action	1086
590	15-010(b)	Yes	Septic system	Remedial Action	1086
591	15-010(c)	Yes	Operational release (still active)	Remedial Action	1086
592	15-011(a)	Yes	Sump	Remedial Action	1086
593	15-011(b)	Yes	Dry well	Remedial Action	1086
594	15-011(c)	Yes	Sump	Remedial Action	1086
595	15-012(a)	Yes	Surface disposal (not located)	Remedial Action	1086
596	15-012(b)	Yes	Surface disposal site	Remedial Action	1086
597	15-014(a)	Yes	Ind. or san. wastewater treat.	Remedial Action	1086
598	15-014(b)	Yes	Ind. or san. wastewater treat.	Remedial Action	1086
599	15-014(d)	No	Ind. or san. wastewater treat.	Remedial Action	1086
600	15-014(e)	No	Ind. or san. wastewater treat. (active)	Remedial Action	1086
601	15-014(g)	No	Ind. or san. wastewater treat.	Remedial Action	1086
602	15-014(h)	No	Outfall	Remedial Action	1086
603	15-014(i)	Yes	Outfall	Remedial Action	1086
604	15-014(j)	Yes	Outfall	Remedial Action	1086
605	15-014(k)	Yes	Outfall	Remedial Action	1086
606	15-014(l)	Yes	Outfall (still active)	Remedial Action	1086
607	15-014(m)	Yes	Outfall (still active)	Remedial Action	1086
608	16-001(a)	Yes	Tank	Remedial Action	1082
609	16-001(b)	Yes	Dry wells	Remedial Action	1082
610	16-001(c)	Yes	Tank	Remedial Action	1082
611	16-001(d)	Yes	Dry well	Remedial Action	1082
612	16-001(e)	Yes	Dry well	Remedial Action	1082
613	16-003(a)	Yes	Sump	Remedial Action	1082
614	16-003(b)	Yes	Sump	Remedial Action	1082
615	16-003(c)	Yes	Sump	Remedial Action	1082
616	16-003(d)	Yes	Sump	Remedial Action	1082
617	16-003(e)	Yes	Sump	Remedial Action	1082
618	16-003(f)	Yes	Sump	Remedial Action	1082
619	16-003(g)	Yes	Sump	Remedial Action	1082
620	16-003(h)	Yes	Sump	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
621	16-003(i)	Yes	Sump	Remedial Action	1082
622	16-003(j)	Yes	Sump	Remedial Action	1082
623	16-003(k)	Yes	Sumps/Drain lines with TA-16-260	Remedial Action	1082
624	16-003(l)	Yes	Sump	Remedial Action	1082
625	16-003(m)	Yes	Sump	Remedial Action	1082
626	16-003(n)	Yes	Sump	Remedial Action	1082
627	16-003(o)	Yes	Sump	Remedial Action	1082
628	16-003(p)	No	Sump	Remedial Action	1082
629	16-003(q)	No	Sump	Remedial Action	1082
630	16-004(a)	Yes	Wastewater treatment facility	Remedial Action	1082
631	16-004(b)	Yes	Wastewater treatment facility	Remedial Action	1082
632	16-004(c)	Yes	Wastewater treatment facility	Remedial Action	1082
633	16-004(d)	Yes	Wastewater treatment facility	Remedial Action	1082
634	16-004(e)	Yes	Wastewater treatment facility	Remedial Action	1082
635	16-004(f)	Yes	Wastewater treatment facility	Remedial Action	1082
636	16-005(a)	Yes	Septic tank	Remedial Action	1082
637	16-005(b)	Yes	Decommissioned septic system	Remedial Action	1082
638	16-005(c)	Yes	Septic tank	Remedial Action	1082
639	16-005(d)	Yes	Septic tank	Remedial Action	1082
640	16-005(e)	Yes	Septic tank	Remedial Action	1082
641	16-005(f)	Yes	Decommissioned septic system	Remedial Action	1082
642	16-005(g)	Yes	Burn site	Remedial Action	1082
643	16-005(h)	Yes	Septic tank	Remedial Action	1082
644	16-005(i)	Yes	Septic tank same as 13-003(a)	Remedial Action	1082
645	16-005(j)	Yes	Septic tank	Remedial Action	1082
646	16-005(k)	Yes	Septic tank	Remedial Action	1082
647	16-005(l)	Yes	Grease trap	Remedial Action	1082
648	16-005(m)	Yes	Soil contamination area associated with former chemical pit	Remedial Action	1082
649	16-005(n)	Yes	Septic system	Remedial Action	1082
650	16-005(o)	Yes	Septic system	Remedial Action	1082
651	16-006(a)	Yes	Septic system	Remedial Action	1082
652	16-006(b)	Yes	Septic system	Remedial Action	1082
653	16-006(c)	Yes	Septic system	Remedial Action	1082
654	16-006(d)	Yes	Septic system	Remedial Action	1082
655	16-006(e)	Yes	Septic system	Remedial Action	1082
656	16-006(f)	Yes	Septic system	Remedial Action	1082
657	16-006(g)	Yes	Septic tank	Remedial Action	1082
658	16-006(h)	Yes	Pump pit	Remedial Action	1082
659	16-006(i)	Yes	Septic system	Remedial Action	1082
660	16-007(a)	Yes	Surface impoundment	Remedial Action	1082
661	16-008(a)	Yes	Surface impoundment (90s Line pond)	Remedial Action	1082
662	16-009(a)	Yes	Burn site	Remedial Action	1082
663	16-010(a)	Yes	Burn site	Remedial Action	1082
664	16-010(b)	Yes	Burn site	Remedial Action	1082
665	16-010(c)	Yes	Burn site	Remedial Action	1082
666	16-010(d)	Yes	Burn site	Remedial Action	1082
667	16-010(e)	Yes	Burn site	Remedial Action	1082
668	16-010(f)	Yes	Burn site	Remedial Action	1082
669	16-010(g)	Yes	Wastewater treatment facility	Remedial Action	1082
670	16-010(h)	Yes	Burn site	Remedial Action	1082
671	16-010(i)	Yes	Burn site	Remedial Action	1082
672	16-010(j)	Yes	Burn site	Remedial Action	1082
673	16-010(k)	Yes	Trough	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
674	16-010(l)	Yes	Trough	Remedial Action	1082
675	16-010(m)	Yes	Trough	Remedial Action	1082
676	16-010(n)	Yes	Trough	Remedial Action	1082
677	16-011	No	Incinerator	Remedial Action	1082
678	16-012(a)	Yes	Container storage - Rest House	Remedial Action	1082
679	16-012(b)	Yes	Container storage - Rest House	Remedial Action	1082
680	16-012(c)	Yes	Container storage - Rest House	Remedial Action	1082
681	16-012(d)	Yes	Satellite accumulation area	Remedial Action	1082
682	16-012(e)	Yes	Container storage - Rest House	Remedial Action	1082
683	16-012(f)	Yes	Container storage - Rest House	Remedial Action	1082
684	16-012(g)	Yes	Container storage - Rest House	Remedial Action	1082
685	16-012(h)	Yes	Container storage - Rest House	Remedial Action	1082
686	16-012(i)	Yes	Satellite accumulation area	Remedial Action	1082
687	16-012(j)	Yes	Satellite accumulation area	Remedial Action	1082
688	16-012(k)	Yes	Container storage - Rest House	Remedial Action	1082
689	16-012(l)	Yes	Satellite accumulation area	Remedial Action	1082
690	16-012(m)	Yes	Satellite accumulation area	Remedial Action	1082
691	16-012(n)	Yes	Satellite accumulation area	Remedial Action	1082
692	16-012(o)	Yes	Container storage - Rest House	Remedial Action	1082
693	16-012(p)	Yes	Container storage	Remedial Action	1082
694	16-012(q)	Yes	Container storage - Rest House	Remedial Action	1082
695	16-012(r)	Yes	Container storage - Rest House	Remedial Action	1082
696	16-012(s)	Yes	Container storage - Rest House	Remedial Action	1082
697	16-012(t)	Yes	Satellite accumulation area	Remedial Action	1082
698	16-012(u)	Yes	Satellite accumulation area	Remedial Action	1082
699	16-012(v)	Yes	Container storage - Rest House	Remedial Action	1082
700	16-012(w)	Yes	Container storage - Rest House	Remedial Action	1082
701	16-012(x)	Yes	Satellite accumulation area	Remedial Action	1082
702	16-012(y)	Yes	Container storage - Rest House	Remedial Action	1082
703	16-012(z)	Yes	Container storage - Rest House	Remedial Action	1082
704	16-013	Yes	Container storage V-site	Remedial Action	1082
705	16-015(a)	Yes	Operational facility	Remedial Action	1082
706	16-015(b)	Yes	Operational facility	Remedial Action	1082
707	16-015(c)	No	Operational facility	Remedial Action	1082
708	16-015(d)	No	Operational facility	Remedial Action	1082
709	16-016(a)	Yes	Landfill	Remedial Action	1082
710	16-016(b)	Yes	Landfill	Remedial Action	1082
711	16-016(c)	Yes	Landfill	Remedial Action	1082
712	16-016(d)	Yes	Surface disposal site	Remedial Action	1082
713	16-016(e)	Yes	Surface disposal site	Remedial Action	1082
714	16-016(f)	No	Landfill	Remedial Action	1082
715	16-016(g)	Yes	Surface disposal site	Remedial Action	1082
716	16-017	Yes	Abandoned building & appurtenances	Remedial Action	1082
717	16-018	Yes	Material disposal area MDA P RCRA (closure)	Remedial Action	1082
718	16-019	Yes	Material disposal area (MDA R)	Remedial Action	1082
719	16-020	Yes	Silver recovery unit	Remedial Action	1082
720	16-021(a)	Yes	Systematic release site	Remedial Action	1082
721	16-021(b)	No	Systematic leak	Remedial Action	1082
722	16-021(c)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
723	16-022(a)	No	Underground tank	Remedial Action	1082
724	16-022(b)	No	Underground tank	Remedial Action	1082
725	16-023(b)	No	Incinerator	Remedial Action	1082
726	16-024(a)	No	Magazine	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
727	16-024(b)	No	Magazine	Remedial Action	1082
728	16-024(c)	No	Magazine	Remedial Action	1082
729	16-024(d)	No	Magazine	Remedial Action	1082
730	16-024(e)	Yes	Operational facility	Remedial Action	1082
731	16-024(f)	No	Magazine	Remedial Action	1082
732	16-024(g)	No	Magazine	Remedial Action	1082
733	16-024(h)	No	Magazine	Remedial Action	1082
734	16-024(i)	No	Magazine	Remedial Action	1082
735	16-024(j)	No	Magazine	Remedial Action	1082
736	16-024(k)	No	Magazine	Remedial Action	1082
737	16-024(l)	No	Magazine	Remedial Action	1082
738	16-024(m)	No	Magazine	Remedial Action	1082
739	16-024(n)	No	Magazine	Remedial Action	1082
740	16-024(o)	No	Magazine	Remedial Action	1082
741	16-024(p)	No	Magazine	Remedial Action	1082
742	16-024(q)	No	Magazine	Remedial Action	1082
743	16-024(r)	No	Magazine	Remedial Action	1082
744	16-024(s)	No	Magazine	Remedial Action	1082
745	16-024(t)	No	Operational facility	Remedial Action	1082
746	16-024(u)	No	Magazine	Remedial Action	1082
747	16-024(v)	No	Magazine	Remedial Action	1082
748	16-025(a)	Yes	Abandoned building & appurtenances	Remedial Action	1082
749	16-025(a2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
750	16-025(b)	Yes	Abandoned building & appurtenances	Remedial Action	1082
751	16-025(b2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
752	16-025(c)	Yes	Abandoned HE building & appurtenances	Remedial Action	1082
753	16-025(c2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
754	16-025(d)	Yes	Abandoned building & appurtenances	Remedial Action	1082
755	16-025(d2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
756	16-025(e)	Yes	Abandoned building & appurtenances	Remedial Action	1082
757	16-025(e2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
758	16-025(f)	Yes	Abandoned building & appurtenances	Remedial Action	1082
759	16-025(f2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
760	16-025(g)	Yes	Abandoned building & appurtenances	Remedial Action	1082
761	16-025(g2)	Yes	Magazine	Remedial Action	1082
762	16-025(h)	Yes	Abandoned building & appurtenances	Remedial Action	1082
763	16-025(h2)	Yes	Abandoned building & appurtenances	Remedial Action	1082
764	16-025(i)	Yes	Abandoned building & appurtenances	Remedial Action	1082
765	16-025(j)	Yes	Abandoned building & appurtenances	Remedial Action	1082
766	16-025(k)	Yes	Abandoned building & appurtenances	Remedial Action	1082
767	16-025(l)	Yes	Abandoned building & appurtenances	Remedial Action	1082
768	16-025(m)	Yes	Abandoned building & appurtenances	Remedial Action	1082
769	16-025(n)	Yes	Abandoned building & appurtenances	Remedial Action	1082
770	16-025(o)	Yes	Abandoned building & appurtenances	Remedial Action	1082
771	16-025(p)	Yes	Abandoned building & appurtenances	Remedial Action	1082
772	16-025(q)	Yes	Abandoned building & appurtenances	Remedial Action	1082
773	16-025(r)	Yes	Abandoned building & appurtenances	Remedial Action	1082
774	16-025(s)	Yes	Abandoned building & appurtenances	Remedial Action	1082
775	16-025(t)	Yes	Abandoned building & appurtenances	Remedial Action	1082
776	16-025(u)	Yes	Abandoned building & appurtenances	Remedial Action	1082
777	16-025(v)	Yes	Abandoned building & appurtenances	Remedial Action	1082
778	16-025(w)	Yes	Abandoned building & appurtenances	Remedial Action	1082
779	16-025(x)	Yes	Abandoned building & appurtenances	Remedial Action	1082
780	16-025(y)	Yes	Abandoned building & appurtenances	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
781	16-025(z)	Yes	Abandoned building & appurtenances	Remedial Action	1082
782	16-026(a)	Yes	Outfall	Remedial Action	1082
783	16-026(a2)	Yes	Outfall	Remedial Action	1082
784	16-026(b)	Yes	Outfall	Remedial Action	1082
785	16-026(b2)	Yes	Outfall	Remedial Action	1082
786	16-026(c)	Yes	Outfall	Remedial Action	1082
787	16-026(c2)	Yes	Outfall	Remedial Action	1082
788	16-026(d)	Yes	Outfall	Remedial Action	1082
789	16-026(d2)	Yes	Outfall	Remedial Action	1082
790	16-026(e)	Yes	Outfall	Remedial Action	1082
791	16-026(e2)	Yes	Outfall	Remedial Action	1082
792	16-026(f)	Yes	Outfall	Remedial Action	1082
793	16-026(f2)	Yes	Outfall	Remedial Action	1082
794	16-026(g)	Yes	Outfall	Remedial Action	1082
795	16-026(g2)	Yes	Outfall	Remedial Action	1082
796	16-026(h)	Yes	Outfall	Remedial Action	1082
797	16-026(h2)	Yes	Outfall	Remedial Action	1082
798	16-026(i)	Yes	Outfall	Remedial Action	1082
799	16-026(i2)	Yes	Outfall (inactive)	Remedial Action	1082
800	16-026(j)	Yes	Outfall	Remedial Action	1082
801	16-026(j2)	Yes	Outfall	Remedial Action	1082
802	16-026(k)	Yes	Outfall	Remedial Action	1082
803	16-026(k2)	Yes	Outfall	Remedial Action	1082
804	16-026(l)	Yes	Outfall	Remedial Action	1082
805	16-026(m)	Yes	Outfall	Remedial Action	1082
806	16-026(n)	Yes	Outfall	Remedial Action	1082
807	16-026(o)	Yes	Outfall	Remedial Action	1082
808	16-026(p)	Yes	Outfall	Remedial Action	1082
809	16-026(q)	Yes	Outfall	Remedial Action	1082
810	16-026(r)	Yes	Outfall	Remedial Action	1082
811	16-026(s)	Yes	Outfall	Remedial Action	1082
812	16-026(t)	Yes	Outfall	Remedial Action	1082
813	16-026(u)	Yes	Outfall	Remedial Action	1082
814	16-026(v)	Yes	Outfall	Remedial Action	1082
815	16-026(w)	Yes	Outfall	Remedial Action	1082
816	16-026(x)	Yes	Outfall	Remedial Action	1082
817	16-026(y)	Yes	Outfall	Remedial Action	1082
818	16-026(z)	Yes	Outfall	Remedial Action	1082
819	16-027(a)	No	Transformer	Remedial Action	1082
820	16-027(b)	No	Transformer	Remedial Action	1082
821	16-027(c)	No	Transformer	Remedial Action	1082
822	16-027(d)	No	Transformer	Remedial Action	1082
823	16-028(a)	Yes	South Drainage	Remedial Action	1082
824	16-028(b)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
825	16-028(c)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
826	16-028(d)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
827	16-028(e)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
828	16-029(a)	Yes	Sump	Remedial Action	1082
829	16-029(a2)	Yes	Sump	Remedial Action	1082
830	16-029(b)	Yes	Sump	Remedial Action	1082
831	16-029(b2)	Yes	Sump	Remedial Action	1082
832	16-029(c)	Yes	Sump	Remedial Action	1082
833	16-029(c2)	Yes	Sump	Remedial Action	1082
834	16-029(d)	Yes	Sump	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
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	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
835	16-029(d2)	Yes	Sump	Remedial Action	1082
836	16-029(e)	Yes	Sump	Remedial Action	1082
837	16-029(e2)	Yes	Sump	Remedial Action	1082
838	16-029(f)	Yes	Sump	Remedial Action	1082
839	16-029(f2)	Yes	Outfall	Remedial Action	1082
840	16-029(g)	Yes	Sump	Remedial Action	1082
841	16-029(g2)	Yes	Pump pit	Remedial Action	1082
842	16-029(h)	Yes	Sump	Remedial Action	1082
843	16-029(h2)	Yes	Drain line and outfall	Remedial Action	1082
844	16-029(i)	Yes	Outfall	Remedial Action	1082
845	16-029(j)	Yes	Outfall	Remedial Action	1082
846	16-029(k)	Yes	Sump	Remedial Action	1082
847	16-029(l)	Yes	Sump	Remedial Action	1082
848	16-029(m)	Yes	Sump	Remedial Action	1082
849	16-029(n)	Yes	Sump	Remedial Action	1082
850	16-029(o)	Yes	Sump	Remedial Action	1082
851	16-029(p)	Yes	Sump	Remedial Action	1082
852	16-029(q)	Yes	Sump	Remedial Action	1082
853	16-029(r)	Yes	Outfall	Remedial Action	1082
854	16-029(s)	Yes	Sump	Remedial Action	1082
855	16-029(t)	Yes	Sump	Remedial Action	1082
856	16-029(u)	Yes	Sump	Remedial Action	1082
857	16-029(v)	Yes	Sump	Remedial Action	1082
858	16-029(w)	Yes	Sump	Remedial Action	1082
859	16-029(x)	Yes	Sump	Remedial Action	1082
860	16-029(y)	Yes	Sump	Remedial Action	1082
861	16-029(z)	Yes	Sump	Remedial Action	1082
862	16-030(a)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
863	16-030(b)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
864	16-030(c)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
865	16-030(d)	No	Outfall	Remedial Action	1082
866	16-030(e)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
867	16-030(f)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
868	16-030(g)	No	Outfall	Remedial Action	1082
869	16-030(h)	Yes	Outfall	Remedial Action	1082
870	16-031(a)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
871	16-031(b)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
872	16-031(c)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
873	16-031(d)	Yes	Cooling tower, TA 16-28	Remedial Action	1082
874	16-031(e)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
875	16-031(f)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
876	16-031(g)	Yes	Cooling tower outfall (inactive)	Remedial Action	1082
877	16-031(h)	Yes	Ind. or san. wastewater treatment	Remedial Action	1082
878	16-032(a)	Yes	Sump	Remedial Action	1082
879	16-032(c)	Yes	Sump	Remedial Action	1082
880	16-032(d)	Yes	Decommissioned HE sump	Remedial Action	1082
881	16-032(e)	Yes	Decommissioned HE sump	Remedial Action	1082
882	16-033(a)	No	Underground tank	Remedial Action	1082
883	16-033(b)	No	Underground tank	Remedial Action	1082
884	16-033(c)	No	Underground tank	Remedial Action	1082
885	16-033(d)	No	Tank and/or assoc. equip	Remedial Action	1082
886	16-033(e)	No	Underground tank	Remedial Action	1082
887	16-033(f)	No	Underground tank	Remedial Action	1082
888	16-033(g)	No	Underground tank	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
889	16-033(h)	No	Underground tank	Remedial Action	1082
890	16-033(i)	No	Underground tank	Remedial Action	1082
891	16-033(j)	No	Underground tank	Remedial Action	1082
892	16-033(k)	No	Underground storage tank <100 gallons	Remedial Action	1082
893	16-034(a)	Yes	Soil contamination area	Remedial Action	1082
894	16-034(b)	Yes	Soil contamination area	Remedial Action	1082
895	16-034(c)	Yes	Soil contamination area	Remedial Action	1082
896	16-034(d)	Yes	Soil contamination area	Remedial Action	1082
897	16-034(e)	Yes	Soil contamination area	Remedial Action	1082
898	16-034(f)	Yes	Soil contamination area	Remedial Action	1082
899	16-034(g)	Yes	Soil contamination	Remedial Action	1082
900	16-034(h)	Yes	Soil contamination area	Remedial Action	1082
901	16-034(i)	Yes	Soil contamination area	Remedial Action	1082
902	16-034(j)	Yes	Soil contamination area	Remedial Action	1082
903	16-034(k)	Yes	Soil contamination area	Remedial Action	1082
904	16-034(l)	Yes	Soil contamination area	Remedial Action	1082
905	16-034(m)	Yes	Soil contamination area	Remedial Action	1082
906	16-034(n)	Yes	Soil contamination area	Remedial Action	1082
907	16-034(o)	Yes	Soil contamination area	Remedial Action	1082
908	16-034(p)	Yes	Soil contamination area	Remedial Action	1082
909	16-035	Yes	Soil contamination area	Remedial Action	1082
910	16-036	Yes	Soil contamination area	Remedial Action	1082
911	16-037	No	Aboveground tank	Remedial Action	1082
912	18-001(a)	Yes	Lagoon	Canyon	1093
913	18-001(b)	Yes	Sewer lines	Canyon	1093
914	18-001(c)	Yes	Sump	Canyon	1093
915	18-002(a)	Yes	Firing site	Canyon	1093
916	18-002(b)	Yes	Firing site	Canyon	1093
917	18-002(c)	No	Drop tower	Canyon	1093
918	18-003(a)	Yes	Settling pit	Canyon	1093
919	18-003(b)	Yes	Septic system	Canyon	1093
920	18-003(c)	Yes	Septic system	Canyon	1093
921	18-003(d)	Yes	Septic system	Canyon	1093
922	18-003(e)	Yes	Septic system	Canyon	1093
923	18-003(f)	Yes	Septic system	Canyon	1093
924	18-003(g)	Yes	Septic system	Canyon	1093
925	18-003(h)	Yes	Septic system	Canyon	1093
926	18-004(a)	Yes	Waste lines containment	Canyon	1093
927	18-004(b)	Yes	Pit	Canyon	1093
928	18-005(a)	Yes	Storage area	Canyon	1093
929	18-006	No	Storage pipe	Canyon	1093
930	18-007	Yes	Buried armored vehicle (does not exist)	Canyon	1093
931	18-008	No	Underground tank TA 18-26 (5/9/97 app. letter from NMUSTB)	Canyon	1093
932	18-009(b)	No	Transformer	Canyon	1093
933	18-010(b)	No	Outfall	Canyon	1093
934	18-010(c)	No	Outfall	Canyon	1093
935	18-010(d)	No	Outfall	Canyon	1093
936	18-010(e)	No	Outfall	Canyon	1093
937	18-010(f)	No	Outfall	Canyon	1093
938	18-011	No	Soil containment	Canyon	1093
939	18-012(a)	Yes	Outfall	Canyon	1093
940	18-012(b)	Yes	Outfall	Canyon	1093
941	18-012(c)	No	Sump and drain lines	Canyon	1093

