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DOE-EA-1212

Environmental Assessment for Lease of Land for the Development of a Research Park at Los Alamos National Laboratory

Los Alamos, New Mexico

Final Document

Date Prepared: October 7, 1997

Prepared by: US Department of Energy
Los Alamos Area Office

6882

TABLE OF CONTENTS

ACRONYMS AND TERMS v

EXECUTIVE SUMMARY ix

1.0 PURPOSE AND NEED FOR AGENCY ACTION 1

1.1 Introduction 1
1.2 Background 1
1.3 Purpose of and Need for DOE Action 5
1.4 Scope of This EA 5
1.5 Public Involvement 6

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES 7

2.1 Description of the Proposed Action 7
2.1.1 Location and Description of the Research Park 7
2.1.2 Proposed Land Use 9
2.2 No Action Alternative 13
2.3 Alternatives Considered but Dismissed from Further Consideration 14

3.0 AFFECTED ENVIRONMENT 15

3.1 Regional Setting 15
3.2 Potential Environmental Issues 16
3.3 Socioeconomic Conditions 16
3.4 Land Use and Traffic 18
3.5 Ecological Resources 19
3.6 Waste Management and Environmental Restoration 21
3.7 Aesthetics 25
3.8 Human Health 26
3.9 Air Quality 26
3.10 Noise 27
3.11 Cultural Resources 28
3.12 Water Quality 28
3.13 Environmental Justice 28
3.14 Natural Resources 29

4.0 ENVIRONMENTAL CONSEQUENCES 31

4.1 Proposed Action 31
4.1.1 Socioeconomics 31
4.1.1.1 Employment and Local Economy 31
4.1.1.2 Housing 32
4.1.1.3 Utility Demands 32
4.1.2 Land Use and Traffic 34
4.1.3 Ecological Resources 35
4.1.4 Waste Management and Environmental Restoration 38
4.1.5 Aesthetics 39
4.1.6 Human Health 40
4.1.7 Air Quality 41
4.1.8 Noise 44
4.1.9 Cultural Resources 44
4.1.10 Water Quality 45
4.2 Potential Accident Scenarios 45

4.2.1 Scenario 1: Radiological Material Spill at the Proposed Research Park 45
4.2.2 Scenario 2: Human Error Release of Arsine Gas from Semiconductor Laboratory 46
4.3 Cumulative Effects 46
4.4 No Action Alternative 51
4.4.1 Socioeconomics 51
4.4.2 Land Use and Traffic 51
4.4.3 Ecological Resources 52
4.4.4 Waste Management and Environmental Restoration 52
4.4.5 Aesthetics 52
4.4.6 Human Health 52
4.4.7 Air Quality 52
4.4.8 Noise 52
4.4.9 Cultural Resources 52
4.4.10 Water Quality 52
4.5 Comparison of Alternatives 53

5.0 AGENCY CONSULTATIONS 55

6.0 REFERENCES 57

APPENDIX A 61

APPENDIX B 63

FIGURES

Figure 1-1. Location of Los Alamos National Laboratory and Research Park tract. 2
Figure 1-2. Los Alamos National Laboratory showing TAs affected by the land lease. 3
Figure 2-1. Location of proposed Research Park. 8
Figure 2-2. Conceptual site development plan for proposed Research Park. 10
Figure 2-3. Conceptual site plan/Alternative No. 2 for proposed Research Park 11
Figure 3-1. Locations of utility lines, PRSs, and slopes greater than 20% within proposed Research Park 24
Figure 4-1. Location of proposed Research Park showing approximate site buffer zone 37

TABLES

Table 3-1. Potential Environmental Issues 16
Table 3-2. Utilities: Usage and Capacity 18
Table 3-3. Federal Threatened or Endangered Species Potentially Occurring in the Proposed Land Lease Tract 21
Table 3-4. Sanitary Sewer Usage and Capacity 22
Table 3-5. Summary of Annual Effective Dose Equivalents for 1995 27
Table 4-1. Building Construction Emission Estimates 42
Table 4-2. Parking Lot Clearing and Asphalt Paving Emission Estimates 42
Table 4-3. Vehicular Traffic Emission Estimates 43
Table 4-4. Estimated Maximum Receptor Concentrations for Research Park 43
Table 4-5. Anticipated Emissions from Building Operations 44
Table 4-6. Summary of the Potential Effects of the Proposed Action and the No Action Alternative 53
Table B-1. Qualitative Likelihood Classification 64
Table B-2. Predicted Mean Doses from Airplane Crash at the CMR Building 64
Table B-3. Latent Cancer Fatalities at the Research Park 65

ACRONYMS AND TERMS

ac	*acre*
ac-ft	*acre feet*
ADTs	*average daily trips*
AECA	*Atomic Energy Community Act*
BMPs	*best management practices*
Btu	*British thermal unit*
CEDE	*committed effective dose equivalent*
CEQ	*Council on Environmental Quality*
cfs	*cubic feet per second*
cm	*centimeter*
CMR	*Chemical and Metallurgy Research*
CO	*carbon monoxide*
DARHT	*Dual Axis Radiographic Hydrodynamic Test*
dB	*decibel*
dBA	*A-weighted decibels*
DBH	*diameter at breast height*
DOE	*Department of Energy*
EA	*environmental assessment*
EDE	*effective dose equivalents*
EIS	*Environmental Impact Statement*
EPA	*Environmental Protection Agency*
ER	*Environmental Restoration*
ERPG	*Emergency Response Planning Guideline*
ft	*feet*
ft^2	*square feet*
g	*gram*
gal.	*gallon*
ha	*hectare*
HCN	*hydrogen cyanide*
HSWA	*Hazardous and Solid Waste Amendments*
in.	*inch*
IWMT	*Interagency Wildfire Management Team*
kg	*kilogram*
km	*kilometer*
km^2	*square kilometer*
kV	*kilovolt*
kW	*kilowatt*
L	*liter*
LAAO	*Los Alamos Area Office*
LANSCE	*Los Alamos Neutron Science Center*
LANL	*Los Alamos National Laboratory*
lb	*pound*
LCFs	*latent cancer fatalities*
m	*meter*
m^2	*square meter*
m^3	*cubic meter*
MAR	*material at risk*
MEI	*maximum exposed individual*
mi	*mile*
mrem	*millirem*
m/s	*meters per second*
MW	*megawatt*
MWh	*megawatt hours*
NAAQS	*National Ambient Air Quality Standards*
NEPA	*National Environmental Policy Act*
NHPA	*National Historic Preservation Act*
NMAAQS	*New Mexico Ambient Air Quality Standards*
NMED	*New Mexico Environment Department*
NO_2	*nitrogen dioxide*
NO_x	*nitrogen oxides*

NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O_3	ozone
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
Pb	lead
PHERMEX	Pulsed High-Energy Machine Emitting X-Rays
PM	particulate matter
ppm	pounds per meter
PRS	Potential Release Site
psi	pounds per square inch
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man; dose equivalent
ROI	region of influence
sec	second
SHPO	State Historic Preservation Officer
SNM	Special Nuclear Material
SOPs	standard operating procedures
SO_2	sulphur dioxide
SVOC	semivolatile organic compounds
SWEIS	Site-Wide Environmental Impact Statement
SWMU	Solid Waste Management Unit
SWPP	Stormwater Pollution Prevention
SWSC	Sanitary Wastewater Systems Consolidation
TA	technical area
TCP	Traditional Cultural Properties
TLDs	thermoluminescent dosimeters
TNT	trinitrotoluene
USFWS	United States Fish and Wildlife Service
yd^3	cubic yards
yrs	years

EXPONENTIAL NOTATION: Many values in the text and tables of the Environmental Assessment are expressed in exponential notation. An exponent is the power to which the expression, or number, is raised. This form of notation is used to conserve space and to focus attention on comparisons of the order of magnitude of the numbers (see examples):

1×10^4	=	10,000
1×10^2	=	100
1×10^0	=	1
1×10^{-2}	=	0.01
1×10^{-4}	=	0.0001

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EXECUTIVE SUMMARY

As part of its initiative to fulfill its responsibilities to provide support for the incorporated County of Los Alamos (the County) as an Atomic Energy Community, while simultaneously fulfilling its obligations to enhance the self-sufficiency of the County under authority of the Atomic Energy Community Act of 1955 (42 USC §§ 2342, 2343, 2391, and 2392) and the Defense Authorization Act (Public Law 104-106, § 3161), the U.S. Department of Energy (DOE) proposes to lease undeveloped land in Los Alamos, New Mexico, to the County for private sector use as a research park.

The Proposed Action is intended to accelerate economic development activities within the County by creating regional employment opportunities through offering federal land for private sector lease and use. As a result of the proposed land lease, any government expenditures for providing infrastructure to the property would be somewhat supplemented by tenant purchase of Los Alamos National Laboratory (LANL) expertise in research and development activities. The presence of a research park within LANL boundaries is expected to allow private sector tenants of the park to be able to quickly and efficiently call upon LANL scientific expertise and facility and equipment capabilities as part of their own research operations and LANL research personnel, in turn, would be challenged in areas complementary to their federally funded research. In this way a symbiotic relationship would be enjoyed by both parties while simultaneously promoting economic development for the County through new job opportunities at the Research Park and at LANL, new indirect support opportunities for the community at large, and through payment of the basic building space leases.