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
942	18-013	No	Waste tank	Canyon	1093
943	19-001	Yes	Septic system	Remedial Action	1071
944	19-002	Yes	Surface disposal site	Remedial Action	1071
945	19-003	Yes	Septic tank	Remedial Action	1071
946	20-001(a)	Yes	Landfill	Remedial Action	1100
947	20-001(b)	Yes	Landfill	Remedial Action	1100
948	20-001(c)	Yes	Landfill	Remedial Action	1100
949	20-002(a)	Yes	Firing site	Remedial Action	1100
950	20-002(b)	Yes	Firing site	Remedial Action	1100
951	20-002(c)	Yes	Firing site	Remedial Action	1100
952	20-002(d)	Yes	Firing site	Remedial Action	1100
953	20-003(a)	Yes	Firing site	Remedial Action	1100
954	20-003(b)	No	Firing site	Remedial Action	1100
955	20-003(c)	No	Firing site	Remedial Action	1100
956	20-004	No	Septic system	Remedial Action	1100
957	20-005	Yes	Septic tank	Remedial Action	1100
958	21-001	No	Container storage	MDA	1106
959	21-002(a)	Yes	Container storage	MDA	1106
960	21-002(b)	No	Container storage	MDA	1106
961	21-003	Yes	Container storage	MDA	1106
962	21-004(a)	No	Aboveground tank	MDA	1106
963	21-004(b)	Yes	Tank and/or assoc. equipment	MDA	1106
964	21-004(c)	Yes	Tank and/or assoc. equipment	MDA	1106
965	21-005	Yes	Disposal pit	MDA	1106
966	21-006(a)	Yes	Disposal pit Bldg 21-2	MDA	1106
967	21-006(b)	Yes	Disposal pit	MDA	1106
968	21-006(c)	Yes	Disposal pit Bldg 21-3	MDA	1106
969	21-006(d)	Yes	Disposal pit Bldg 21-3	MDA	1106
970	21-006(e)	Yes	Surface disposal site Bldg 21-4	MDA	1106
971	21-006(f)	No	Disposal pit Bldg 21-4	MDA	1106
972	21-007	Yes	Incinerators	MDA	1106
973	21-009	No	Waste treatment lab	MDA	1106
974	21-010(a)	Yes	Waste treatment facility	MDA	1106
975	21-010(b)	Yes	Waste treatment facility	MDA	1106
976	21-010(c)	Yes	Waste treatment facility	MDA	1106
977	21-010(d)	Yes	Waste treatment facility	MDA	1106
978	21-010(e)	Yes	Waste treatment facility	MDA	1106
979	21-010(f)	Yes	Waste treatment facility	MDA	1106
980	21-010(g)	Yes	Waste treatment facility	MDA	1106
981	21-010(h)	Yes	Waste treatment facility	MDA	1106
982	21-011(a)	Yes	Waste treatment facility	MDA	1106
983	21-011(b)	Yes	Sump	MDA	1106
984	21-011(c)	Yes	Tank and Sump	MDA	1106
985	21-011(d)	Yes	Aboveground tank	MDA	1106
986	21-011(e)	Yes	Aboveground tank	MDA	1106
987	21-011(f)	Yes	Aboveground tank	MDA	1106
988	21-011(g)	Yes	Aboveground tank	MDA	1106
989	21-011(h)	No	Aboveground tank	MDA	1106
990	21-011(i)	Yes	Aboveground tank	MDA	1106
991	21-011(j)	Yes	Aboveground tank	MDA	1106
992	21-011(k)	Yes	Outfall	MDA	1106
993	21-012(a)	Yes	Dry well	MDA	1106
994	21-012(b)	Yes	Dry well	MDA	1106
995	21-013(a)	Yes	Surface disposal site	MDA	1106

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
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	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
996	21-013(b)	Yes	Surface disposal site	MDA	1106
997	21-013(c)	Yes	Surface disposal site	MDA	1106
998	21-013(d)	Yes	Surface disposal site (Cold Dump)	MDA	1106
999	21-013(e)	Yes	Surface disposal site	MDA	1106
1000	21-013(f)	No	Surface disposal site	MDA	1106
1001	21-013(g)	No	Surface disposal site	MDA	1106
1002	21-014	Yes	Material disposal area (MDA A)	MDA	1106
1003	21-015	Yes	Material disposal area (MDA B)	MDA	1106
1004	21-016(a)	Yes	Material disposal area (MDA T)	MDA	1106
1005	21-016(b)	Yes	Material disposal area (MDA T)	MDA	1106
1006	21-016(c)	Yes	Material disposal area (MDA T)	MDA	1106
1007	21-017(a)	Yes	Material disposal area (MDA U)	MDA	1106
1008	21-017(b)	Yes	Material disposal area (MDA U)	MDA	1106
1009	21-017(c)	Yes	Material disposal area (MDA U)	MDA	1106
1010	21-018(a)	Yes	Material disposal area (MDA V)	MDA	1106
1011	21-018(b)	Yes	Material disposal area (MDA V) laundry facility	MDA	1106
1012	21-021	Yes	Systematic release (site-wide)	MDA	1106
1013	21-022(a)	Yes	Waste lines	MDA	1106
1014	21-022(b)	Yes	Waste lines Bldg 21-2	MDA	1106
1015	21-022(c)	Yes	Waste lines Bldg 21-3	MDA	1106
1016	21-022(d)	Yes	Waste lines Bldg 21-4	MDA	1106
1017	21-022(e)	Yes	Waste lines Bldg 21-5	MDA	1106
1018	21-022(f)	Yes	Waste lines	MDA	1106
1019	21-022(g)	Yes	Waste lines Bldg 21-150	MDA	1106
1020	21-022(h)	Yes	Waste lines	MDA	1106
1021	21-022(i)	Yes	Tank and/or assoc. equipment	MDA	1106
1022	21-022(j)	Yes	Tank and/or assoc. equipment	MDA	1106
1023	21-023(a)	Yes	Septic system Bldg 21-3	MDA	1106
1024	21-023(b)	Yes	Septic system Bldg 21-3	MDA	1106
1025	21-023(c)	Yes	Septic system	MDA	1106
1026	21-023(d)	Yes	Septic system Bldg 21-3	MDA	1106
1027	21-024(a)	Yes	Septic system	MDA	1106
1028	21-024(b)	Yes	Septic system	MDA	1106
1029	21-024(c)	Yes	Septic system	MDA	1106
1030	21-024(d)	Yes	Septic system VCA for rad	MDA	1106
1031	21-024(e)	Yes	Septic system	MDA	1106
1032	21-024(f)	Yes	Septic system	MDA	1106
1033	21-024(g)	Yes	Septic system	MDA	1106
1034	21-024(h)	Yes	Septic system	MDA	1106
1035	21-024(i)	Yes	Septic system	MDA	1106
1036	21-024(j)	Yes	Septic system	MDA	1106
1037	21-024(k)	Yes	Septic system	MDA	1106
1038	21-024(l)	Yes	Ind. or san. wastewater treat.	MDA	1106
1039	21-024(m)	Yes	Drain line	MDA	1106
1040	21-024(n)	Yes	Drain line	MDA	1106
1041	21-024(o)	Yes	Drain line	MDA	1106
1042	21-026(a)	Yes	Ind. or san. wastewater treat.	MDA	1106
1043	21-026(b)	Yes	Surface disposal site (sand filter/sludge drying beds)	MDA	1106
1044	21-026(c)	No	Wastewater treatment facility (dosing siphon chamber)	MDA	1106
1045	21-026(d)	No	Outfall	MDA	1106
1046	21-027(a)	Yes	Ind. or san. wastewater treat.	MDA	1106

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1047	21-027(b)	Yes	Outfalls	MDA	1106
1048	21-027(c)	Yes	Ind. or san. wastewater treat.	MDA	1106
1049	21-027(d)	Yes	Drain line	MDA	1106
1050	21-028(a)	No	Container storage	MDA	1106
1051	21-028(c)	No	Container storage Bldg 21-3	MDA	1106
1052	21-028(d)	No	Container storage	MDA	1106
1053	21-029	Yes	Soil contamination area	MDA	1106
1054	21-030	No	Sump	MDA	1106
1055	22-010(a)	Yes	Septic system	Remedial Action	1111
1056	22-010(b)	yes	Septic system	Remedial Action	1111
1057	22-011	Yes	Disposal pit	Remedial Action	1111
1058	22-012	Yes	Decontamination facility	Remedial Action	1111
1059	22-014(a)	Yes	Ind. or san. wastewater treat.	Remedial Action	1111
1060	22-014(b)	Yes	Sump	Remedial Action	1111
1061	22-015(a)	Yes	Drain lines and dry wells	Remedial Action	1111
1062	22-015(b)	Yes	Sump and outfall	Remedial Action	1111
1063	22-015(c)	Yes	Outfall	Remedial Action	1111
1064	22-015(d)	Yes	Drain line and outfall	Remedial Action	1111
1065	22-015(e)	Yes	Ind. or san. wastewater treat.	Remedial Action	1111
1066	22-016	Yes	Septic system	Remedial Action	1111
1067	26-001	Yes	Surface disposal site	Remedial Action	1071
1068	26-002(a)	Yes	Tank and/or assoc. equip.	Remedial Action	1071
1069	26-002(b)	Yes	Ind. or san. wastewater treat.	Remedial Action	1071
1070	26-003	Yes	Septic tank	Remedial Action	1071
1071	27-001	Yes	Buried naval guns	Canyon	1093
1072	27-002	Yes	Firing sites	Canyon	1093
1073	27-003	Yes	Bazooka impact area	Canyon	1093
1074	31-001	Yes	Outfall from sanitary septic system	Remedial Action	1079
1075	32-001	Yes	Incinerator (former location)	Remedial Action	1079
1076	32-002(a)	Yes	Septic tank (former location); drain lines	Remedial Action	1079
1077	32-002(b)	Yes	Septic system	Remedial Action	1079
1078	32-003	No	Transformer site (former location)	Remedial Action	1079
1079	32-004	No	Drain line and outfall	Remedial Action	1079
1080	33-001(a)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1081	33-001(b)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1082	33-001(c)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1083	33-001(d)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1084	33-001(e)	Yes	Material disposal area (MDA E)	Remedial Action	1122
1085	33-002(a)	Yes	Septic tank located at MDA K	Remedial Action	1122
1086	33-002(b)	Yes	Sump located at MDA K	Remedial Action	1122
1087	33-002(c)	Yes	Sump located at MDA K	Remedial Action	1122
1088	33-002(d)	Yes	Drain line and outfall located at MDA K	Remedial Action	1122
1089	33-002(e)	Yes	Drain line and outfall located at MDA K	Remedial Action	1122
1090	33-003(a)	Yes	Material disposal area MDA D	Remedial Action	1122
1091	33-003(b)	Yes	Material disposal area MDA D	Remedial Action	1122
1092	33-004(a)	Yes	Septic system	Remedial Action	1122
1093	33-004(b)	Yes	Septic system	Remedial Action	1122
1094	33-004(c)	Yes	Septic system	Remedial Action	1122
1095	33-004(d)	Yes	Septic system	Remedial Action	1122
1096	33-004(e)	Yes	Seepage pit	Remedial Action	1122
1097	33-004(f)	Yes	Septic system	Remedial Action	1122
1098	33-004(g)	Yes	Outfall	Remedial Action	1122
1099	33-004(h)	Yes	Outfall	Remedial Action	1122
1100	33-004(i)	Yes	Outfall	Remedial Action	1122

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1101	33-004(j)	Yes	Outfall	Remedial Action	1122
1102	33-004(k)	Yes	Outfall	Remedial Action	1122
1103	33-004(m)	Yes	Septic system	Remedial Action	1122
1104	33-005(a)	Yes	Septic system	Remedial Action	1122
1105	33-005(b)	Yes	Septic system	Remedial Action	1122
1106	33-005(c)	Yes	Septic system	Remedial Action	1122
1107	33-006(a)	Yes	Firing site	Remedial Action	1122
1108	33-006(b)	Yes	Firing range	Remedial Action	1122
1109	33-007(a)	Yes	Firing range	Remedial Action	1122
1110	33-007(b)	Yes	Firing range	Remedial Action	1122
1111	33-007(c)	Yes	Firing range	Remedial Action	1122
1112	33-008(a)	Yes	Landfill	Remedial Action	1122
1113	33-008(b)	Yes	Landfill	Remedial Action	1122
1114	33-008(c)	No	Landfill	Remedial Action	1122
1115	33-009	Yes	Surface disposal	Remedial Action	1122
1116	33-010(a)	Yes	Surface disposal	Remedial Action	1122
1117	33-010(b)	Yes	Surface disposal	Remedial Action	1122
1118	33-010(c)	Yes	Surface disposal	Remedial Action	1122
1119	33-010(d)	Yes	Surface disposal	Remedial Action	1122
1120	33-010(f)	Yes	Surface disposal	Remedial Action	1122
1121	33-010(g)	Yes	Surface disposal	Remedial Action	1122
1122	33-010(h)	Yes	Surface disposal	Remedial Action	1122
1123	33-011(a)	Yes	Storage area	Remedial Action	1122
1124	33-011(b)	No	Storage area	Remedial Action	1122
1125	33-011(c)	Yes	Storage area	Remedial Action	1122
1126	33-011(d)	Yes	Storage area	Remedial Action	1122
1127	33-011(e)	Yes	Drum storage	Remedial Action	1122
1128	33-012(a)	Yes	Drum storage	Remedial Action	1122
1129	33-013	Yes	Storage area	Remedial Action	1122
1130	33-014	Yes	Burn site	Remedial Action	1122
1131	33-015	Yes	Incinerator	Remedial Action	1122
1132	33-016	Yes	Sump	Remedial Action	1122
1133	33-017	Yes	Operational release	Remedial Action	1122
1134	35-002	Yes	Material disposal area (MDA X)	Remedial Action	1129
1135	35-003(a)	Yes	Wastewater treatment facility	Remedial Action	1129
1136	35-003(b)	Yes	Wastewater treatment facility	Remedial Action	1129
1137	35-003(c)	Yes	Wastewater treatment facility	Remedial Action	1129
1138	35-003(d)	Yes	Wastewater treatment facility	Remedial Action	1129
1139	35-003(e)	Yes	Wastewater treatment facility	Remedial Action	1129
1140	35-003(f)	Yes	Wastewater treatment facility	Remedial Action	1129
1141	35-003(g)	Yes	Wastewater treatment facility	Remedial Action	1129
1142	35-003(h)	Yes	Wastewater treatment facility	Remedial Action	1129
1143	35-003(i)	Yes	Wastewater treatment facility storage tanks	Remedial Action	1129
1144	35-003(j)	Yes	Wastewater treatment facility	Remedial Action	1129
1145	35-003(k)	Yes	Wastewater treatment facility	Remedial Action	1129
1146	35-003(l)	Yes	Wastewater treatment facility	Remedial Action	1129
1147	35-003(m)	Yes	Wastewater treatment facility	Remedial Action	1129
1148	35-003misc	No	Industrial waste lines	Remedial Action	1129
1149	35-003(n)	Yes	Wastewater treatment facility	Remedial Action	1129
1150	35-003(o)	Yes	Wastewater treatment facility	Remedial Action	1129
1151	35-003(p)	Yes	Wastewater treatment facility	Remedial Action	1129
1152	35-003(q)	Yes	Wastewater treatment facility	Remedial Action	1129
1153	35-003(r)	No	Outfall	Remedial Action	1129
1154	35-004(a)	Yes	Storage areas	Remedial Action	1129

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1155	35-004(b)	Yes	Storage areas	Remedial Action	1129
1156	35-004(e)	Yes	Container storage area	Remedial Action	1129
1157	35-004(g)	Yes	Container storage area	Remedial Action	1129
1158	35-004(h)	Yes	Container storage area	Remedial Action	1129
1159	35-004(m)	No	Container storage area	Remedial Action	1129
1160	35-006	Yes	Surface impoundment (closure) Bldg 85, duplicate of 35-005(a)	Remedial Action	1129
1161	35-008	Yes	Surface disposal and landfill	Remedial Action	1129
1162	35-009(a)	Yes	Septic system	Remedial Action	1129
1163	35-009(b)	Yes	Septic system	Remedial Action	1129
1164	35-009(c)	Yes	Septic system	Remedial Action	1129
1165	35-009(d)	Yes	Septic system	Remedial Action	1129
1166	35-009(e)	Yes	Septic system	Remedial Action	1129
1167	35-010(a)	Yes	Sanitary lagoon	Remedial Action	1129
1168	35-010(b)	Yes	Sanitary lagoon	Remedial Action	1129
1169	35-010(c)	Yes	Sanitary lagoon	Remedial Action	1129
1170	35-010(d)	Yes	Sand filters	Remedial Action	1129
1171	35-010(e)	No	Discharge headwall from sand filter	Remedial Action	1129
1172	35-011(a)	Yes	Underground storage tank	Remedial Action	1129
1173	35-013(a)	Yes	Sump	Remedial Action	1129
1174	35-013(b)	Yes	Sump	Remedial Action	1129
1175	35-013(c)	Yes	Sump	Remedial Action	1129
1176	35-013(d)	Yes	Sump	Remedial Action	1129
1177	35-014(a)	Yes	Operational release	Remedial Action	1129
1178	35-014(b)	Yes	Leaking drum	Remedial Action	1129
1179	35-014(d)	No	Operational release	Remedial Action	1129
1180	35-014(e)	Yes	Oil spill	Remedial Action	1129
1181	35-014(e2)	No	Oil spill	Remedial Action	1129
1182	35-014(e3)	No	Operational release	Remedial Action	1129
1183	35-014(f)	No	Soil contamination	Remedial Action	1129
1184	35-014(g)	Yes	Soil contamination	Remedial Action	1129
1185	35-014(g2)	No	Soil contamination	Remedial Action	1129
1186	35-014(g3)	No	Soil contamination	Remedial Action	1129
1187	35-015(a)	Yes	Soil contamination	Remedial Action	1129
1188	35-015(b)	Yes	Waste oil treatment	Remedial Action	1129
1189	35-016(a)	Yes	Drains and outfalls	Remedial Action	1129
1190	35-016(b)	No	Outfall	Remedial Action	1129
1191	35-016(c)	Yes	Outfall	Remedial Action	1129
1192	35-016(d)	Yes	Outfall	Remedial Action	1129
1193	35-016(e)	No	Outfall	Remedial Action	1129
1194	35-016(f)	No	Storm drain	Remedial Action	1129
1195	35-016(g)	No	Outfall	Remedial Action	1129
1196	35-016(h)	No	Storm drain	Remedial Action	1129
1197	35-016(i)	Yes	Drains and outfalls	Remedial Action	1129
1198	35-016(j)	No	Storm drain	Remedial Action	1129
1199	35-016(k)	Yes	Drains and outfalls	Remedial Action	1129
1200	35-016(l)	No	Storm drain	Remedial Action	1129
1201	35-016(m)	Yes	Drains and outfalls	Remedial Action	1129
1202	35-016(n)	No	Storm drain	Remedial Action	1129
1203	35-016(o)	Yes	Drains and outfalls	Remedial Action	1129
1204	35-016(p)	Yes	Outfall	Remedial Action	1129
1205	35-016(q)	Yes	Drains and outfalls	Remedial Action	1129
1206	35-018(a)	No	Transformer	Remedial Action	1129
1207	36-001	Yes	Material disposal area (MDA AA)	Remedial Action	1130