A "sliding-scale" approach (DOE 1993) is the basis for the analysis of effects in this Environmental Assessment (EA). That is, certain aspects of the Proposed Action have a greater potential for creating adverse environmental effects than others; therefore, they are discussed in greater detail in this EA than those aspects of the action that have little potential for effect.

The Proposed Action would result in an increase of as many as 1,500 new direct jobs and, as many as 2,565 indirect jobs could be created from the development of a research park. Lease of the tract would not reduce the size of LANL or change its site boundary.. However, approximately 30 ac (12 ha) of a 60-ac (24-ha) tract would be changed from an undeveloped to a developed status.

Under the No Action Alternative, no transfer or lease of Federal lands would occur. LANL would not have the benefit of its research personnel working on a variety of complementary research efforts beyond their federally funded responsibilities. No new jobs would be created from proposed development activities. Undeveloped lands would remain in their current condition.

Two hypothetical accidents were analyzed that evaluated a potential chemical release and radiological doses to the public from hypothetical accidents at the proposed Research Park. Neither accident scenario resulted in potentially serious health effects for workers or the public at the proposed Research Park.

The cumulative effects of the Proposed Action as well as reasonably foreseeable related actions could result in potential adverse health effects. Environmental effects would be limited to the loss of a small amount of wildlife habitat. Additional economic development would be expected to occur.

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1.0 PURPOSE AND NEED FOR AGENCY ACTION

1.1 Introduction

As part of its initiative to fulfill its responsibilities to provide support to the County of Los Alamos (the County) as an Atomic Energy Community, while simultaneously fulfilling its obligations to enhance the self-sufficiency of the County under authority of the Atomic Energy Community Act of 1955 (42 USC §§ 2342, 2343, 2391, and 2392) and the Defense Authorization Act (Public Law 104-106, § 3161), the U.S. Department of Energy (DOE) proposes to lease to the County or its designees certain undeveloped land that is part of Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico, for private sector use as a research park. In this document, when discussing the leasing of land to the County or its designees, the term "the County" is intended to include both parties. All estimates of acreage used in this document are approximated. Actual acreages may vary slightly from the estimates provided here.

The National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.), requires DOE to consider the environmental consequences of Proposed Actions before decisions are made. In complying with NEPA, DOE follows the Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508) and DOE's own NEPA implementing procedures (10 CFR 1021). The purpose of an Environmental Assessment (EA) is to provide DOE with sufficient evidence and analysis to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact. In this case, the DOE decision to be made is whether to lease a certain tract of land. The focus of the environmental analysis is on subsequent property development and use by the County, tenants, or other third parties that could occur only if DOE decides to implement the lease of the subject tract for use as a research park. The objectives of this EA are (1) to describe the baseline environmental conditions at the location involved in the Proposed Action, (2) to analyze potential effects to the baseline environment from land development activities and future occupants' operations occurring at the tract location, and (3) to identify and characterize cumulative effects of future anticipated uses of the Research Park together with those of surrounding properties. In addition, the EA provides DOE with environmental information that would be used in developing potential lease provisions together with land use provisions serving to preserve the integrity of the human environment and natural ecosystems should DOE decide to proceed with the Proposed Action.

1.2 Background

The general Los Alamos, New Mexico area was occupied primarily by small ranches and farms until 1942 when the nation underwent a dramatic change upon its entry into World War II. At that time, the Los Alamos Boys School (then the single largest private land holding in the Los Alamos area), together with portions of surrounding properties, were chosen as the location of a secret research and development facility for the world's first nuclear weapon by the Federal government, Manhattan District of the Army Corps of Engineers. The original facility and its operations were referred to as Project Y of the Manhattan Project, and later were redesignated as LANL (Figure 1-1). Additionally, the Federal agency with management responsibility for LANL evolved from the post-World War II Atomic Energy Commission and the Energy Research and Development Administration to DOE. For more than 50 years, Federal activities conducted at LANL have strongly influenced the social and economic characteristics of the Los Alamos community and the surrounding region. Construction of LANL facilities and structures within the present-day designated boundaries began in the 1940s, with all of the main laboratory functions having now been moved onto the mesas located south of the Los Alamos Townsite (Townsite). LANL is organized geographically and functionally by technical areas (TAs) shown in Figure 1-2.

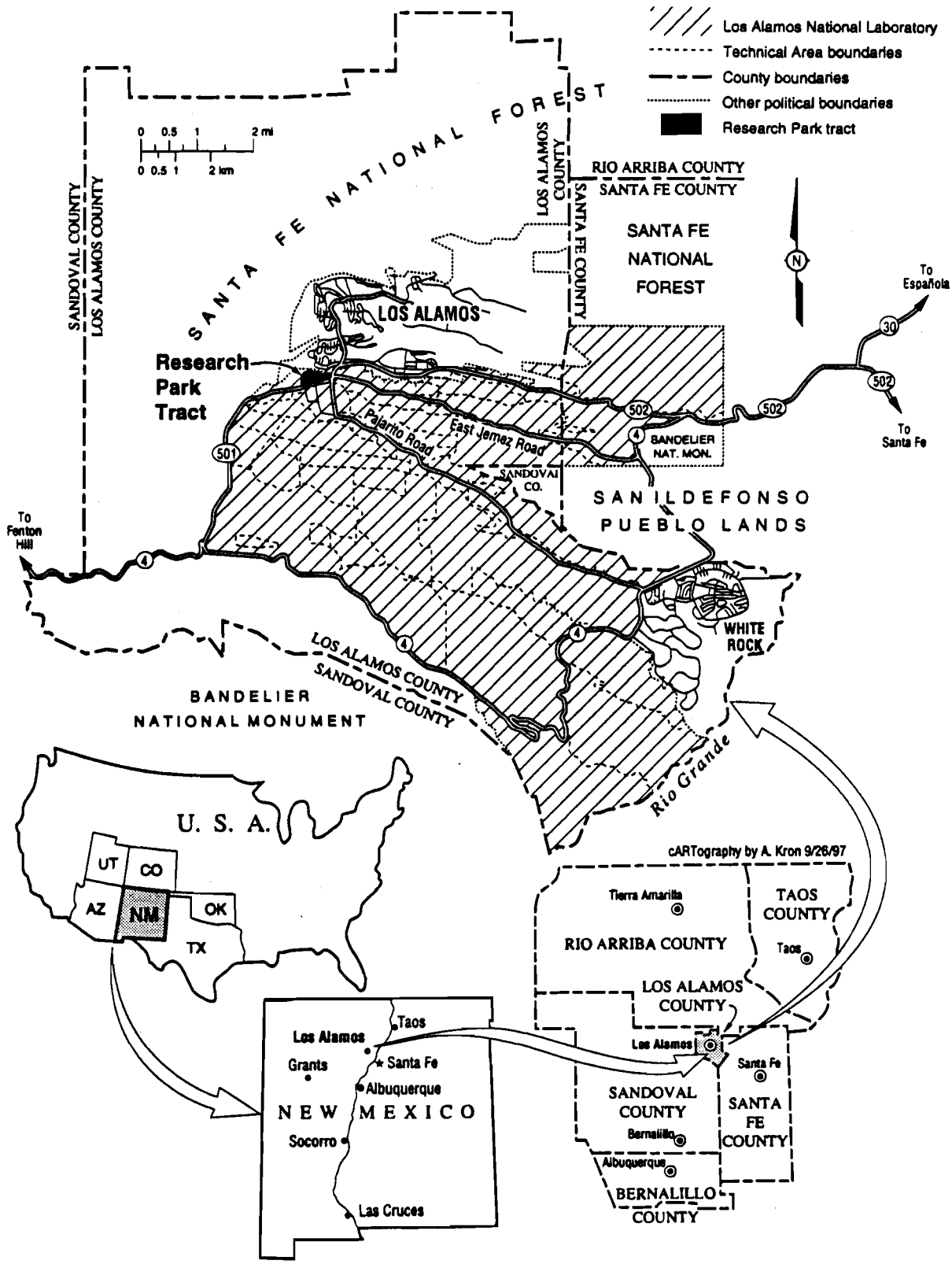

Figure 1-1. Location of Los Alamos National Laboratory and Research Park tract.