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1208	36-002	Yes	Sump	Remedial Action	1130
1209	36-003(a)	Yes	Septic system	Remedial Action	1130
1210	36-003(b)	Yes	Septic system, I-J site	Remedial Action	1130
1211	36-003(c)	Yes	Septic system	Remedial Action	1130
1212	36-004(a)	No	Firing site	Remedial Action	1130
1213	36-004(b)	No	Firing site	Remedial Action	1130
1214	36-004(c)	No	Firing site	Remedial Action	1130
1215	36-004(d)	Yes	Firing site (Lower Slabovia, Skunk Works, Burn Pit)	Remedial Action	1130
1216	36-004(e)	No	I-J Firing Site	Remedial Action	1130
1217	36-005	Yes	Surface disposal site	Remedial Action	1130
1218	36-006	Yes	Surface disposal site	Remedial Action	1130
1219	39-001(a)	Yes	Landfill	Remedial Action	1132
1220	39-001(b)	Yes	Material disposal area (MDA Y)	Remedial Action	1132
1221	39-002(a)	Yes	Storage area	Remedial Action	1132
1222	39-002(b)	No	Storage area	Remedial Action	1132
1223	39-002(c)	No	Storage area	Remedial Action	1132
1224	39-002(d)	No	Storage area	Remedial Action	1132
1225	39-002(e)	No	Storage area	Remedial Action	1132
1226	39-002(f)	No	Storage area	Remedial Action	1132
1227	39-003	Yes	Incinerator	Remedial Action	1132
1228	39-004(a)	Yes	Firing site	Remedial Action	1132
1229	39-004(b)	Yes	Firing site	Remedial Action	1132
1230	39-004(c)	Yes	Firing site	Remedial Action	1132
1231	39-004(d)	Yes	Firing site	Remedial Action	1132
1232	39-004(e)	Yes	Firing site	Remedial Action	1132
1233	39-005	Yes	Seepage pit	Remedial Action	1132
1234	39-006(a)	Yes	Septic system	Remedial Action	1132
1235	39-006(b)	Yes	Septic system	Remedial Action	1132
1236	39-007(a)	Yes	Storage area	Remedial Action	1132
1237	39-007(d)	No	Storage area	Remedial Action	1132
1238	39-008	Yes	Firing range	Remedial Action	1132
1239	40-001(a)	Yes	Septic system	Remedial Action	1111
1240	40-001(b)	Yes	Septic system	Remedial Action	1111
1241	40-001(c)	Yes	Septic system	Remedial Action	1111
1242	40-003(a)	Yes	Firing site (closure)	Remedial Action	1111
1243	40-004	Yes	Operational release	Remedial Action	1111
1244	40-005	Yes	Sump	Remedial Action	1111
1245	40-006(a)	Yes	Firing site	Remedial Action	1111
1246	40-006(b)	Yes	Firing site	Remedial Action	1111
1247	40-006(c)	Yes	Firing site	Remedial Action	1111
1248	40-007(a)	No	Storage area	Remedial Action	1111
1249	40-007(b)	No	Storage area	Remedial Action	1111
1250	40-007(c)	No	Storage area	Remedial Action	1111
1251	40-007(d)	No	Storage area	Remedial Action	1111
1252	40-007(e)	No	Storage area	Remedial Action	1111
1253	40-009	Yes	Landfill	Remedial Action	1111
1254	40-010	Yes	Surface disposal site	Remedial Action	1111
1255	41-001	Yes	Septic system	Canyon	1098
1256	41-002(a)	Yes	Wastewater treatment facility	Canyon	1098
1257	41-002(b)	Yes	Wastewater treatment facility	Canyon	1098
1258	41-002(c)	Yes	Wastewater treatment facility	Canyon	1098
1259	41-003	No	Sump	Canyon	1098
1260	42-001(a)	Yes	Incinerator (former location)	Remedial Action	1129

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1261	42-001(b)	Yes	Ash storage tank (former location	Remedial Action	1129
1262	42-001(c)	Yes	Ash storage tank (former location	Remedial Action	1129
1263	42-002(a)	No	Decontam. facility (former location)	Remedial Action	1129
1264	42-002(b)	Yes	Decontam. facility driveway (former location)	Remedial Action	1129
1265	42-003	Yes	Septic system (former location)	Remedial Action	1129
1266	43-001(a1)	Yes	Waste lines (Pre-1981)	Remedial Action	1136
1267	43-001(a2)	No	Waste lines (Post-1981)	Remedial Action	1136
1268	43-001(b2)	No	Outfall	Remedial Action	1136
1269	43-002	Yes	Incinerator	Remedial Action	1136
1270	45-001	Yes	Wastewater treatment facility	Remedial Action	1079
1271	45-002	Yes	Vehicle decontamination facility	Remedial Action	1079
1272	45-003	Yes	Waste lines	Remedial Action	1079
1273	45-004	Yes	Sanitary sewer outfall	Remedial Action	1079
1274	46-002	Yes	Surface impoundment	Remedial Action	1140
1275	46-003(a)	Yes	Septic system	Remedial Action	1140
1276	46-003(b)	Yes	Septic system	Remedial Action	1140
1277	46-003(c)	Yes	Septic system	Remedial Action	1140
1278	46-003(d)	Yes	Septic system	Remedial Action	1140
1279	46-003(e)	Yes	Septic system	Remedial Action	1140
1280	46-003(f)	Yes	Septic system	Remedial Action	1140
1281	46-003(g)	Yes	Septic system	Remedial Action	1140
1282	46-003(h)	Yes	Operational release	Remedial Action	1140
1283	46-004(a)	Yes	Waste line	Remedial Action	1140
1284	46-004(a2)	Yes	Outfall	Remedial Action	1140
1285	46-004(b)	Yes	Operational release	Remedial Action	1140
1286	46-004(b2)	Yes	Operational release	Remedial Action	1140
1287	46-004(c)	Yes	Sump	Remedial Action	1140
1288	46-004(c2)	Yes	Outfall	Remedial Action	1140
1289	46-004(d)	Yes	Sump	Remedial Action	1140
1290	46-004(d2)	Yes	Stack emissions	Remedial Action	1140
1291	46-004(e)	Yes	Sump	Remedial Action	1140
1292	46-004(e2)	No	Outfall	Remedial Action	1140
1293	46-004(f)	Yes	Outfall	Remedial Action	1140
1294	46-004(f2)	No	Outfall	Remedial Action	1140
1295	46-004(g)	Yes	Outfall/Stack emissions	Remedial Action	1140
1296	46-004(h)	Yes	Outfall/Stack emissions	Remedial Action	1140
1297	46-004(m)	Yes	Outfall	Remedial Action	1140
1298	46-004(p)	Yes	Sump	Remedial Action	1140
1299	46-004(q)	Yes	Outfall	Remedial Action	1140
1300	46-004(r)	Yes	Outfall	Remedial Action	1140
1301	46-004(s)	Yes	Outfall	Remedial Action	1140
1302	46-004(t)	Yes	Outfall	Remedial Action	1140
1303	46-004(u)	Yes	Outfall	Remedial Action	1140
1304	46-004(v)	Yes	Outfall	Remedial Action	1140
1305	46-004(w)	Yes	Outfall	Remedial Action	1140
1306	46-004(x)	Yes	Outfall	Remedial Action	1140
1307	46-004(y)	Yes	Outfall	Remedial Action	1140
1308	46-004(z)	Yes	Outfall	Remedial Action	1140
1309	46-005	Yes	Surface impoundment	Remedial Action	1140
1310	46-006(a)	Yes	Operational release	Remedial Action	1140
1311	46-006(b)	Yes	Operational release	Remedial Action	1140
1312	46-006(c)	Yes	Operational release	Remedial Action	1140
1313	46-006(d)	Yes	Operational release	Remedial Action	1140

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1314	46-006(f)	Yes	Storage area	Remedial Action	1140
1315	46-006(g)	Yes	Operational release	Remedial Action	1140
1316	46-007	Yes	Operational release	Remedial Action	1140
1317	46-008(a)	Yes	Storage area	Remedial Action	1140
1318	46-008(b)	Yes	Storage area	Remedial Action	1140
1319	46-008(c)	Yes	Storage area	Remedial Action	1140
1320	46-008(d)	Yes	Storage area	Remedial Action	1140
1321	46-008(e)	Yes	Storage area	Remedial Action	1140
1322	46-008(f)	Yes	Storage area	Remedial Action	1140
1323	46-008(g)	Yes	Storage area	Remedial Action	1140
1324	46-009(a)	Yes	Surface disposal	Remedial Action	1140
1325	46-009(b)	Yes	Surface disposal	Remedial Action	1140
1326	46-010(d)	Yes	Operational release	Remedial Action	1140
1327	48-001	No	Air exhaust system	Remedial Action	1129
1328	48-002(a)	Yes	Container storage area	Remedial Action	1129
1329	48-002(b)	Yes	Container storage area	Remedial Action	1129
1330	48-002(e)	No	Container storage	Remedial Action	1129
1331	48-003	Yes	Septic system	Remedial Action	1129
1332	48-004(a)	Yes	Sumps and tanks	Remedial Action	1129
1333	48-004(b)	Yes	Sumps and tanks	Remedial Action	1129
1334	48-004(c)	Yes	Sumps and tanks	Remedial Action	1129
1335	48-005	Yes	Waste lines	Remedial Action	1129
1336	48-007(a)	Yes	Drains and outfalls	Remedial Action	1129
1337	48-007(b)	Yes	Drains and outfalls	Remedial Action	1129
1338	48-007(c)	Yes	Drains and outfalls	Remedial Action	1129
1339	48-007(d)	Yes	Drains and outfalls	Remedial Action	1129
1340	48-007(f)	Yes	Drains and outfalls	Remedial Action	1129
1341	48-010	Yes	Surface Impoundment	Remedial Action	1129
1342	48-011	No	Disposal shaft	Remedial Action	1129
1343	49-001(a)	Yes	Material disposal area (MDA AB) (experimental shafts)	MDA	1144
1344	49-001(b)	Yes	Material disposal area (MDA AB) (experimental shafts)	MDA	1144
1345	49-001(c)	Yes	Material disposal area (MDA AB) (experimental shafts)	MDA	1144
1346	49-001(d)	Yes	Material disposal area (MDA AB) (experimental shafts)	MDA	1144
1347	49-001(e)	Yes	Material disposal area (MDA AB) (experimental shafts)	MDA	1144
1348	49-001(f)	Yes	Material disposal area (MDA AB) (experimental shafts)	MDA	1144
1349	49-001(g)	Yes	Material disposal area (MDA AB) (miscellaneous)	MDA	1144
1350	49-002	No	Operational facility (Area 10 underground chamber)	MDA	1144
1351	49-003	Yes	Leach field (Area 11 Radchem and small shot area)	MDA	1144
1352	49-004	Yes	Burn site and landfill (Area 6)	MDA	1144
1353	49-005(a)	Yes	Landfill (east of Area 10)	MDA	1144
1354	49-005(b)	No	Landfill (Area 5)	MDA	1144
1355	49-006	Yes	Sump (Area 5)	MDA	1144
1356	49-007(a)	No	Septic system (Area 6)	MDA	1144
1357	49-007(b)	No	Septic system (HDT area)	MDA	1144
1358	49-008(a)	No	Soil contamination (Area 5)	MDA	1144

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1359	49-008(b)	No	Soil contamination (Area 6)	MDA	1144
1360	49-008(c)	No	Soil contamination (Area 11)	MDA	1144
1361	49-008(d)	No	Firing sites (Bottle House area) soil contamination and underground chamber	MDA	1144
1362	49-009	No	Aboveground tank (former location)	MDA	1144
1363	50-001(a)	Yes	Waste treatment facility	MDA	1147
1364	50-001(b)	No	Waste lines and manholes	MDA	1147
1365	50-002(a)	Yes	Underground tanks	MDA	1147
1366	50-002(b)	Yes	Underground tank	MDA	1147
1367	50-002(c)	Yes	Underground tank	MDA	1147
1368	50-002(d)	No	Underground tank	MDA	1147
1369	50-003(a)	No	Storage area	MDA	1147
1370	50-004(a)	Yes	Waste lines	MDA	1147
1371	50-004(b)	Yes	Underground tanks	MDA	1147
1372	50-004(c)	Yes	Waste lines	MDA	1147
1373	50-006(a)	Yes	Operational release	MDA	1147
1374	50-006(c)	Yes	Operational release	MDA	1147
1375	50-006(d)	Yes	Effluent discharge	MDA	1147
1376	50-007	No	Incinerator	MDA	1147
1377	50-008	No	Reduction site	MDA	1147
1378	50-009	Yes	Material disposal area (MDA C)	MDA	1147
1379	50-010	No	Decontamination facility	MDA	1147
1380	50-011(a)	Yes	Septic system	MDA	1147
1381	50-011(b)	No	Septic system	MDA	1147
1382	51-001	No	Septic system	MDA	1148
1383	52-001(a)	Yes	UHTREX equip.	Remedial Action	1129
1384	52-001(b)	Yes	UHTREX equip.	Remedial Action	1129
1385	52-001(c)	Yes	UHTREX equip.	Remedial Action	1129
1386	52-001(d)	Yes	UHTREX equip.	Remedial Action	1129
1387	52-002(a)	Yes	Septic system	Remedial Action	1129
1388	52-002(b)	Yes	Septic system	Remedial Action	1129
1389	52-002(c)	Yes	Septic system	Remedial Action	1129
1390	52-002(d)	Yes	Septic system	Remedial Action	1129
1391	52-002(f)	Yes	Septic system	Remedial Action	1129
1392	52-003(a)	No	Waste treatment facility	Remedial Action	1129
1393	53-001(a)	Yes	Storage area	Remedial Action	1100
1394	53-001(b)	Yes	Storage area	Remedial Action	1100
1395	53-001(c)	No	Storage area	Remedial Action	1100
1396	53-001(e)	No	Storage area	Remedial Action	1100
1397	53-001(g)	No	Storage area	Remedial Action	1100
1398	53-002(a)	Yes	Disposal lagoon inactive (NE, NW impoundments)	Remedial Action	1100
1399	53-002(b)	Yes	Disposal lagoon (active) RCRA corrective action	Remedial Action	1100
1400	53-004	No	Operational facility	Remedial Action	1100
1401	53-005	Yes	Disposal pit	Remedial Action	1100
1402	53-006(a)	No	Underground tank	Remedial Action	1100
1403	53-006(b)	Yes	Underground tank	Remedial Action	1100
1404	53-006(c)	Yes	Underground tank	Remedial Action	1100
1405	53-006(d)	Yes	Underground tank	Remedial Action	1100
1406	53-006(e)	Yes	Underground tank	Remedial Action	1100
1407	53-006(f)	Yes	Underground tank	Remedial Action	1100
1408	53-007(a)	Yes	Aboveground neutralizer tank	Remedial Action	1100
1409	53-007(b)	Yes	Aboveground tanks (2)	Remedial Action	1100

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1410	53-008	No	Storage area, Boneyard	Remedial Action	1100
1411	53-009	No	Aboveground tanks (3)	Remedial Action	1100
1412	53-010	No	Container storage	Remedial Action	1100
1413	53-012(a)	No	Outfall	Remedial Action	1100
1414	53-012(b)	No	Outfall	Remedial Action	1100
1415	53-012(c)	No	Outfall	Remedial Action	1100
1416	53-012(d)	No	Outfall	Remedial Action	1100
1417	53-012(e)	No	Outfall	Remedial Action	1100
1418	53-012(f)	No	Outfall	Remedial Action	1100
1419	53-012(g)	No	Outfall	Remedial Action	1100
1420	53-012(h)	No	Outfall	Remedial Action	1100
1421	53-013	No	Soil Contamination - Lead storage site I	Remedial Action	1100
1422	53-014	No	Soil Contamination - Lead storage site II	Remedial Action	1100
1423	54-001(a)	Yes	Storage area surface	MDA	1148
1424	54-001(b)	No	Storage area	MDA	1148
1425	54-001(c)	Yes	Storage area	MDA	1148
1426	54-001(d)	No	Storage area	MDA	1148
1427	54-001(e)	No	Storage area	MDA	1148
1428	54-002	No	Storage area (gas cylinder storage area)	MDA	1148
1429	54-004	Yes	Material disposal area (MDA H) (except Shaft 9)	MDA	1148
1430	54-005	Yes	Material disposal area (MDA J) (Pits 1-5, Shafts 1-4)	MDA	1148
1431	54-006	Yes	Material disposal area (MDA L) (All subsurface units such as Pit A, SI B,C,D Shafts 1-28, 29-34)	MDA	1148
1432	54-007(a)	Yes	Septic system (tank and seepage trench)	MDA	1148
1433	54-007(b)	Yes	Septic system	MDA	1148
1434	54-007(c)	Yes	Septic system	MDA	1148
1435	54-007(d)	No	Septic system	MDA	1148
1436	54-007(e)	No	Septic system	MDA	1148
1437	54-009	No	Aboveground tanks (treatment tanks)	MDA	1148
1438	54-012(a)	No	Reduction site (drum compactor)	MDA	1148
1439	54-012(b)	Yes	Reduction site	MDA	1148
1440	54-013(a)	Yes	Decontamination facility (not built)	MDA	1148
1441	54-013(b)	Yes	Material disposal area (MDA G) disposal pit (truck washing pit converted to Pit 19)	MDA	1148
1442	54-014(a)	No	Material disposal area (MDA L) storage shafts (Pb stringer shafts)	MDA	1148
1443	54-014(b)	Yes	Material disposal area (MDA G) storage pit (Pit 9, TRU waste)	MDA	1148
1444	54-014(c)	Yes	Material disposal area (MDA G) storage shafts (shafts 200-233)	MDA	1148
1445	54-014(d)	Yes	Material disposal area (MDA G) storage trenches A, B, C, D	MDA	1148
1446	54-015(a)	No	Storage area (active surface corrosive inhibitor)	MDA	1148
1447	54-015(b)	No	Storage area (TRU surface storage)	MDA	1148
1448	54-015(c)	No	Storage area, TRU Pad 1	MDA	1148
1449	54-015(d)	No	Storage area, TRU Pad 2	MDA	1148
1450	54-015(e)	No	Storage area, TRU Pad 3	MDA	1148
1451	54-015(f)	No	Storage area, TRU Pad 4	MDA	1148
1452	54-015(h)	Yes	Storage area (drums)	MDA	1148
1453	54-015(j)	No	Storage area (Dome #49, mixed waste	MDA	1148

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites
Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
			sludge)		
1454	54-015(k)	Yes	Storage area (TRU waste mound)	MDA	1148
1455	54-016(b)	No	Sump	MDA	1148
1456	54-017	Yes	Material disposal area (MDA G) disposal pits 16,22 (active before 11/19/80)	MDA	1148
1457	54-018	Yes	Material disposal area (MDA G) disposal pits 27-33, 35-37 (active after 11/19/80)	MDA	1148
1458	54-019	Yes	Material disposal area (MDA G) disposal shafts (active before 11/19/80)	MDA	1148
1459	54-020	Yes	Material disposal area (MDA G) disposal shafts (active after 11/19/80)	MDA	1148
1460	55-008	Yes	Sumps and tanks	Remedial Action	1129
1461	55-009	Yes	Sumps and tanks	Remedial Action	1129
1462	57-001(b)	No	Drilling mud pits	Remedial Action	1154
1463	57-001(c)	No	Drilling mud pits	Remedial Action	1154
1464	57-002	No	Landfill	Remedial Action	1154
1465	57-003	No	Storage area	Remedial Action	1154
1466	57-004(a)	No	Surface impoundment	Remedial Action	1154
1467	57-004(b)	No	Surface impoundment	Remedial Action	1154
1468	57-006	No	Drum and contents Fenton Hill (removed)	Remedial Action	1154
1469	57-007	No	Leach field	Remedial Action	1154
1470	59-001	Yes	Septic system	Remedial Action	1114
1471	59-004	No	Outfall	Remedial Action	1114
1472	60-002	Yes	Storage area	Remedial Action	1114
1473	60-004(b)	No	Storage area	Remedial Action	1114
1474	60-004(c)	No	Storage area	Remedial Action	1114
1475	60-004(d)	No	Storage area	Remedial Action	1114
1476	60-004(e)	No	Storage area	Remedial Action	1114
1477	60-004(f)	No	Storage area	Remedial Action	1114
1478	60-005(a)	Yes	Surface impoundment - formerly 3-029(a)	Remedial Action	1114
1479	60-006(a)	Yes	Septic tank	Remedial Action	1114
1480	60-007(a)	Yes	Systematic or intent. prod. release	Remedial Action	1114
1481	60-007(b)	Yes	Systematic or intent. prod. release	Remedial Action	1114
1482	61-002	Yes	Transformer storage area	Remedial Action	1114
1483	61-004(a)	Yes	Septic tank	Remedial Action	1114
1484	61-005	Yes	Landfill (LA County Municipal)	Remedial Action	1114
1485	61-006	Yes	Waste oil tank	Remedial Action	1114
1486	61-007	Yes	Transformer site - systematic leak	Remedial Action	1114
1487	63-001(a)	Yes	Septic system	Remedial Action	1129
1488	63-001(b)	Yes	Septic system	Remedial Action	1129
1489	69-001	Yes	Incinerator and assoc. equip.	Remedial Action	1157
1490	72-001	No	Firing range	Remedial Action	1100
1491	73-001(a)	Yes	Landfill	Remedial Action	1071
1492	73-001(b)	Yes	Surface disposal site (waste oil pit)	Remedial Action	1071
1493	73-001(c)	Yes	Landfill	Remedial Action	1071
1494	73-001(d)	Yes	Landfill	Remedial Action	1071
1495	73-002	Yes	Incinerator surface disposal	Remedial Action	1071
1496	73-003	No	Steam cleaning plant	Remedial Action	1071
1497	73-004(a)	Yes	Septic tank	Remedial Action	1071
1498	73-004(b)	Yes	Septic tank	Remedial Action	1071
1499	73-004(c)	Yes	Septic tank	Remedial Action	1071
1500	73-004(d)	Yes	Septic tank (land fill)	Remedial Action	1071
1501	73-005	Yes	Surface disposal site	Remedial Action	1071
1502	73-006	Yes	Airport building outfalls	Remedial Action	1071

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1503	73-007	No	Septic tank and drain lines	Remedial Action	1071
1504	C-00-001	No	Guaje Canyon	Canyon	1049
1505	C-00-002	No	Rendija Canyon	Canyon	1049
1506	C-00-003	No	Barrancas Canyon	Canyon	1049
1507	C-00-004	No	Bayo Canyon	Canyon	1049
1508	C-00-005	No	Pueblo Canyon	Canyon	1049
1509	C-00-006	No	Los Alamos Canyon	Canyon	1049
1510	C-00-007	No	Sandia Canyon	Canyon	1049
1511	C-00-008	No	Mortandad Canyon	Canyon	1049
1512	C-00-009	No	Canada del Buey	Canyon	1049
1513	C-00-010	No	Two Mile Canyon	Canyon	1049
1514	C-00-011	No	Pajarito Canyon	Canyon	1049
1515	C-00-012	No	Three Mile Canyon	Canyon	1049
1516	C-00-013	No	Potrillo Canyon	Canyon	1049
1517	C-00-014	No	Canon de Valle	Canyon	1049
1518	C-00-015	No	Fence Canyon	Canyon	1049
1519	C-00-016	No	Water Canyon	Canyon	1049
1520	C-00-017	No	Indio Canyon	Canyon	1049
1521	C-00-018	No	Ancho Canyon	Canyon	1049
1522	C-00-019	No	Chaquehui Canyon	Canyon	1049
1523	C-00-020	No	Mortar impact area	Remedial Action	1071
1524	C-00-021	No	DP Canyon	Canyon	1049
1525	C-00-036(a)	No	Borrow pit 1, Bandelier NM	Remedial Action	1071
1526	C-00-036(b)	No	Borrow pit 2, Bandelier NM	Remedial Action	1071
1527	C-00-036(c)	No	Borrow pit 3, Bandelier NM	Remedial Action	1071
1528	C-00-036(d)	No	Borrow pit 4, Bandelier NM	Remedial Action	1071
1529	C-00-037	No	Landfill, Bandelier NM	Remedial Action	1071
1530	C-00-038	No	Surface disposal, Bandelier NM	Remedial Action	1071
1531	C-00-041	No	Asphalt and tar remnant site	Remedial Action	1071
1532	C-00-042	No	Tank (formerly part of 00-032)	Remedial Action	1071
1533	C-00-043	No	Manhole (abandoned)	Remedial Action	1071
1534	C-02-001	No	Metal nugget pile	Canyon	1098
1535	C-03-001	No	Gas trap	Remedial Action	1114
1536	C-03-002	No	One-time spill - leak from asphalt machine	Remedial Action	1114
1537	C-03-003	No	One-time spill - stained asphalt	Remedial Action	1114
1538	C-03-004	No	Miscellaneous debris	Remedial Action	1114
1539	C-03-005	No	Oil spill	Remedial Action	1114
1540	C-03-006	No	One-time spill	Remedial Action	1114
1541	C-03-007	No	Storage area	Remedial Action	1114
1542	C-03-008	No	Storage area/ rad contaminated	Remedial Action	1114
1543	C-03-009	No	Storage area	Remedial Action	1114
1544	C-03-010	No	Outfall	Remedial Action	1114
1545	C-03-011	No	Waste oil tank	Remedial Action	1114
1546	C-03-012	No	Satellite accumulation area	Remedial Action	1114
1547	C-03-014	No	Storage area	Remedial Action	1114
1548	C-03-015	No	Underground storage tank	Remedial Action	1114
1549	C-03-016	No	Oil metal bin	Remedial Action	1114
1550	C-03-017	No	Underground storage tank	Remedial Action	1114
1551	C-03-018	No	Underground storage tank	Remedial Action	1114
1552	C-03-019	No	Underground storage tank	Remedial Action	1114
1553	C-03-020	No	Storage tank	Remedial Action	1114
1554	C-03-021	No	Underground storage tank	Remedial Action	1114
1555	C-03-022	No	Kerosene tanker trailer	Remedial Action	1114
1556	C-06-001	No	Building	Remedial Action	1111