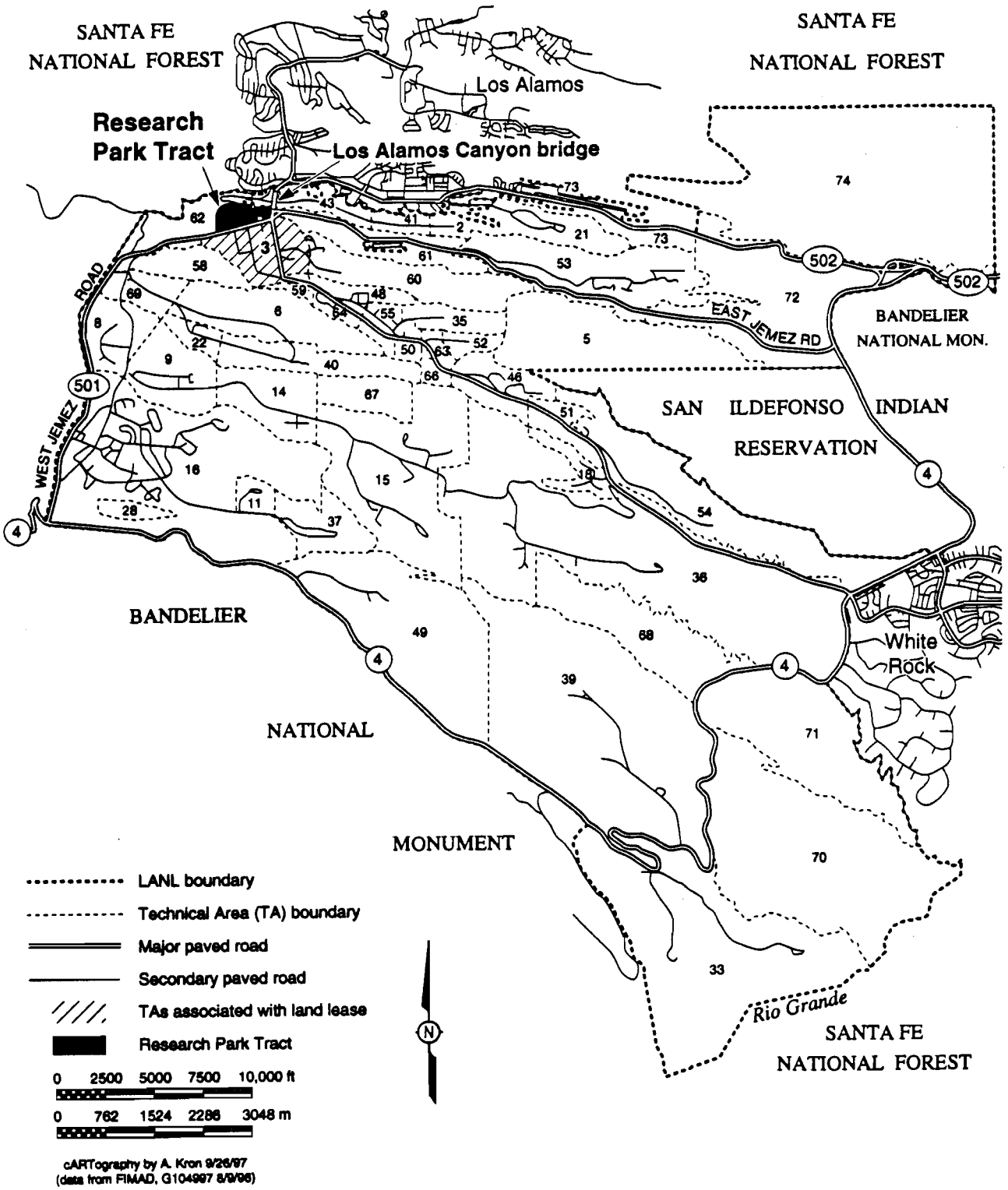

Figure 1-2. Los Alamos National Laboratory showing TAs affected by the land lease.

Under the Atomic Energy Community Act of 1955 (AECA, 42 USC § 2391), the Federal government recognized its responsibility to provide support to agencies or municipalities that were very strongly affected by their proximity to facilities that are part of the nation's nuclear weapons complex, namely, the three so-called Atomic Energy Communities (Oak Ridge, Tennessee; Richland, Washington; and Los Alamos, New Mexico), while they achieved self-sufficiency. Under the provisions of the AECA, national policies were established regarding the obligations of the United States to the three Atomic Energy Communities, and these policies were directed at terminating Federal government ownership and management of the communities by facilitating the establishment of local self-government; providing for the orderly transfer to local entities of municipal functions; and providing for the orderly sale to private purchasers of property within these communities with a minimum of dislocation. The establishment of self-government and transfer of infrastructures and land were intended for the purpose of encouraging self-sufficiency of the communities through the establishment of a broad base for economic development.

In 1949, the New Mexico legislature created Los Alamos County from portions of Santa Fe and Sandoval Counties. However, the County remained Federal government property until legislation was passed in 1965 that changed the status of the County to a more traditional government entity, and subsequently allowed DOE to move forward with the transfer and lease of certain Federal lands under its management to the County, other government agencies, and to private parties. In 1967, DOE's predecessor agencies began to transfer ownership of certain land tracts, roads, buildings, and some of the utility systems managed by LANL to the County to be made available for public use. The Federal government also established leases for certain small tracts of land that it owned located within the County.

Because of changes in mission and underutilization of some facilities across the DOE complex, DOE's land and facility use and transfer policy has continued to change in recent years. In December 1993, DOE directed agency officials at each of its major sites to "implement a site-specific process to identify future-use options based on the unique characteristics of the site and stakeholder needs" (Pearman and Grumbly 1993). Subsequent to this directive, DOE's former Secretary Hazel O'Leary issued a *Land and Facility Use Policy* for returning lands to public use, stimulating local economies, ensuring public participation, and protecting natural resources.

This policy statement reiterates a commitment to integrating agency and community interests, as has been practiced in the County by DOE for at least 40 years. Since the 1950s, DOE and its predecessor agencies have sold or transferred approximately 27,850 ac (11,271 ha) of land from DOE management to the local community. These land transactions involved about 42 percent of the 66,181 ac (26,784 ha) of the original Manhattan Project land area and neighboring properties obtained by the Federal government from 1942 through 1948 in the Los Alamos area. More than half of these transfers were to private parties for housing, churches, businesses, and other community needs.

The current multipurpose work conducted at LANL reflects DOE's major program activities that include Defense Programs, Nuclear Nonproliferation, Energy Research, and Environmental Management missions. LANL activities focus on technology research and development, education and training, technology transfer for DOE and others, environmental restoration, waste management, and the nation's nuclear weapons stockpile stewardship and management support. Some tracts of land have been recognized by DOE and LANL as nonessential to meet LANL's current and foreseeable programmatic missions. These tracts of land may be leased or otherwise transferred to the County to further its self-sufficiency goal.

DOE has reviewed its responsibility to further the self-sufficiencies of the Atomic Energy Communities, including Los Alamos, in the face of increasing budgetary constraints and pressures, together with the downsizing or closure of some of the facilities within the nuclear weapons complex. Various potential means exist for mitigating the reduction or removal of monetary support from the agencies or municipalities. As stated in the closing chapters of the AECA of 1955, as amended, " . . . *the Administrator shall assure that the governmental or other entities receiving assistance hereunder utilize*

all reasonable, available means to achieve financial self-sufficiency to the end that assistance payments by the Administrator may be reduced or terminated at the earliest practical time." In spite of efforts to the contrary, the transfer and self-sufficiency process has been slower for Los Alamos than for other Atomic Energy Communities due to its unique nature and location. In October 1996, the federal government enacted legislation, the Energy and Water Development Appropriations Act of 1997, to terminate the annual assistance payments to the County by mid 1997. DOE regards this land lease as being intertwined with both the issues of County self-sufficiency and the elimination of funding for assistance payments.

1.3 Purpose of and Need for DOE Action

DOE is responsible for providing support to the County as an Atomic Energy Community, under authority of the AECA of 1955 (42 § 2301- 2394), as amended, while being obligated to facilitate the furtherance of County self-sufficiency. The most recent annual subsidy payment to the County occurred in 1996 and was in the amount of approximately 2.6 million dollars. A lump sum payment of approximately 17 million dollars was made to the County in April 1997, as authorized by the Energy and Water Development Appropriations Act of 1997. Up to 5 million dollars may follow at a later time. These payments, totaling 22 million dollars, represent a one-time, final assistance payment from the Federal Government to the County of Los Alamos. DOE needs to help the County in its effort to become self-sufficient by providing other means by which the elimination of annual assistance payments can be offset. The principal means at the government's disposal is the transfer of land. DOE can meet this need while meeting its legal obligations by affecting a long-term lease of property to the County for the purpose of encouraging self-sufficiency. The leasing of DOE property in the immediate vicinity of the core LANL operations area would be a highly advantageous location for encouraging economic development at this time.

To meet its purpose and need for action in a timely fashion as a part of its fulfillment of meeting its responsibilities and obligations to aide in the self-sufficiency of the County, DOE proposes to engage in a lease of 55 years with options for renewal of federal land to the County in Los Alamos, New Mexico, for development and private sector use as a research park. The Proposed Action is intended to accelerate economic development activities within the County by creating regional employment opportunities by offering underutilized Federal land for private sector use. As a result of the proposed lease of land to the County, DOE expenditures for providing limited modifications to the infrastructure for the property would be offset by tenant purchase of LANL expertise in research and development activities. The presence of a research park within LANL boundaries is expected to allow private sector tenants of the park to be able to quickly and efficiently call upon LANL scientific expertise and facility and equipment capabilities as part of their own research operations. LANL research personnel, in turn, would be challenged and utilized in areas complementary to their federally funded research. In this way a symbiotic relationship would be enjoyed by both parties while simultaneously promoting economic development for the County through new job opportunities at the Research Park and at LANL, new indirect support opportunities for the community at large, and through an increased tax base and building space lease payments. The lease is ripe for a DOE decision at this time because the County has identified not only the future proposed use of the land tract, but has had some strong indications of interest from private sector corporations for development within the County.

1.4 Scope of This EA

A "sliding-scale" approach (DOE 1993) is the basis for the analysis of potential environmental and socioeconomic effects in this EA. That is, certain aspects of the Proposed Action have a greater potential for creating adverse environmental effects than others; therefore, they are discussed in greater detail in this EA than those aspects of the action that have little potential for effect. For example, implementation of the Proposed Action could slightly increase noise levels from land development activities, which could in turn result in a negligible increase in local noise levels. The EA, therefore, presents descriptive information on noise only to the extent necessary for effects analysis, and not for the entire County. On the other hand,

implementation of the Proposed Action could potentially affect the socioeconomic environment. Thus, a more in-depth description of the affected environment and analysis of potential effects regarding this issue is presented.