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1557	C-06-003	No	Building	Remedial Action	1111
1558	C-06-005	No	Building	Remedial Action	1111
1559	C-06-006	No	Building	Remedial Action	1111
1560	C-06-007	No	Building	Remedial Action	1111
1561	C-06-008	No	Building	Remedial Action	1111
1562	C-06-009	No	Building	Remedial Action	1111
1563	C-06-010	No	Building	Remedial Action	1111
1564	C-06-011	No	Building	Remedial Action	1111
1565	C-06-012	No	Building	Remedial Action	1111
1566	C-06-013	No	Building	Remedial Action	1111
1567	C-06-014	No	Building	Remedial Action	1111
1568	C-06-015	No	Building	Remedial Action	1111
1569	C-06-016	No	Building	Remedial Action	1111
1570	C-06-017	No	Building	Remedial Action	1111
1571	C-06-018	No	Building	Remedial Action	1111
1572	C-06-019	No	Building	Remedial Action	1111
1573	C-06-021	No	Building	Remedial Action	1111
1574	C-08-010	Yes	Building	Remedial Action	1157
1575	C-08-014	No	Laboratory	Remedial Action	1157
1576	C-09-001	Yes	Soil contamination	Remedial Action	1157
1577	C-10-001	No	Surface soil, 2 10x10 foot plots, Bayo Canyon	Remedial Action	1079
1578	C-11-001	No	Laboratory	Remedial Action	1082
1579	C-11-002	No	Laboratory	Remedial Action	1082
1580	C-12-001	No	Building	Remedial Action	1085
1581	C-12-002	No	Building	Remedial Action	1085
1582	C-12-003	No	Building	Remedial Action	1085
1583	C-12-004	No	Building	Remedial Action	1085
1584	C-12-005	No	Building	Remedial Action	1085
1585	C-14-001	No	Building	Remedial Action	1085
1586	C-14-002	No	Building	Remedial Action	1085
1587	C-14-003	No	Building	Remedial Action	1085
1588	C-14-004	No	Building	Remedial Action	1085
1589	C-14-005	No	Building	Remedial Action	1085
1590	C-14-006	No	Building	Remedial Action	1085
1591	C-14-007	No	Building	Remedial Action	1085
1592	C-14-008	No	Building	Remedial Action	1085
1593	C-14-009	No	Building	Remedial Action	1085
1594	C-15-001	No	Surface disposal	Remedial Action	1086
1595	C-15-004	No	Transformers	Remedial Action	1086
1596	C-15-005	No	Laboratory and building	Remedial Action	1086
1597	C-15-006	No	Building	Remedial Action	1086
1598	C-15-007	No	Non-intentional release	Remedial Action	1086
1599	C-15-010	No	Underground tank	Remedial Action	1086
1600	C-15-011	No	Underground tank	Remedial Action	1086
1601	C-16-001	No	Building	Remedial Action	1082
1602	C-16-002	No	Building	Remedial Action	1082
1603	C-16-005	No	Building	Remedial Action	1082
1604	C-16-006	No	Building	Remedial Action	1082
1605	C-16-008	No	Building	Remedial Action	1082
1606	C-16-009	No	Building	Remedial Action	1082
1607	C-16-010	No	Building	Remedial Action	1082
1608	C-16-011	No	Building	Remedial Action	1082
1609	C-16-012	No	Building	Remedial Action	1082

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1610	C-16-013	No	Storage area	Remedial Action	1082
1611	C-16-014	No	Building	Remedial Action	1082
1612	C-16-015	No	Building	Remedial Action	1082
1613	C-16-016	No	Building	Remedial Action	1082
1614	C-16-017	No	Building	Remedial Action	1082
1615	C-16-018	No	Aboveground tank	Remedial Action	1082
1616	C-16-019	No	Building	Remedial Action	1082
1617	C-16-020	No	Building	Remedial Action	1082
1618	C-16-025	Yes	Building	Remedial Action	1082
1619	C-16-026	Yes	Building	Remedial Action	1082
1620	C-16-028	No	Building	Remedial Action	1082
1621	C-16-030	No	Building	Remedial Action	1082
1622	C-16-031	No	Building	Remedial Action	1082
1623	C-16-034	No	Aboveground tank	Remedial Action	1082
1624	C-16-035	No	Aboveground tank	Remedial Action	1082
1625	C-16-036	No	Septic system	Remedial Action	1082
1626	C-16-041	No	Building	Remedial Action	1082
1627	C-16-044	No	Manhole	Remedial Action	1082
1628	C-16-046	No	Manhole	Remedial Action	1082
1629	C-16-047	No	Transport area	Remedial Action	1082
1630	C-16-049	No	Building	Remedial Action	1082
1631	C-16-050	No	Building	Remedial Action	1082
1632	C-16-051	No	Transport area	Remedial Action	1082
1633	C-16-058	No	Transport area	Remedial Action	1082
1634	C-16-060	No	Building	Remedial Action	1082
1635	C-16-061	No	Building	Remedial Action	1082
1636	C-16-062	No	Generation area	Remedial Action	1082
1637	C-16-063	No	Generation area	Remedial Action	1082
1638	C-16-064	No	Drum storage area (HE scrap pick-up)	Remedial Action	1082
1639	C-16-065	No	Drum storage area, TA 16-185	Remedial Action	1082
1640	C-16-067	No	Storage area	Remedial Action	1082
1641	C-16-068	No	Building, 16-522	Remedial Action	1082
1642	C-16-069	No	Building	Remedial Action	1082
1643	C-16-070	No	Underground tank	Remedial Action	1082
1644	C-16-071	No	One-time spill	Remedial Action	1082
1645	C-16-072	No	Tank	Remedial Action	1082
1646	C-16-073	No	Underground tank	Remedial Action	1082
1647	C-16-074	No	Storage	Remedial Action	1082
1648	C-16-075	No	Spill location near Bldg 16-340	Remedial Action	1082
1649	C-19-001	No	Soil contamination	Remedial Action	1071
1650	C-20-002	No	Storage building	Remedial Action	1100
1651	C-20-003	No	Building	Remedial Action	1100
1652	C-21-001	No	One-time spill Bldg 21-5	MDA	1106
1653	C-21-005	No	One-time spill	MDA	1106
1654	C-21-006	No	Non-intentional release area Bldg 21-2	MDA	1106
1655	C-21-007	No	Non-intentional release area	MDA	1106
1656	C-21-009	No	One-time spill	MDA	1106
1657	C-21-012	No	One-time spill	MDA	1106
1658	C-21-027	No	Machinery	MDA	1106
1659	C-21-031	No	Tank	MDA	1106
1660	C-21-032	No	Machinery and tanks	MDA	1106
1661	C-21-033	No	One-time spill	MDA	1106
1662	C-21-034	No	Tank	MDA	1106
1663	C-21-035	No	Aboveground tank	MDA	1106

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Table B-1
Los Alamos Environmental Restoration Potential Release Sites Under Investigation (sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1664	C-21-036	No	Aboveground tank	MDA	1106
1665	C-21-037	No	Aboveground tank	MDA	1106
1666	C-33-001	No	Transformer	Remedial Action	1122
1667	C-33-002	No	Transformer	Remedial Action	1122
1668	C-33-003	No	Soil contamination area	Remedial Action	1129
1669	C-35-007	No	Soil contamination	Remedial Action	1129
1670	C-36-001	No	Containment vessel	Remedial Action	1130
1671	C-36-003	Yes	Storm drainages	Remedial Action	1130
1672	C-36-06(e)	No	I-J Firing Site, Projectile Test Area (duplicate of 15-006(e))	Remedial Action	1130
1673	C-41-004	No	Storm drains	Canyon	1098
1674	C-43-001	No	Outfall	Remedial Action	1136
1675	C-45-001	No	Parking lot of former treatment plant	Remedial Action	1079
1676	C-46-001	No	One-time spill	Remedial Action	1140
1677	C-46-002	No	Stack emissions	Remedial Action	1140
1678	C-46-003	No	Stack emissions	Remedial Action	1140
1679	C-50-001	No	Transformer	MDA	1147
1680	C-59-001	No	PCB-containing capacitors & transformer	Remedial Action	1114
1681	C-60-001	No	Underground tank	Remedial Action	1114
1682	C-60-002	No	Underground tank	Remedial Action	1114
1683	C-60-003	No	One-time spill at pesticide shed	Remedial Action	1114
1684	C-60-004	No	Underground tank	Remedial Action	1114
1685	C-61-001	No	Transformer storage area - PCB leak	Remedial Action	1114
1686	C-61-002	No	Subsurface contamination	Remedial Action	1114
1687	C-73-001	No	Underground tank	Remedial Action	1071
1688	C-73-002	No	Underground tank	Remedial Action	1071
1689	C-73-003	No	Underground tank	Remedial Action	1071
1690	C-73-004	No	Underground tank	Remedial Action	1071
1691	C-73-005(a)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1692	C-73-005(b)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1693	C-73-005(c)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1694	C-73-005(d)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1695	C-73-005(e)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071
1696	C-73-005(f)	No	Excavation (unlined septic tank/outhouse trench)	Remedial Action	1071

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Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
1	00-008	No	Surface disposal site	Remedial Action	1071
2	00-010(a)	No	Surface disposal site	Remedial Action	1071
3	00-015	No	Firing range, Rendija Canyon	Remedial Action	1071
4	00-024	No	Cistern	Remedial Action	1071
5	00-025	No	Landfill	Remedial Action	1071
6	00-026	No	Landfill	Remedial Action	1071
7	00-035(a)	No	Surface disposal	Remedial Action	1071
8	00-040	No	Underground tank	Remedial Action	1071
9	01-001(p)	No	Septic system	Remedial Action	1078
10	01-001(q)	No	Septic system	Remedial Action	1078
11	01-001(r)	No	Septic system	Remedial Action	1078
12	01-001(v)	No	Septic system	Remedial Action	1078
13	01-001(w)	No	Septic system	Remedial Action	1078
14	01-004(a)	No	Incinerator	Remedial Action	1078
15	01-004(b)	No	Incinerator	Remedial Action	1078
16	01-005	No	Incinerator	Remedial Action	1078
17	01-006(f)	No	Drain lines and outfall	Remedial Action	1078
18	01-006(i)	No	Drain lines and outfall	Remedial Action	1078
19	01-006(j)	No	Drain lines and outfall	Remedial Action	1078
20	01-006(k)	No	Drain lines and outfall	Remedial Action	1078
21	01-006(l)	No	Drain lines and outfall	Remedial Action	1078
22	01-006(m)	No	Drain lines and outfall	Remedial Action	1078
23	01-006(q)	No	Drain lines and outfall	Remedial Action	1078
24	01-006(r)	No	Drain lines and outfall	Remedial Action	1078
25	01-006(s)	No	Drain lines and outfall	Remedial Action	1078
26	01-006(t)	No	Drain lines and outfall	Remedial Action	1078
27	01-007(f)	No	Soil contamination area	Remedial Action	1078
28	01-007(g)	No	Soil contamination area	Remedial Action	1078
29	01-007(h)	No	Soil contamination area	Remedial Action	1078
30	01-007(m)	No	Soil contamination area	Remedial Action	1078
31	01-007(n)	No	Soil contamination area	Remedial Action	1078
32	01-007(o)	No	Soil contamination area	Remedial Action	1078
33	02-001	No	Open burning ground	Canyon	1098
34	02-002	No	Storage area	Canyon	1098
35	02-013	No	Storage area	Canyon	1098
36	03-001(m)	No	Satellite accumulation area	Remedial Action	1114
37	03-001(p)	No	Satellite accumulation area	Remedial Action	1114
38	03-001(r)	No	Satellite accumulation area	Remedial Action	1114
39	03-010(b)	No	Operational release	Remedial Action	1114
40	03-010(c)	No	Operational release	Remedial Action	1114
41	03-010(d)	No	Operational release	Remedial Action	1114
42	03-013(c)	No	Operational release	Remedial Action	1114
43	03-013(d)	No	Operational release	Remedial Action	1114
44	03-013(e)	No	Operational release	Remedial Action	1114
45	03-013(f)	No	Operational release	Remedial Action	1114
46	03-013(g)	No	Operational release	Remedial Action	1114
47	03-013(h)	No	Operational release	Remedial Action	1114
48	03-020(b)	No	Surface disposal site	Remedial Action	1114
49	03-024	Yes	Tank and/or assoc. equipment	Remedial Action	1114
50	03-039(b)	No	Silver recovery unit	Remedial Action	1114
51	03-039(c)	No	Silver recovery unit	Remedial Action	1114
52	03-039(d)	No	Silver recovery unit	Remedial Action	1114
53	03-039(e)	No	Silver recovery unit	Remedial Action	1114
54	03-044(b)	No	Container storage	Remedial Action	1114

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Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
55	03-045(d)	Yes	Aboveground storage tank (Ind. or san. wastewater treatment)	Remedial Action	1114
56	03-055(b)	No	Outfall	Remedial Action	1114
57	05-006(a)	No	Former building location	Remedial Action	1129
58	05-006(d)	No	Former building location	Remedial Action	1129
59	05-006(f)	No	Former building location	Remedial Action	1129
60	05-006(g)	No	Former building location	Remedial Action	1129
61	06-003(b)	No	Firing site	Remedial Action	1111
62	06-004	No	Sump	Remedial Action	1111
63	08-008(a)	No	Storage area	Remedial Action	1157
64	08-008(b)	No	Storage area	Remedial Action	1157
65	08-008(c)	No	Storage area	Remedial Action	1157
66	08-008(d)	No	Storage area	Remedial Action	1157
67	08-009(b)	No	Ind. or san. wastewater treat.	Remedial Action	1157
68	08-010(a)	No	Storage area	Remedial Action	1157
69	08-010(b)	No	Storage area	Remedial Action	1157
70	08-010(c)	No	Storage area	Remedial Action	1157
71	08-011(a)	No	Underground tank	Remedial Action	1157
72	08-011(b)	No	Underground tank	Remedial Action	1157
73	09-008(a)	No	Surface impoundment	Remedial Action	1157
74	09-010(c)	No	Storage area	Remedial Action	1157
75	09-011(a)	No	Storage area	Remedial Action	1157
76	09-015	No	Manhole	Remedial Action	1157
77	09-016	No	Underground tank	Remedial Action	1157
78	10-001(e)	No	Detonation Test Area	Remedial Action	1079
79	11-003(a)	No	Mortar impact area	Remedial Action	1082
80	11-008	No	Surface disposal	Remedial Action	1082
81	11-010(a)	No	Container storage area	Remedial Action	1082
82	11-010(b)	No	Container storage	Remedial Action	1082
83	12-003	No	Storage area	Remedial Action	1085
84	14-004(a)	No	Storage area (still active)	Remedial Action	1085
85	14-004(c)	No	Storage area	Remedial Action	1085
86	14-008	No	Landfill and surface disposal	Remedial Action	1085
87	15-004(e)	No	Mistakenly called firing site (actually manhole bunker)	Remedial Action	1086
88	15-005(a)	No	Storage area	Remedial Action	1086
89	15-005(d)	No	Storage area	Remedial Action	1086
90	15-008(e)	No	Surface disposal	Remedial Action	1086
91	15-009(d)	No	Septic tank	Remedial Action	1086
92	15-013(a)	No	Underground tank	Remedial Action	1086
93	15-013(b)	No	Underground tank	Remedial Action	1086
94	15-014(c)	No	Ind. or san. wastewater treat.	Remedial Action	1086
95	15-014(f)	No	Ind. or san. wastewater treat.	Remedial Action	1086
96	16-007(b)	No	Surface disposal site	Remedial Action	1082
97	16-008(b)	No	Surface impoundment	Remedial Action	1082
98	16-012(a2)	No	Container storage	Remedial Action	1082
99	16-023(a)	No	Incinerator	Remedial Action	1082
100	16-032(b)	No	Decommissioned HE sump	Remedial Action	1082
101	18-005(b)	No	Storage area	Canyon	1093
102	18-005(c)	No	Storage area	Canyon	1093
103	18-009(a)	No	Transformer	Canyon	1093
104	18-009(c)	No	Transformer	Canyon	1093
105	18-009(d)	No	Transformer	Canyon	1093
106	18-009(e)	No	Transformer	Canyon	1093

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Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
107	18-010(a)	No	Outfall	Canyon	1093
108	18-012(d)	No	Drain line	Canyon	1093
109	20-003(d)	No	Firing site	Remedial Action	1100
110	21-004(d)	No	Drain line	MDA	1106
111	21-008	No	Incinerator	MDA	1106
112	21-019(a)	No	Filter houses/exhaust stacks	MDA	1106
113	21-019(b)	No	Filter houses/exhaust stacks	MDA	1106
114	21-019(c)	No	Filter houses/exhaust stacks	MDA	1106
115	21-019(d)	No	Filter houses/exhaust stacks	MDA	1106
116	21-019(e)	No	Filter houses/exhaust stacks	MDA	1106
117	21-019(f)	No	Filter houses/exhaust stacks	MDA	1106
118	21-019(g)	No	Filter houses/exhaust stacks	MDA	1106
119	21-019(h)	No	Filter houses/exhaust stacks	MDA	1106
120	21-019(i)	No	Filter houses/exhaust stacks	MDA	1106
121	21-019(j)	No	Filter houses/exhaust stacks	MDA	1106
122	21-019(k)	No	Filter houses/exhaust stacks	MDA	1106
123	21-019(l)	No	Filter houses/exhaust stacks	MDA	1106
124	21-019(m)	No	Filter houses/exhaust stacks	MDA	1106
125	21-020(a)	No	Filter house	MDA	1106
126	21-020(b)	No	Filter house	MDA	1106
127	21-025(a)	No	Operational facility	MDA	1106
128	21-025(b)	No	Operational facility	MDA	1106
129	21-028(b)	No	Container storage	MDA	1106
130	21-028(e)	No	Container storage	MDA	1106
131	22-001	No	Building	Remedial Action	1111
132	22-003(a)	No	Satellite accumulation area	Remedial Action	1111
133	22-003(b)	No	Satellite accumulation area	Remedial Action	1111
134	22-003(c)	No	Satellite accumulation area	Remedial Action	1111
135	22-003(d)	No	Satellite accumulation area	Remedial Action	1111
136	22-003(e)	No	Satellite accumulation area	Remedial Action	1111
137	22-003(f)	No	Satellite accumulation area	Remedial Action	1111
138	22-003(g)	No	Satellite accumulation area	Remedial Action	1111
139	22-013	No	Liquid waste treatment/storage	Remedial Action	1111
140	22-014(c)	No	Unit (does not exist)	Remedial Action	1111
141	25-001	No	Pit	Remedial Action	1082
142	27-004	No	Building	Canyon	1093
143	30-001	No	Surface disposal and landfill	Remedial Action	1114
144	33-004(l)	No	Outfall	Remedial Action	1122
145	33-004(n)	No	Septic system	Remedial Action	1122
146	33-010(e)	No	Surface disposal (Area 6)	Remedial Action	1122
147	33-012(b)	No	Satellite accumulation area	Remedial Action	1122
148	33-012(c)	No	Satellite accumulation area	Remedial Action	1122
149	33-012(d)	No	Satellite accumulation area	Remedial Action	1122
150	35-001	No	Material disposal area (MDA W)	Remedial Action	1129
151	35-004(c)	No	Storage areas	Remedial Action	1129
152	35-004(d)	No	Container storage area	Remedial Action	1129
153	35-004(f)	No	Container storage area	Remedial Action	1129
154	35-004(i)	No	Container storage area	Remedial Action	1129
155	35-004(j)	No	Container storage area	Remedial Action	1129
156	35-004(k)	No	Container storage area	Remedial Action	1129
157	35-004(l)	No	Container storage area	Remedial Action	1129
158	35-004(n)	No	Container storage area	Remedial Action	1129
159	35-004(o)	No	Container storage area	Remedial Action	1129

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Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
160	35-005(a)	No	Surface impoundment (closure) Bldg 85 duplicate of 35-006	Remedial Action	1129
161	35-005(b)	No	Surface impoundment (closure) Bldg 125	Remedial Action	1129
162	35-007	No	Waste oil treatment	Remedial Action	1129
163	35-011(b)	No	Underground storage tank	Remedial Action	1129
164	35-011(c)	No	Underground storage tank	Remedial Action	1129
165	35-011(d)	No	Underground storage tank	Remedial Action	1129
166	35-012(a)	No	Underground storage tank	Remedial Action	1129
167	35-012(b)	No	Underground storage tank (inactive)	Remedial Action	1129
168	35-014(c)	No	Operational release	Remedial Action	1129
169	35-017	No	Soil contamination from reactor	Remedial Action	1129
170	35-018(b)	No	Former transformer site	Remedial Action	1129
171	36-003(d)	No	Septic system	Remedial Action	1130
172	36-004(f)	No	Firing site	Remedial Action	1130
173	36-007(a)	No	Storage area	Remedial Action	1130
174	36-007(b)	No	Storage area	Remedial Action	1130
175	36-007(c)	No	Storage area	Remedial Action	1130
176	36-007(d)	No	Storage area	Remedial Action	1130
177	36-007(e)	No	Storage area	Remedial Action	1130
178	36-007(f)	No	Storage area	Remedial Action	1130
179	37-001	No	Septic system	Remedial Action	1082
180	39-002(g)	No	Storage area (still active)	Remedial Action	1132
181	39-007(b)	No	Storage area	Remedial Action	1132
182	39-007(c)	No	Storage area	Remedial Action	1132
183	39-007(e)	No	Storage area	Remedial Action	1132
184	39-009	No	Outfall	Remedial Action	1132
185	40-002(a)	No	Container storage area	Remedial Action	1111
186	40-002(b)	No	Container storage area	Remedial Action	1111
187	40-002(c)	No	Container storage area	Remedial Action	1111
188	40-003(b)	No	Burning area/open detonation (closure)	Remedial Action	1111
189	40-008	No	HE storage area decommissioned	Remedial Action	1111
190	41-004	No	Container storage	Canyon	1098
191	42-004	No	Canyon disposal	Remedial Action	1129
192	43-001(b1)	No	Outfall	Remedial Action	1136
193	43-003	No	Carcass storage	Remedial Action	1136
194	43-004	No	Waste storage	Remedial Action	1136
195	43-005	No	Radioactive liquid storage	Remedial Action	1136
196	46-001	No	Aboveground tank	Remedial Action	1140
197	46-004(i)	No	Outfall	Remedial Action	1140
198	46-004(j)	No	Outfall	Remedial Action	1140
199	46-004(k)	No	Outfall	Remedial Action	1140
200	46-004(l)	No	Outfall	Remedial Action	1140
201	46-004(n)	No	Outfall	Remedial Action	1140
202	46-004(o)	No	Outfall	Remedial Action	1140
203	46-006(e)	No	Surface disposal	Remedial Action	1140
204	46-008misc	No	Storage area	Remedial Action	1140
205	46-010(a)	No	Storage area	Remedial Action	1140
206	46-010(b)	No	Storage area	Remedial Action	1140
207	46-010(c)	No	Storage area	Remedial Action	1140
208	46-010(e)	No	Storage area	Remedial Action	1140
209	46-010(f)	No	Storage area	Remedial Action	1140
210	46-010misc	No	Storage area	Remedial Action	1140

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Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
211	48-002(c)	No	Container storage area	Remedial Action	1129
212	48-002(d)	No	Container storage	Remedial Action	1129
213	48-004(d)	No	Sumps and tanks	Remedial Action	1129
214	48-006	No	Septic system	Remedial Action	1129
215	48-007(e)	No	Outfall	Remedial Action	1129
216	48-008	No	Transformer leak	Remedial Action	1129
217	48-009	No	Soil contamination	Remedial Action	1129
218	50-003(b)	No	Storage area	MDA	1147
219	50-003(c)	No	Storage area	MDA	1147
220	50-003(d)	No	Storage area	MDA	1147
221	50-003(e)	No	Storage area	MDA	1147
222	50-005	No	Waste treatment facility	MDA	1147
223	50-006(b)	No	Operational release	MDA	1147
224	50-006(e)	No	Aboveground tank	MDA	1147
225	51-002(a)	No	Usage site (Environmental Research Caisson)	MDA	1148
226	51-002(b)	No	Usage site (Environmental Research Caisson)	MDA	1148
227	52-002(e)	Yes	Septic system with 63-001(a)	Remedial Action	1129
228	52-002(g)	No	Septic system	Remedial Action	1129
229	52-003(b)	No	Industrial waste line	Remedial Action	1129
230	52-004	No	Evaporator	Remedial Action	1129
231	53-001(d)	No	Storage area	Remedial Action	1100
232	53-001(f)	No	Storage area	Remedial Action	1100
233	53-001(h)	No	Storage area	Remedial Action	1100
234	53-001(i)	No	Storage area	Remedial Action	1100
235	53-001(j)	No	Storage area	Remedial Action	1100
236	53-001(k)	No	Storage area	Remedial Action	1100
237	53-001(l)	No	Storage area	Remedial Action	1100
238	53-001(m)	No	Storage area	Remedial Action	1100
239	53-001(n)	No	Storage area	Remedial Action	1100
240	53-001(o)	No	Storage area	Remedial Action	1100
241	53-003	No	Septic tank	Remedial Action	1100
242	53-011(a)	No	Transformer	Remedial Action	1100
243	53-011(b)	No	Transformer	Remedial Action	1100
244	53-011(c)	No	Transformer	Remedial Action	1100
245	53-011(d)	No	Transformer	Remedial Action	1100
246	53-011(e)	No	Transformer	Remedial Action	1100
247	54-001(f)	No	Storage area	MDA	1148
248	54-008	No	Underground tank	MDA	1148
249	54-010	No	Underground tank (supply wash-water tank)	MDA	1148
250	54-015(g)	No	Storage area (Pb casks near shaft 4)	MDA	1148
251	54-015(i)	No	Storage area - forklift battery	MDA	1148
252	54-016(a)	No	Sump	MDA	1148
253	54-021	No	Aboveground oil storage tanks (6)	MDA	1148
254	54-022	No	Transformer spill (PCB)	MDA	1148
255	55-001	No	Cement plant	Remedial Action	1129
256	55-002(a)	No	Rad waste storage area	Remedial Action	1129
257	55-002(b)	No	Rad waste storage area	Remedial Action	1129
258	55-002(c)	No	Container storage area	Remedial Action	1129
259	55-003	No	Containment area	Remedial Action	1129
260	55-004	No	Evaporator	Remedial Action	1129

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Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
261	55-005	No	Filtration Unit	Remedial Action	1129
262	55-006	No	Glass breaker	Remedial Action	1129
263	55-007	No	Thermal combustion unit	Remedial Action	1129
264	55-010	No	Solvent spills	Remedial Action	1129
265	55-011(a)	No	Storm drain	Remedial Action	1129
266	55-011(b)	No	Storm drain	Remedial Action	1129
267	55-011(c)	No	Storm drain	Remedial Action	1129
268	55-011(d)	No	Storm drain	Remedial Action	1129
269	55-011(e)	No	Storm drain	Remedial Action	1129
270	55-012	No	Container storage area	Remedial Action	1129
271	55-013(a)	No	Storage area	Remedial Action	1129
272	55-013(b)	No	Storage area	Remedial Action	1129
273	57-001(a)	No	Drilling mud pits	Remedial Action	1154
274	57-005	No	Pond filtration unit	Remedial Action	1154
275	59-002	No	Container storage area	Remedial Action	1114
276	59-003	No	Sump	Remedial Action	1114
277	60-001(a)	No	Storage area (active storage)	Remedial Action	1114
278	60-001(b)	No	Storage area (active Storage)	Remedial Action	1114
279	60-001(c)	No	Storage area (active)	Remedial Action	1114
280	60-001(d)	No	Storage area - pesticide shed	Remedial Action	1114
281	60-003	No	Oil-water separator	Remedial Action	1114
282	60-004(a)	No	Storage area	Remedial Action	1114
283	60-005(b)	No	Drilling mud pit	Remedial Action	1114
284	60-006(b)	No	Septic system	Remedial Action	1114
285	60-006(c)	No	Septic tank	Remedial Action	1114
286	61-001	No	Storage area	Remedial Action	1114
287	61-003	No	Burn sites	Remedial Action	1114
288	61-004(b)	No	Septic tank	Remedial Action	1114
289	61-004(c)	No	Septic tank	Remedial Action	1114
290	63-002	No	Container storage area	Remedial Action	1129
291	64-001	No	Storage area	Remedial Action	1114
292	66-002(a)	No	Septic system	Remedial Action	1157
293	66-002(b)	No	Septic system	Remedial Action	1157
294	72-002	No	Firing site	Remedial Action	1100
295	72-003(a)	No	Septic system	Remedial Action	1100
296	72-003(b)	No	Septic system	Remedial Action	1100
297	C-04-001	No	Former building location	Remedial Action	1129
298	C-05-001	No	Former building location	Remedial Action	1129
299	C-06-020	No	Building	Remedial Action	1111
300	C-08-001	No	Building	Remedial Action	1157
301	C-08-002	No	Building	Remedial Action	1157
302	C-08-003	No	Building	Remedial Action	1157
303	C-08-004	No	Building	Remedial Action	1157
304	C-08-005	No	Building	Remedial Action	1157
305	C-08-006	No	Building	Remedial Action	1157
306	C-08-007	No	Building	Remedial Action	1157
307	C-08-008	No	Building	Remedial Action	1157
308	C-08-009	No	Building	Remedial Action	1157
309	C-08-011	No	Building	Remedial Action	1157
310	C-08-012	No	Building	Remedial Action	1157
311	C-08-013	No	Building	Remedial Action	1157
312	C-08-015	No	Building	Remedial Action	1157
313	C-08-016	No	Building	Remedial Action	1157
314	C-08-017	No	Storage area	Remedial Action	1157