When details about a Proposed Action are incomplete, as they are for the Proposed Action evaluated in this EA (that is, for example, the exact future use of leased floor space by tenants of the Research Park is unknown at this time), a "bounding" analysis is often used to assess potential effects. When this approach is used, reasonable maximum assumptions are made regarding emissions, effluents, waste streams, and project activities (see Sections 2.0 and 4.0 of the EA). Such an analysis usually provides an overestimation of potential effects. In addition, any proposed future action(s) that exceeds the assumptions ("bounds") of this effects analysis would not be allowed until an additional NEPA review could be performed and a decision to proceed with that action(s) is then made.

1.5 Public Involvement

DOE provided written notification of this NEPA review to the State of New Mexico, the four Accord Pueblos[1] (San Ildefonso, Santa Clara, Jemez, and Cochiti), the Mescalero Apache, and to over 30 known stakeholders in the County area in March 1997. On July 24, 1997, the Predecisional Draft EA was provided to the State, the four Accord Pueblos, and the Mescalero Apache for review and comment at the same time that it was made available to the public for review through placement in the DOE Public Reading Rooms at Los Alamos and Albuquerque. Upon request, the Predecisional Draft EA was provided to all interested parties for their review. The Predecisional Draft EA was also made available for public review through the World Wide Web Computer Internet System at http://www.laao.doe.gov/. Additionally, a public stakeholder meeting to discuss land transfers was held on February 18, 1997 at the DOE's Los Alamos Area Office (LAAO).

As a result of the public review and comment process for the Predecisional Draft EA, DOE received comments from the U.S. Fish and Wildlife Service, the State of New Mexico, and a member of the public. In general, comments addressed construction in the vicinity of threatened or endangered species, former LANL waste sites, aesthetics, noise, negative effect on property values, and vehicular traffic. DOE considered these comments and modified the final EA as appropriate. Formal responses were provided by DOE to the respondents and these are available for review at the DOE public reading rooms.

[1] Accord refers to the written agreements signed by DOE and the four Pueblos on December 8, 1992, stating the basic understanding and commitments of the parties and describing the general framework for their working together. Subsequently, cooperative agreements between each Pueblo and DOE, and between each Pueblo and the University of California have been signed, which specify further details related to the accord agreements.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This section describes the Proposed Action and discusses alternatives considered for enabling DOE to meet its purpose and need for agency action. The No Action Alternative is analyzed as a baseline to compare with the consequences of implementing the Proposed Action. Alternatives that were considered but were not analyzed further in this EA are discussed in Section 2.3.

2.1 Description of the Proposed Action

DOE proposes to lease to the County an approximately 60-ac (24-ha)[2] tract of land located in TA-3 at LANL. This tract is bounded in general, but not strictly, by Diamond Drive on the east, West Jemez Road on the south, West Road on the west, and Los Alamos Canyon on the north. The leased land would be used to establish a research park tentatively referred to as the Los Alamos Research Park (Research Park). This tract of land is currently part of LANL and is located in TA-3. The term of the lease is expected to be 55 years with options for renewal depending upon final agreements between the County and DOE. The tract of land would be developed by the County or third parties within 5 to 10 years of the date of the lease and used for a research park. Research parks are professional developments that allow a wide range of companies to work within the same geographic location and to benefit from a well-planned environment suited to business needs. The County recommended that the type of research park best suited for Los Alamos would include freestanding buildings with landscaping and a possible atrium arrangement between related structures (LAC 1994).

2.1.1 Location and Description of the Research Park

The general location of the proposed lease tract for the Research Park is shown in Figure 1-2. The specific area being considered for lease is highlighted in Figure 2-1. Currently the tract is partially developed for use as parking lots along with vacant land covered by native vegetation. The tract was previously disturbed by surface activities and is a prior site for dry land farming and small facilities or structures. Although, the proposed lease tract for the Research Park is Federal land and as such, is not subject to land use controls by the County, the tract is designated as "Federal Lands or FL" for County planning purposes.

Existing water, sewer, and gas mains, together with electric utility lines, bisect the proposed lease tract. A 14-in.- (35-cm-) diameter steel water transmission line runs from the S-Site Booster Station No. 1 (north of Los Alamos Canyon), through the proposed tract, to the S-Site water tanks located at TA-16. Sanitary sewer lines exist at the southeast corner of the proposed lease tract (County Feasibility Study). A 500 psi (10 in. [23 cm] diameter) high-pressure gas transmission line runs along the entire southern boundary of the tract. A 13.2-kV overhead power line runs along the entire southern boundary of the tract. One water tank (Pajarito 4) is located near the tract; this tank is active and serves TA-3 and the Los Alamos Neutron Science Center (LANSCE) on East Jemez Road. Some of these utilities may be relocated as part of the site development of the Research Park.

The Research Park would be situated close to core LANL operating areas so that the park tenants could benefit from LANL expertise and provide for the most efficient use of mutual resources and existing infrastructure. The Research Park tract is adjacent to Federal property that might be considered for lease or transfer at a later date. If that adjacent tract is considered for transfer or lease in the future, additional NEPA reviews would be required at the time the contemplated action is proposed and ripe for decision.

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[2] The amount of acreage which is articulated in this document should not be construed as absolute for the purpose of conveyance.

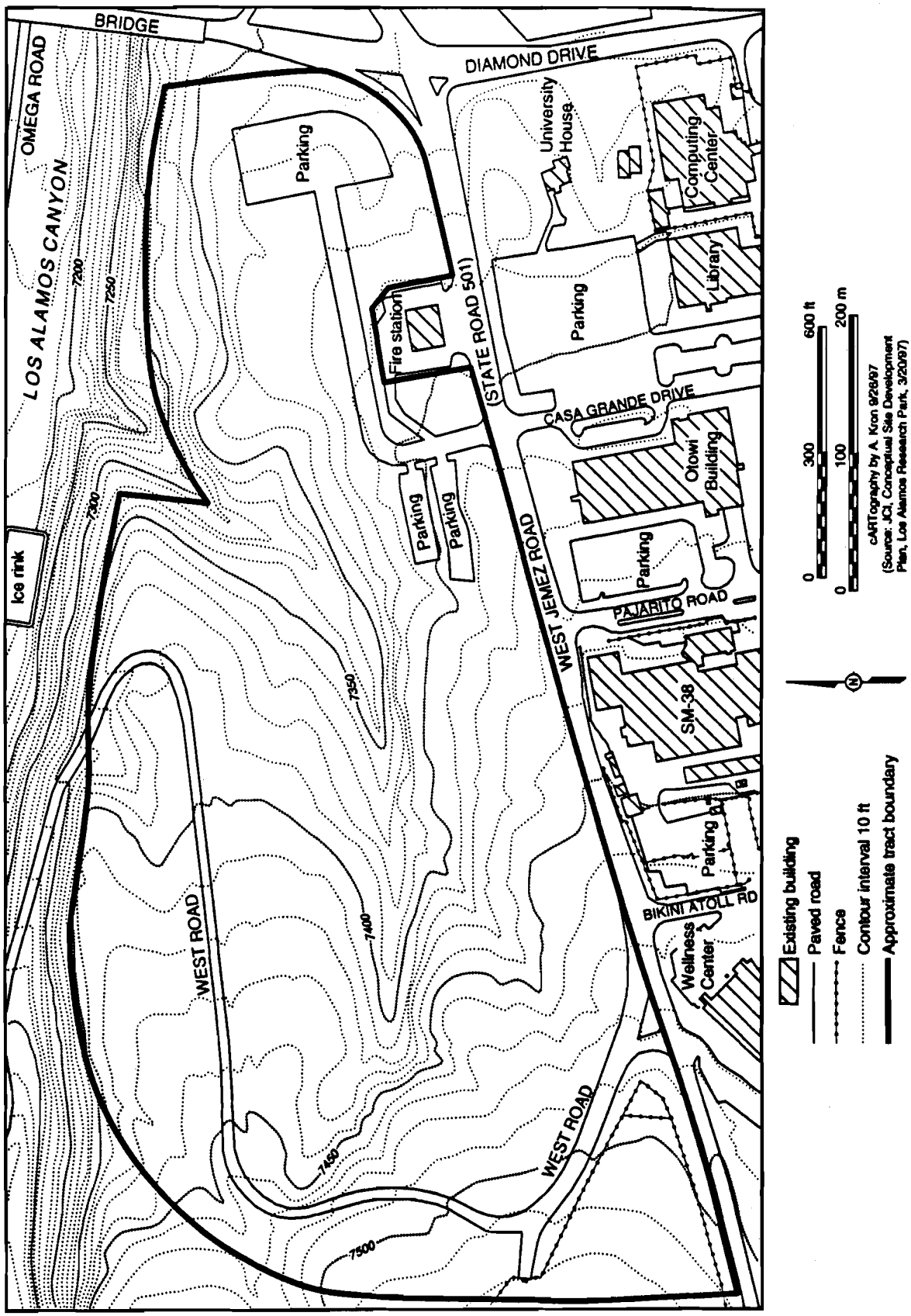

Figure 2-1. Location of proposed Research Park.