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Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
315	C-08-018	No	Storage area	Remedial Action	1157
316	C-08-019	No	Storage area	Remedial Action	1157
317	C-08-020	No	Disposal area	Remedial Action	1157
318	C-09-002	No	Buildings	Remedial Action	1157
319	C-09-003	No	Buildings	Remedial Action	1157
320	C-09-004	No	Building	Remedial Action	1157
321	C-09-005	No	Building	Remedial Action	1157
322	C-09-006	No	Buildings	Remedial Action	1157
323	C-09-007	No	Building	Remedial Action	1157
324	C-09-008	No	Underground tank	Remedial Action	1157
325	C-09-009	No	Non-intentional release	Remedial Action	1157
326	C-09-010	No	Burn site	Remedial Action	1157
327	C-09-011	No	Burn site	Remedial Action	1157
328	C-11-003	No	One-time release site	Remedial Action	1082
329	C-12-006	No	Pole - duplicate of 12-004(a)	Remedial Action	1085
330	C-15-002	No	Surface disposal	Remedial Action	1086
331	C-15-003	No	Surface disposal	Remedial Action	1086
332	C-15-008	No	Non-intentional release	Remedial Action	1086
333	C-15-009	No	Underground tank	Remedial Action	1086
334	C-15-012	No	Underground tank (still active)	Remedial Action	1086
335	C-15-013	No	Underground tank	Remedial Action	1086
336	C-16-003	No	Septic system (see 16-005n)	Remedial Action	1082
337	C-16-004	No	Building	Remedial Action	1082
338	C-16-007	No	Tank stand	Remedial Action	1082
339	C-16-021	No	Building	Remedial Action	1082
340	C-16-022	No	Building	Remedial Action	1082
341	C-16-023	No	Warehouse	Remedial Action	1082
342	C-16-024	No	Building	Remedial Action	1082
343	C-16-027	No	Building	Remedial Action	1082
344	C-16-029	No	Building	Remedial Action	1082
345	C-16-032	No	Building	Remedial Action	1082
346	C-16-033	No	Warehouse	Remedial Action	1082
347	C-16-037	No	Storage area	Remedial Action	1082
348	C-16-038	No	Storage area	Remedial Action	1082
349	C-16-039	No	Building	Remedial Action	1082
350	C-16-040	No	Building	Remedial Action	1082
351	C-16-042	No	Steam manhole	Remedial Action	1082
352	C-16-043	No	Steam manhole	Remedial Action	1082
353	C-16-045	No	Manhole	Remedial Action	1082
354	C-16-048	No	Steam manhole	Remedial Action	1082
355	C-16-052	No	Steam manhole	Remedial Action	1082
356	C-16-053	No	Water manhole	Remedial Action	1082
357	C-16-054	No	Steam manhole	Remedial Action	1082
358	C-16-055	No	Switch box	Remedial Action	1082
359	C-16-056	No	Steam manhole	Remedial Action	1082
360	C-16-057	No	Steam manhole	Remedial Action	1082
361	C-16-059	No	Electrical pit	Remedial Action	1082
362	C-16-066	No	Storage area	Remedial Action	1082
363	C-18-001	No	Laboratory	Canyon	1093
364	C-18-002	No	Building	Canyon	1093
365	C-18-003	No	Storage area	Canyon	1093
366	C-20-001	No	Storage building	Remedial Action	1100
367	C-21-002	No	Non-intentional release area	MDA	1106
368	C-21-003	No	Non-intentional release area	MDA	1106

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Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
369	C-21-004	No	Non-intentional release area	MDA	1106
370	C-21-008	No	One-time spill	MDA	1106
371	C-21-010	No	Systematic leak	MDA	1106
372	C-21-011	No	One-time spill	MDA	1106
373	C-21-013	No	Disposal pit	MDA	1106
374	C-21-014	No	Warehouse	MDA	1106
375	C-21-015	No	Building	MDA	1106
376	C-21-016	No	Storage area	MDA	1106
377	C-21-017	No	Storage area	MDA	1106
378	C-21-018	No	Storage area	MDA	1106
379	C-21-019	No	Storage area	MDA	1106
380	C-21-020	No	Storage area	MDA	1106
381	C-21-021	No	Storage area	MDA	1106
382	C-21-022	No	Laboratory	MDA	1106
383	C-21-023	No	Laboratory	MDA	1106
384	C-21-024	No	Warehouse	MDA	1106
385	C-21-025	No	Building	MDA	1106
386	C-21-026	No	Building	MDA	1106
387	C-21-028	No	Tank	MDA	1106
388	C-21-029	No	Aboveground tank	MDA	1106
389	C-21-030	No	Aboveground tank	MDA	1106
390	C-25-001	No	Building	Remedial Action	1082
391	C-31-001	No	Buildings	Remedial Action	1079
392	C-32-001	No	Buildings	Remedial Action	1079
393	C-35-001	No	Former UST site	Remedial Action	1129
394	C-35-002	No	Former UST site	Remedial Action	1129
395	C-35-003	No	Former UST site	Remedial Action	1129
396	C-35-004	No	Operational release	Remedial Action	1129
397	C-35-005	No	Operational release	Remedial Action	1129
398	C-35-006	No	Operational release	Remedial Action	1129
399	C-35-008	No	Leaking transformer	Remedial Action	1129
400	C-36-002	No	Surface disposal	Remedial Action	1130
401	C-40-001	No	Usage site	Remedial Action	1111
402	C-41-001	No	Sump	Canyon	1098
403	C-41-002	No	Underground tank	Canyon	1098
404	C-41-003	No	Underground tank	Canyon	1098
405	C-41-005	No	Underground tank - mystery tank	Canyon	1098
406	C-51-001	No	Storage area	MDA	1148
407	C-51-002	No	Buildings	MDA	1148
408	C-52-001	No	Former transformer site	Remedial Action	1129
409	C-52-002	No	Former transformer site	Remedial Action	1129
410	C-53-001	No	Transformer	Remedial Action	1100
411	C-53-002	No	Transformer	Remedial Action	1100
412	C-53-003	No	Transformer	Remedial Action	1100
413	C-53-004	No	Transformer	Remedial Action	1100
414	C-53-005	No	Transformer	Remedial Action	1100
415	C-53-006	No	Transformer	Remedial Action	1100
416	C-53-007	No	Transformer	Remedial Action	1100
417	C-53-008	No	Transformer	Remedial Action	1100
418	C-53-009	No	Transformer	Remedial Action	1100
419	C-53-010	No	Transformer	Remedial Action	1100
420	C-53-011	No	Transformer	Remedial Action	1100
421	C-53-012	No	Transformer	Remedial Action	1100
422	C-53-013	No	Transformer	Remedial Action	1100

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Table B-2
Los Alamos Environmental Restoration Potential Release Sites
Investigation Complete and Removed from Project
(sorted by PRS Number)

	PRS Number	HSWA SWMU	Unit Description	Focus Area	Former OU
423	C-53-014	No	Transformer	Remedial Action	1100
424	C-53-015	No	Transformer	Remedial Action	1100
425	C-53-016	No	Transformer	Remedial Action	1100
426	C-53-017	No	One-time spill	Remedial Action	1100
427	C-53-018	No	One-time spill	Remedial Action	1100
428	C-53-019	No	One-time spill	Remedial Action	1100

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Methodology for Calculating Human Health SALs in Mesa-Top Soils and Sediments

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IWP
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METHODOLOGY FOR CALCULATING HUMAN HEALTH SCREENING ACTION LEVELS IN MESA-TOP SOILS AND SEDIMENTS

The appendix provides guidance to Environmental Restoration (ER) Project risk assessors for the calculation of human health screening action levels (SALs) for organic and inorganic chemicals in mesa-top 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.

1.0 INTRODUCTION

1.1 Purpose

This appendix provides guidance to ER Project risk assessors who calculate SALs for organic and inorganic chemicals in mesa-top soils and sediments. 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. Implementation of this guidance is intended to insure consistency in the calculation of SALs and in their application for evaluating specific media. Any deviations from the procedure in this appendix will be done only with approval from the Administrative Authority.

Sufficient discussion is provided in this appendix regarding assumptions and conditions of use to allow independent review of the methodology for calculating SALs by stakeholders and concerned citizens. This appendix is not intended to provide complete guidance for the application of SALs in ER Project assessments.

The ER Project calculates SAL values such that responsibility for the accuracy of the SAL values resides completely with the ER Project rather than with an outside source. In addition, 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 IX in the derivation of its preliminary remediation goals (PRGs) (EPA 1998, 58751). The ER Project is adopting the approach of EPA Region IX for three reasons. The first is to use Region IX PRGs 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 Region IX PRGs, 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 potential release sites (PRSs) 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.

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1.2 Applicable Regulations and Guidance

ER Project investigations and remedial actions are conducted in accordance with the Hazardous and Solid Wastes Amendments Act 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 preamble to the EPA Region IX PRG document (EPA 1998, 58751).

2.0 IDENTIFICATION OF ACCEPTABLE RISK LEVELS

The 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 VI. 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 the 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.

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) (EPA 1998). 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 proposed for use 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.

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Toxicity values are specified separately by EPA for the 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.

The 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 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 from 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 bioavailabilty from soil. The assumption of equivalent bioavailabilty 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 at PRSs do not have EPA-approved or provisional toxicity values. A general approach to this screening 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.

4.0 EXPOSURE SCENARIOS, MEDIA, AND PATHWAYS

Three 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 town-site 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

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because it is more restrictive than the 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 mesa-top PRSs where residential land use is expected to follow the urban pattern characteristic of the Los Alamos town site. 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-bottom settings. For example, ingestion of homegrown produce may be considered an important exposure pathway for future residential land use in some canyon-bottom areas. Therefore, SAL values developed using this guidance are not automatically applicable to non-mesa-top sites. In addition, SALs are not necessarily protective of ecological endpoints or groundwater resources.

The 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 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 IX (EPA 1988, 58751). EPA Region IX referenced 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.

5.0 MODELING INHALATION AND DERMAL PATHWAYS

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

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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 non-aqueous 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 the soil screening guidance (EPA 1996, 58917) and the EPA Region IX PRG document (EPA 1998, 58751). 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 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). 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).

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

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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 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.

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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. Similarly, default values are employed for the ABS (0.1 for organic chemicals, 0.01 for metals) unless there is readily available information for a specific chemical.

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 IX's PRGs (EPA 1998, 58751).

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 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.

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 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

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ABS	=	skin absorption factor	(organic: 0.1) (inorganic: 0.01)
AF_c	=	adherence factor – child	0.3 mg/cm^2
BW_c	=	body weight – child	15 kg
CSF_o	=	cancer slope factor – oral	(mg/kg-day)$^{-1}$ see Section 3.0
CSF_i	=	cancer slope factor – inhalation	(mg/kg-day)$^{-1}$ see Section 3.0
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 3.0
RfD_i	=	reference dose – inhalation	(mg/kg-day) see Section 3.0
SA_c	=	exposed surface area – child	2900 cm^2/day
SFS_{adj}	=	age-adjusted skin contact factor for carcinogens	504 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 5.3 of this appendix.

Because contact rates may be different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors ("adj"). Use of age-adjusted factors are 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:

$$InhF_{adj} = \frac{ED_c \times IRA_c}{BW_c} + \frac{(ED_r - ED_c) \times IRA_a)}{BW_a}$$

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where:

BW_a	=	body weight – adult	70 kg
ED_r	=	exposure duration – residential	30 yr
Af_a	=	adherence factor – adult	0.08 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

$$VF_s = \left(\frac{Q}{C}\right) \times \frac{(3.14 \times D_A \times T)^{1/2}}{2 \times \rho_b \times D_A} \times 10^{-4}\left(m^2/cm^2\right)$$

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) =	$K_{oc} f_{oc}$
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: $H' = \frac{\text{Henry's Law Constant}}{\text{Universal Gas Constant x Temperature}}$

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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)	$= K_{oc}f_{oc}$
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

Note: $H' = \frac{\text{Henry's Law Constant}}{\text{Universal Gas Constant x Temperature}}$

Θ_a	=	air filled soil porosity (L_{air}/L_{soil})	0.28 or $n - \Theta_w$

See Section 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

$$PEF\left(m^3/kg\right) = \frac{Q}{C} \times \frac{3{,}600\ sec/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

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 1.316×10^9 is calculated using the default parameter values described.

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Annual Work Schedule for the Environmental Restoration Project at Los Alamos National Laboratory

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IWP
LA-UR-98-4652

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APPENDIX D

To be delivered at a later date.

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ACRONYMS AND ABBREVIATIONS

ABS	absorption factor
AEA	Atomic Energy Act
AEC	US Atomic Energy Commission
AF	adherence factor
ALARA	as low as reasonably achievable
ANTI-C	radiologic protective clothing
AOC	area of concern
AP	administrative procedure
AR	administrative record
BUS	Business Systems (Division)
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
D&D	decontamination and decommissioning
DOE	US Department of Energy
DOE/UC	US Department of Energy/University of California
DOE-AL	US Department of Energy/Albuquerque Operations Office
DOE-HQ	US Department of Energy/Headquarters
DOE-LAAO	US Department of Energy/Los Alamos Area Office
DOL	US Department of Labor
DOT	US Department of Transportation
ED	exposure duration
EM	Office of Environmental Restoration and Waste Management
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
FSF	Field Support Facility
FY	fiscal year
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
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
ICR	incremental cancer risk
ID	identification number
IRIS	Integrated Risk Information System

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IWP	installation work plan
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LASL	Los Alamos Scientific Laboratory (the Laboratory before January 1, 1981)
LDR	land disposal restriction
Ma	million years
MCL	maximum contaminant level
MDA	materials disposal area
MSA	Major Systems Acquisition
MSA AL-1	DOE Operations Office in Albuquerque
NEPA	National Environmental Policy Act
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
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
PP&C	Project Planning and Control Team
PRG	preliminary remediation goal
PRS	potential release site
QA	quality assurance
QMP	quality management plan
QC	quality control
QP	quality procedure
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPF	Records-Processing Facility
RSI	Request for Supplemental Information
SAL	screening action level
SAP	sampling and analysis plan
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SWMU	solid waste management unit
TA	technical area
TCLP	toxicity characteristic leaching procedure
TSCA	Toxic Substances Control Act
TSD	treatment, storage, disposal
UC	University of California
UCL	upper confidence limit
UHTREX	ultra-high-temperature reactor experiment
USGS	US Geological Survey
UST	underground storage tank
UTL	upper tolerance limit
VCA	voluntary corrective action
VCM	voluntary corrective measure
VF	volatilization factor
VOC	volatile organic compound

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APPROXIMATE CONVERSION FACTORS FOR SELECTED SI (METRIC) UNITS

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

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