2.1.2 Proposed Land Use

Although the Research Park tract would remain in the ownership of the Federal government, it would be leased to the County for construction, development, and operation of a research park. Detailed restrictions on the type, extent, and intensity of development applicable to the leased tract would be negotiated between DOE and the County prior to the implementation of the lease. In general, the restrictions would prohibit the County and any future tenants from developing the tract for residential uses[3], heavy industrial uses[4], or any other uses that would be inconsistent with or limiting to LANL mission operations. The existing DOE property site boundary would not change under the Proposed Action. Improvements to the tract, including utilities, roads, and new construction and support services would be the responsibility of the County or their sublessees, or DOE could chose to make certain improvements with provisions for County repayment over time. DOE, the County, and any sublessees would jointly ensure that all tract improvements and uses are consistent with the terms of the lease once it has been negotiated and executed.

The anticipated Research Park could be composed of up to ten variably sized office buildings and supporting infrastructure built to appropriate County and State buildings codes. A total of about 300,000 ft^2 (27,870 m^2) of floor space is planned for the site with parking for up to 1,400 cars. No building would be over 50 ft (16 m) above ground level in accordance with County building code requirements. Up to 1,500 employees are anticipated to occupy the Research Park after its completion. Roadway improvements planned as part of this development include the relocation of a segment of West Road and the intersection of West Road and West Jemez Road as well as the widening of West Road within the boundaries of the park. The construction of an acceleration and deceleration lane on the north side of West Jemez Road would be needed. Modifications to the traffic signals on West Jemez Road at Casa Grande and Pajarito Roads would be required. In addition, it is anticipated that West Jemez Road would be widened to six lanes. Diamond Drive, between West Jemez and Pajarito Roads, would be widened to five lanes. The Research Park may be served by LANL or County utilities depending upon final agreements. New utility lines and roadway realignment and improvements could require new right-of-ways across DOE and County land.

Two examples of conceptual layout options are shown in Figures 2-2 and 2-3. The proposed tract of land could be leased as individual or multiple building sites to support County needs or to address construction schedules. Construction of Research Park buildings would be anticipated to begin on the eastern end of the tract. It is anticipated that it would take 5 to 10 years from the date of the lease to complete the construction of all new site facilities. During that period, the first buildings on the tract could be occupied and research activities could proceed while construction activities at other portions of the tract were being conducted.

About half of the tract is appropriate for building (the portions of the site with slopes of less than 20 percent); thus a maximum of about 30 ac (12 ha) could be disturbed across the tract. There would be no construction on areas of greater than 20 percent slope. Clearing or excavation activities during site construction have the potential to generate dust and to encounter previously buried materials. If buried material or remains of cultural significance are encountered during construction, activities would cease until their significance was determined. Standard dust suppression methods (such as water spraying) would be used to minimize the generation of dust during all phases of construction activities.

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[3] In general the term "residential use" is intended to include such possible uses as high-density multifamily dwellings (e.g., apartments, condominiums, or town homes), single-family dwellings, motels, hotels, hospitals, nursing homes, child-care centers, and halfway houses.

[4] The term "heavy industrial use," as adapted from the County zoning ordinance, includes industrial activities which create noise, smoke, odor, dust, or similar emissions and generate truck traffic.

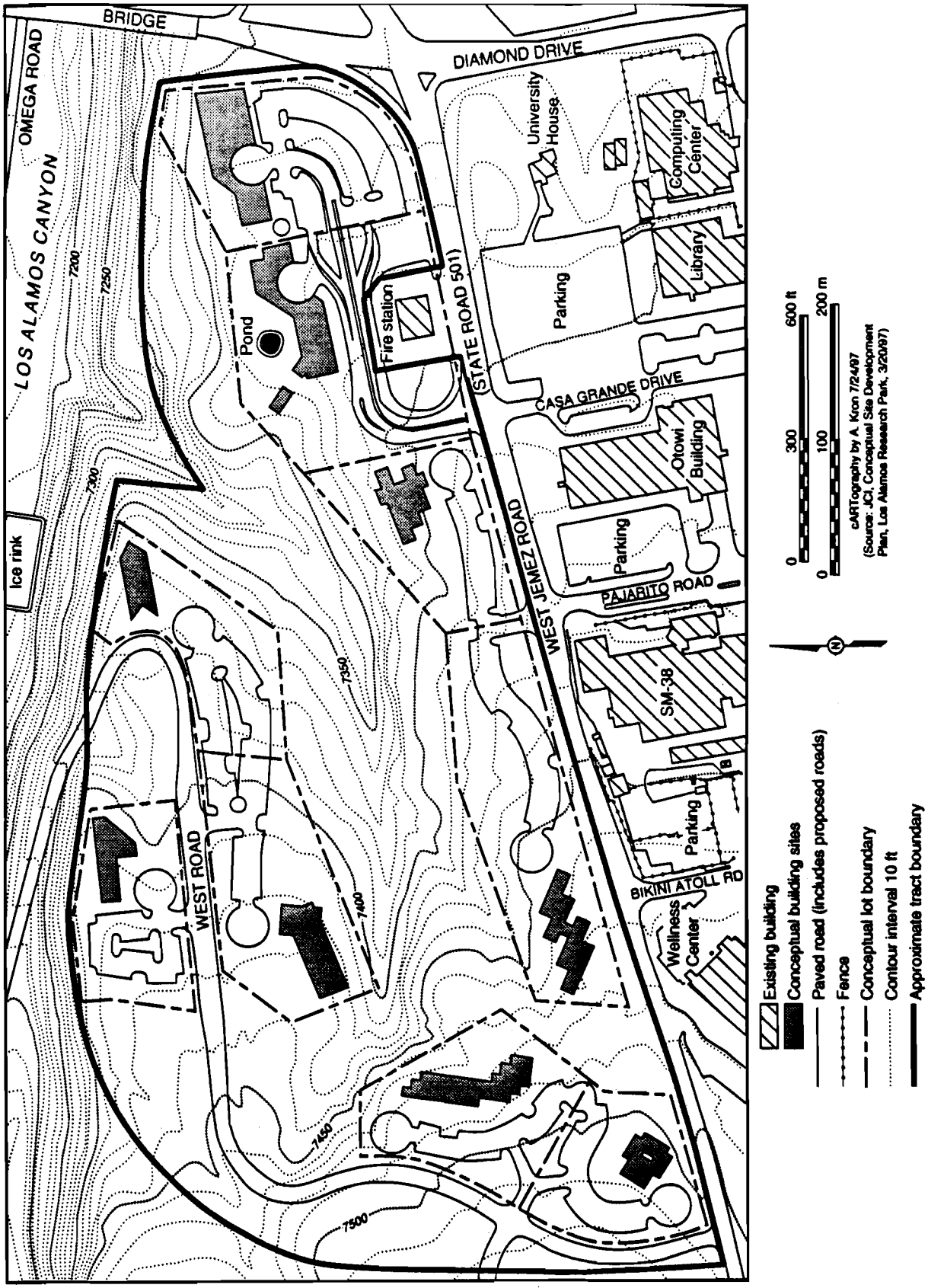

Figure 2-2. Conceptual site development plan for proposed Research Park.

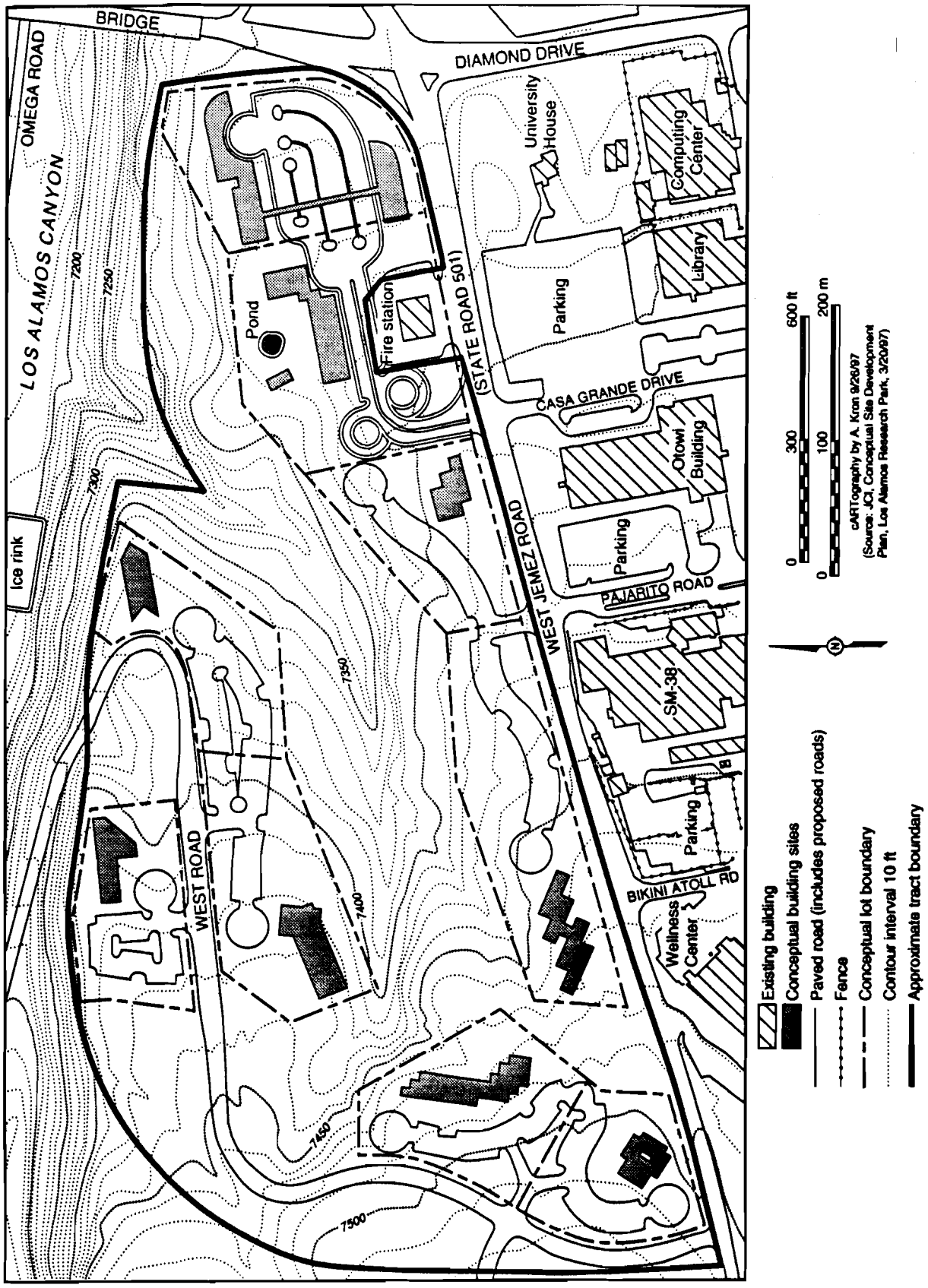

Figure 2-3. Conceptual site plan/Alternative No. 2 for proposed Research Park.

Some excavation activities may occur within or in the vicinity of a LANL Environmental Restoration (ER) Solid Waste Management Unit (SWMU) or Potential Release Site (PRS). To ensure the protection of the workers, all activities at these sites would be performed in accordance with requirements set forth in "Hazardous Waste Operations and Emergency Response" regulations (29 CFR 1910.120). LANL's ER Project staff would review activities in the Proposed Action that involve a SWMU or PRS and would stipulate procedures for working within that site area. It is anticipated that these sites would be approved for no further action by the New Mexico Environment Department (NMED) as the regulatory oversight agency for Resource Conservation and Recovery Act (RCRA) activities for the Environmental Protection Agency. However, DOE will fence the PRSs as appropriate to protect the sites from construction activities while awaiting the no further action approval by NMED. Remediation by the PRSs may be required before construction activities are allowed. DOE would review PRSs after the NMED has approved the sites for no further action to determine if, based on any remaining levels of site contamination, soil at the site could still be regulated as a hazardous, mixed, or radioactive waste. For those sites that still contain soil contamination above appropriate regulatory levels for waste disposal, DOE may chose to perform additional remediation before releasing the site, or may chose to not release these sites to the County for construction purposes.

No construction would be conducted within a floodplain or in a wetland. However, some activities that are a part of the Proposed Action may require work to be performed near a small pond on the site and near a drainage area located in the center of the Research Park tract. Appropriately engineered best management practices (BMPs) for each building, parking area, or roadway site would be implemented as part of a site Storm Water Pollution Prevention (SWPP) Plan executed under a National Pollutant Discharge Elimination System (NPDES) construction permit that would be obtained by the County or other appropriate entity (see Section 3.12 and 4.1.10). These BMPs may include the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain excavated soil and surface water discharge during construction of the Research Park. After each building is constructed, mounds of loose soil would be removed from the area. The site would be restored to natural-like contours and reseeded with an appropriate seed mix to stabilize the site. Permanent site engineered controls for stormwater run-off may include stormwater retention ponds, curbing, permeable asphalt, or use of timber or stone as rip-rap to slow water flow run-off.

DOE's goal would be to have the County maintain as much of the natural setting, forestation, and overall environmental integrity of the Research Park site as practical, as supported through the terms of the lease agreement. Disturbance and removal of vegetation at the Research Park would be limited to those areas necessary to accommodate building, roadway, and parking area footprints and work areas; total tree removal would only be allowed within 20 ft (6.0 m) from building footprints and 10 ft (3.0 m) within parking and roadways. No trees greater than 10 in. (25 cm) in diameter (measured at 4.5 ft [1.5 m] from the ground surface, which is also known as diameter at breast height) shall be cut and removed from areas with slope less than 20 degrees at distances greater than 20 ft (6.0 m) from building footprints or 10 ft (3.0 m) from parking lots and roadways without DOE's permission. No tree cutting or other disturbance would occur in areas with a greater than 20 percent slope, except as periodically permitted by DOE for wildland fire management purposes. Wildfire management planning is currently being developed for LANL. It is anticipated that certain management activities, such as tree thinning, would be put into effect at the Research Park. Tree thinning procedures would include the incorporation of BMPs, including protective measures against soil erosion and the use of manual timber cutting on the steeper slopes rather than the use of mechanical methods. Trees over the site could be thinned from September 1 through February 28, as necessary, to avoid the bird breeding season. The first thinning action could be conducted during the early stages of site development. This would ensure the least amount of site tenant disruption. Successive thinnings for fuel break maintenance could be done frequently on primarily sapling-stage trees to avoid any major site disturbances or effects to the site, tenants, or surrounding areas. Timber collected during the clearing of the tract for development or for wildland fire management purposes could be disposed of locally by the County.

Wastes from construction activities would be expected to be nonhazardous and could be disposed of in the County landfill. Construction materials would probably be procured primarily from local New Mexico suppliers. Construction workers would likely be drawn from local communities and communities across New Mexico and the southwest region of the United States.

Research activities would occur primarily in an office environment with some low-hazard laboratory-type activities possible (e.g., testing of electronic components). Only DOE approved and appropriately licensed radioactive sealed sources, materials that are less than Nuclear Facility Category 3 levels of radioactive materials (per DOE-STD-1027-92), and ionizing radiation producing equipment (such as x-ray machines) would be allowed to be used and stored at the Research Park. If there is a need to conduct higher hazard research activities, they would be performed in either existing LANL facilities or at other off-site government or commercial facilities. Minimal emissions of hazardous air pollutants and minimal amounts of hazardous wastes could be generated by routine operations conducted at the Research Park. Air emissions and generation of hazardous wastes would be regulated by the State of New Mexico. Any hazardous wastes would be the responsibility of the generating tenant and would be disposed of off-site at permitted commercial facilities. Solid waste would be disposed of at the existing County landfill or its replacement facility and would be regulated by the County (or other counties) and the State of New Mexico. Any radioactive waste or mixed waste generated at the Research Park would require disposal at an off-site, licensed facility. No liquid effluents would be discharged directly to the environment via NPDES-permitted outfalls.

Two options are considered for treating sanitary wastewater. Each option requires upgrades and trenching to connect to existing sanitary wastewater treatment systems. One option is to connect to the LANL sanitary treatment system. While the overall LANL system is operating at less than full capacity, the TA-3 area sewer is at full capacity and the necessary upgrades to the system to accommodate additional burden would include construction of a relief sewer, installation of a new pipeline, and discontinuing the use of two lift stations. The other option is to tie into the County sewage system at Fairway or the Los Alamos Medical Center by installing pipelines and a lift station to direct sewage through Los Alamos Canyon.

Site utility lines present over the tract may be rerouted before construction occurs at the individual affected building sites. New utilities may be added to the tract during or shortly after its buildout. Connecting utility lines to existing or new main lines would require trenching to bury the lines. As with other soil moving activities, dust suppression would be incorporated in the activity, and if any buried materials of cultural significance are encountered, construction would cease until their significance is determined. As part of the routine air monitoring program at LANL, air monitoring stations may be moved or set-up in proximity to the proposed Research Park.

At the end of each tenant's tenure at the Research Park, any necessary decontamination and decommissioning will be the responsibility of the tenant or the County and may be subject to further NEPA review. At the end of each facility's useful life final decontamination and decommissioning would be performed as needed. If required, separate NEPA analysis would be performed at that time.

2.2 No Action Alternative

The No Action alternative provides an environmental baseline to compare to the potential effects of the Proposed Action. It must be considered even if DOE is under a court order or legislative command to act [10 CFR 1021.321(c)]. Under the No Action alternative, the land tract would not be leased to the County. The tract could remain largely undeveloped or could be developed at some time in the future by DOE for some as yet undetermined use. Potential effects associated with the development and use of this tract of Federal land as planned by the County would not occur. The tract would continue to act as a buffer between LANL and the community of Los Alamos. The site would not generate waste and would not increase LANL or County utility use. The site would not generate additional traffic. The potential

research benefit to LANL and economic benefits the County from the development of this tract would not occur. Without economic development, the County would need to seek other alternatives to offset the loss of certain Federal subsidies in 1997.

Since the implementation of this alternative would not enable DOE to lease currently available land to the County that could be used for the benefit of LANL and the common good of the public and to mitigate the loss of Federal funds, the No Action alternative does not meet DOE's purpose and need for action. However, consistent with the CEQ and DOE NEPA regulations (40 CFR 1500 and 10 CFR 1021, respectively), this alternative is analyzed for comparison of potential effects with those of the Proposed Action in this EA.

2.3 Alternatives Considered but Dismissed from Further Consideration

Alternatives that have been considered but dismissed from detailed analysis include the following: 1) lease of the tract to a nongovernment entity, 2) lease of the tract to another Federal agency or Indian tribe, 3) transfer ownership of the proposed Research Park land to the County, 4) transfer of the land to entities other than the County, and 5) lease of a tract at another LANL location. Alternative 1, the lease of the land to a nongovernment lessee, would not allow DOE to fully meet its purpose and need for action because while the County would gain from the increased tax base and other economic benefits, it would not receive revenue in the form of lease payments. Alternative 2, the lease of the land tract to another Federal agency or Indian tribe also does not meet DOE's purpose and need for action for the same reason. This would, again, limit the economic benefits to the County. Alternative 3, the transfer of the proposed tract to the County, would meet the DOE's purpose and need for action, but is not considered a reasonable alternative at this time due to the experimental nature of establishing such a research park and uncertainty of the future need for the land to conduct LANL mission activities. Alternative 4, the transfer of the tract to other entities, would again not meet DOE's purpose and need fully, and is also not considered reasonable due to the uncertainty of future need for LANL mission activities. Alternative 5, the leasing of land at another LANL location to the County for development as a research park was considered for analysis, but was dismissed as unreasonable because locating the park at a distance from the LANL operations area at TA-3 would not facilitate the development of a close working relationship between LANL scientists and tenants of the park. TA-3 is considered the central core of LANL where roughly half of the staff work and where much of theoretical computation and experimental science is conducted. Because of this, siting the Research Park within TA-3 is considered essential to its success. In addition, it is anticipated that the environmental effects of choosing another LANL site would approximate those resulting at the TA-3 area location. Therefore, these alternatives were dismissed from further analysis in this EA.

3.0 AFFECTED ENVIRONMENT

Section 3.0 describes the natural and human environment that could be affected by either the Proposed Action or No Action alternative. Environmental media not likely to be affected are addressed in minimal detail. Detailed descriptions of LANL's physical and socioeconomic environment, its climate, meteorology, hydrology, cultural resources, waste management, floodplains, wetlands, and threatened and endangered species are presented in the 1979 Final EIS for Los Alamos Scientific Laboratory Site (DOE 1979) and the most recent Environmental Surveillance at Los Alamos during 1995 (LANL 1996a).

3.1 Regional Setting

LANL is a government-owned, contractor-operated multidisciplinary research facility that is located on 43 mi^2 (111 km^2) of land in north-central New Mexico approximately 60 mi (100 km) north of Albuquerque. It comprises a significant portion of Los Alamos County and extends into Santa Fe County.

Commercial and residential development in the County is confined primarily to several mesa tops lying north of the core LANL facility, in the case of the Townsite, or southeast, in the case of White Rock and Pajarito Acres communities. The lands surrounding the County are largely undeveloped wooded areas with large tracts located to the north, west, and south of LANL administered by the U.S. Forest Service (Santa Fe National Forest), the National Park Service (Bandelier National Monument), and the Bureau of Land Management (to the east). The San Ildefonso Pueblo borders LANL to the east. The industrially developed acreage at LANL consists of approximately 30 active TAs.

Recreational resources such as hiking trails, parks, and athletic facilities are abundant in the County. Recreational opportunities such as camping, fishing, and hunting (U. S. Forest Service lands) are available on the surrounding Federal lands. In 1976, the US Energy Research and Development Administration designated LANL as a National Environmental Research Park, which is used by the national scientific community as an outdoor laboratory to study the impacts of human activities on the Southwest woodland ecosystems existing at the site (ERDA 1977).

Four publicly accessible vehicle routes convey traffic to and from LANL (Figure 1-1). State Road 502 (Main Hill Road) is heavily used by commuter traffic from Santa Fe and Española. State Roads 4 and 501 provide access to LANL for small communities to the west of LANL. East Jemez Road and Pajarito Road are DOE owned and provide public access to many of the TAs at LANL. In addition to private vehicles, DOE and LANL employee and government vehicles contribute extensively to the volume of traffic on each of these roadways.

The proposed Research Park lease tract, composed of part of TA-3, is located alongside the south side of Los Alamos Canyon. The deep canyon topography combined with the forested slopes create irregular wind patterns on the mesas and in the canyons. Different wind intensities and directions may occur on the mesas and in the canyons due to variable air temperatures.

The Pajarito Plateau has four distinct seasons. Precipitation occurs primarily during the summer and winter seasons. The County has a semiarid, temperate mountain climate. This climate is characterized by seasonal, variable rainfall with precipitation rates ranging from 10 to 20 in. (25 to 51 cm) per year. Average minimum and maximum temperatures, based on 19- and 15-year means for the community of Los Alamos, have dropped as low as -18°F (-28°C) and have reached as high as 95°F (35°C). The average mean annual precipitation rate for Los Alamos from 1961 to 1990 was approximately 19 in. (48 cm).

3.2 Potential Environmental Issues

Based on the proposed project description, potential environmental resources that may be affected as a result of implementing the Proposed Action have been considered. Environmental issues were identified and either addressed or not analyzed, depending upon their individual applicability to the vicinity of the Proposed Action. Table 3-1 identifies the subsection where potential environmental issues are discussed or notes why they are not addressed in this document.

Table 3-1. Potential Environmental Issues

Potential Issue	Applicability	Described in Section
Socioeconomics	Yes	Sections 3.3; 4.1.1; 4.2.1
Land Use/Traffic	Yes	Sections 3.4; 4.1.2; 4.2.2
Ecological Resources/Wetlands/Floodplains	Yes	Sections 3.5; 4.1.3; 4.2.3
Environmental Restoration/Waste Management	Yes	Sections 3.6; 4.1.4; 4.2.4
Aesthetics	Yes	Sections 3.7; 4.1.5; 4.2.5
Human Health	Yes	Sections 3.8; 4.1.6; 4.2.6
Air Quality	Yes	Sections 3.9; 4.1.7; 4.2.7
Noise Levels	Yes	Sections 3.10; 4.1.8; 4.2.8
Cultural Resources	Yes	Sections 3.11; 4.1.9; 4.2.9
Water Quality	Yes	Sections 3.12; 4.1.10; 4.2.10
Environmental Justice	NA-none affected	Section 3.13
Natural Resources: Parks, forests, conservation areas, or areas of importance for public recreation	NA-negligible	Section 3.14
Seismology and Geology	NA-not applicable, buildings would meet codes	NA
Wild Horses and Burros	NA-none present	NA
Prime Farmland	NA-none present	NA
Coral Reefs and Tundra	NA-none present	NA

3.3 Socioeconomic Conditions

A socioeconomic assessment focuses on the social, economic, and demographic characteristics of an area. The socioeconomic environment can be affected by changes in employment, income, and population, which, in turn, can affect area resources such as housing, community services, and infrastructure.

Los Alamos County has an estimated population of 18,604 (Sunwest 1996, preliminary figure for 1995). Statistics for population, housing, and public infrastructure are based on the region of influence (ROI), a three-county area in which approximately 90 percent of LANL employees[5] reside. The ROI includes the counties of Los Alamos (with 50.4 percent of LANL employees), Rio Arriba (21.0 percent), and Santa Fe (18.3 percent) (LANL 1997). The ROI experienced a population growth of approximately 13.6 percent between 1990 and 1995, with a 1995 total population of about 172,000 persons (Sunwest 1996). By the year 2000, population in the ROI is expected to be approximately 195,000 persons (projection is based on figures in Sunwest 1996).

[5] University of California, Johnson Controls, Inc., and Protection Technology of Los Alamos employees only; residence and employment figures do not include contract labor, affiliates, or special program guests.

In January 1996, LANL employed approximately 8,936 persons[5] in the ROI accounting for 10.4 percent of the total ROI employment (85,721) (LANL 1996b and Sunwest 1996). Nonagricultural employment in New Mexico increased by 4.9 percent in 1995; Los Alamos and Santa Fe Counties had a 2.9 percent increase. Unemployment in the ROI for 1995 was 5.76 percent (Sunwest 1996).

The number of vacant housing units in the ROI increased from approximately 4,358 units in 1980 to 6,872 units in 1990, a 58 percent increase in ten years (BER 1992). In the year 2000 there would be about 10,858 total vacant units if current trends continue.

The County is responsible for residential and commercial distribution of gas, water, electricity, and sewer services to the community on the north side of Los Alamos Canyon bridge. DOE currently owns and operates all utilities on the south side of Los Alamos Canyon bridge on LANL property. DOE also owns and operates the county-wide water production and distribution system. Transfer or lease of the water production system to the County is being contemplated.

In 1985, DOE and the County agreed to pool their electrical generating and transmission resources and to share costs based on usage. Electrical power sources for the Los Alamos Resource Pool include a number of coal, natural gas, and hydroelectric power generators throughout the western United States. As needed, power can also be generated locally at LANL's TA-3 power plant which has an approximately 12- to 15-MW maximum output. Although power generation at the various sources is not a problem, regional transmission limitations have affected the amount of power available for DOE and the County.

Due to the aging infrastructure at LANL, portions of LANL's electrical transmission system need to be upgraded. The TA-3 transmission system, near the proposed Research Park, is one such system where the necessary upgrades have been identified but are currently unfunded. Table 3-2 shows current County and LANL use and capacity figures for electricity, water, and natural gas. For a discussion of current sanitary sewer use and capacity, see Section 3.6.

Approximately 3,550 students are enrolled in Los Alamos public schools (19 percent of the County's population) (LAPS 1997). The ratio of uniformed police officers to residents is currently 1 to 581 (LAPD 1997). The ratio of uniformed firemen to residents is 1 to 177 (LAFD 1997).

Most of the revenue generated by the County in fiscal year 1996[6] (approximately 73.6 million dollars) can be broken down as follows: 53 percent from utilities, 15 percent from gross receipts tax, 11 percent from the DOE fire contract, 7 percent from investment income, 4 percent from DOE assistance payments, and 4 percent from property taxes. The remaining revenue comes from other taxes, other service charges, and other intergovernmental sources (LA Finance Department 1997).

In October 1996, the President signed the Energy and Water Development Appropriations Act of 1997 authorizing a lump sum payment to the County of about 22.6 million dollars. This payment is a buyout of DOE assistance payments in compliance with the AECA. On April 15, 1997, the County received the largest portion of the buyout money, 17.6 million dollars. The remaining 5 million dollars is subject to future transfers of DOE facilities to the County, including the water system and the airport.

[6] County FY96 = June 1995 to July 1996.

Table 3-2. Utilities: Usage and Capacity

Utilities	LANL	Los Alamos County
Electrical	peak Los Alamos Resource Pool usage per hour - 76 MW[3] (Summer 1991) (LANL metered usage - 366,158 MWh per year[3]) peak Los Alamos Resource Pool capacity - (maximum output per hour) - 99 to 117 MW	peak Los Alamos Resource Pool usage per hour - 76 MW[3] (Summer 1991) (County metered usage - 87,139 MWh per year[2]) peak Los Alamos Resource Pool capacity - (maximum output per hour) - 99 to 117 MW
Water	usage- 322,658,000 gallons per year[1] (*1,221,260,500 liters*) 1,406,058,000 gallons yearly production[1] (*5,321,929,500 liters*) [includes both the LANL and County water supply] (DOE water rights - 5,541.3 ac-ft/year* from main aquifer. DOE can buy an additional 1,200 ac-ft/year† from San Juan-Chama Transmountain Diversion Project[4])	usage- 1,082,400,000 gallons per year[2] (*4,096,884,000 liters*) see LANL water production
Natural Gas	usage- 1,365,996 million Btu per year[1] capacity (contractual)- 10,000 million Btu per day or 3,650,000 million Btu per year[1]	usage- 1,059,420 million Btu per year[2] capacity (contractual)- 10,101 million Btu per day or 3,686,865 million Btu per year[5]

1 Information from Jerome Gonzales, LANL FSS-8, record of communication, 4/16/97.

2 Information from John Arrowsmith, Los Alamos County Utility Department, Final Sales Revenue Report: Electric, Gas, and Water (County FY96).

3 Information from Mark Hinrichs, LANL FSS-8, record of communication, 5/9/97; FY 96 Los Alamos Resource Pool data (numbers reflect combined LANL and County peak usage per hour).

4 Information from Timothy Glasco, Los Alamos County Utility Department, record of communication, 4/15/97, and Jerome Gonzales, LANL, FSS-8, personal communication, 4/23/97.

5 Information from Los Alamos County's Utility Department for County FY96, Chris Ortega, record of communication, 4/15/97.

* 1,805,909,670 gallons per year or 6,835,368,100 liters per year

† 391,080,000 gallons per year or 1,480,237,800 liters per year

3.4 Land Use and Traffic

Land Use

Approximately 88 percent of the land in the County is owned by the Federal government, including holdings controlled by DOE, the Department of Agriculture (Santa Fe National Forest), and the Department of the Interior (Bandelier National Monument). About 12 percent of the land in the County is in private or local government ownership. Most of the private land has been developed and is a mix of residential, commercial, and industrial uses.

Currently, the Research Park tract is used for parking and as a buffer zone for LANL operations. It is mostly undeveloped and unoccupied except for utilities, roads, and several parking lots. The existing land use of the tract, as designated by the LANL Site Development Plan (LANL 1990), is "physical support and infrastructure" where parking exists, and "environmental research/buffer" in the undeveloped area.

Directly across West Jemez Road is the core area of TA-3, the most heavily populated technical area at LANL.

The Research Park property and the adjacent LANL buffer areas are not fenced. The tract proposed for lease contains portions of footpaths that lead to the canyon bottom and beyond. These footpaths are used for walking and jogging. A small outdoor ice skating rink, owned and operated by the County, is situated at the bottom of Los Alamos Canyon to the north. The canyon area is also used by hikers and mountain bikers year-round, ice climbers during the winter months, and rock climbers during the warmer months.

Traffic

Highways provide the primary access to LANL and the rest of the County from the Rio Grande Valley, Santa Fe, and Albuquerque. Los Alamos has no bus or rail connections, but commuter air service is available between Los Alamos and Albuquerque. The percentage of LANL employees that live in the County is 50.4, while the balance commute from Santa Fe, Española, and other areas.

Highway access to the County is by State Road 4 from the west and State Road 502 from the east. There are four main access points to LANL which convey about 40,000 average daily trips (ADTs). They are Diamond Drive across the Los Alamos Canyon bridge (28,000 ADTs), Pajarito Road (8,000 ADTs), East Jemez Road (6,000 ADTs), and State Road 4/West Jemez Road from the west (1,000 ADTs) (LANL 1990, LAC 1992).

The Research Park site is accessed directly via West Jemez Road (State Road 501) and West Road (a narrow county road which connects the townsite and LANL via Los Alamos Canyon). These roads in turn connect to other nearby major roads within TA-3 and the County, including Diamond Drive, East Jemez Road (LANL truck route), and Pajarito Road. Traffic on this roadway network is heavy, particularly during peak commuting hours. At present, the nearby Diamond Drive and West Jemez Road intersection is operating at approximately a level of service "E"[7] with considerable congestion during peak traffic periods (Fox 1996).

3.5 Ecological Resources

The proposed Research Park tract ranges in elevation from 7,300 to 7,520 ft (2,225 to 2,292 m). This area is a mesa that is vegetated by ponderosa pine forests with small amounts of mixed conifer forests. Throughout the proposed land lease tract ponderosa pine (*Pinus ponderosa* Laws. var. *scopulorum* Englem.) is the most common tree species. In the mixed conifer forests, white fir (*Abies concolor* [Gord. & Glend.] Hoopes), limber pine (*Pinus flexilis* James), and Douglas fir (*Psuedostuga menziesii* [Mirb.] Franco var. *glauca* [Beissner] Franco) are intermixed with the ponderosa pine. Shrub species include cliffbush (*Jamesia americana* Torr. & Gray), mountain mahogany (*Cercocarpus montanus* var. *paucidentatus* [Wats.] F.L. Martin), rubber rabbitbrush (*Chrysothamnus nauseosus* [Gray] H. & C.), skunkbush sumac (*Rhus trilobata* Nutt.), and oak (*Quercus gambelii* Nutt. and *Q. undulata* Torr.). Understory species include mountain muhly (*Muhlenbergia montana* [Nutt.] Hitchc.), pine dropseed (*Blepharoneuron tricholepis* [Torr.] Nash), bottlebrush squirreltail (*Sitanion hystrix* [Nutt.] J.G. Smith), and little bluestem (*Schizachyrium scoparium* [Michx.] Nash). There are also isolated occurrences of aspen (*Populus tremuloides* Michx. var. *aurea* [Tides.] Daniels), which are found in a drainage, and juniper (*Juniperus* spp.), which grows on the northern extent of the tract.

[7] Level of service is a qualitative measure that represents the collective factors such as speed, travel time, traffic interruptions, safety, etc., provided by a highway facility under a particular volume condition. Level of service A is the highest quality and level of service F the lowest (ITE 1976).

In the wake of the 1996 Dome Wilderness Fire within a forested area nearby, DOE and LANL have recently helped organize the formation of a multi-agency cooperative wildfire management program (known as the Interagency Wildfire Management Team[8] [IWMT]) that addresses fire management practices for the forested areas of the Pajarito Plateau surrounding the Los Alamos Townsite and within LANL and Bandelier National Monument site boundaries. The purpose of this program is to maintain and promote area site practices and controls that protect human life and property, prevent interruptions to site activities, and protect natural and cultural resources. This is in part accomplished by reducing fuel loading, maintaining fuel breaks and enhancing accessibility for firefighters fighting wildfires within the LANL boundaries and other adjacent areas managed by neighboring Federal and County agencies. Fuel load reduction actions could include both chipping of trees with the chipped wood being used as mulch and controlled burns of forested areas to reduce the potential for crown fires that tend to spread very swiftly and are not easily controlled. The forested areas in the immediate vicinity of the Research Park and on adjacent tracts are managed according to IWMT, LANL, and U.S. Forest Service operating procedures.

The proposed tract is bordered on the north by Los Alamos Canyon. This canyon runs west to east with steep, north-facing slopes directly adjacent to the area of interest. The north-facing canyon slopes are vegetated by mixed-conifer forests and the canyon bottom includes riparian and wetland habitats.

The United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps show that this segment of Los Alamos Canyon supports temporarily-flooded, shrubby palustrine wetlands. Palustrine systems include all nontidal, shallow wetlands that are small in size or dominated by trees, shrubs, persistent emergents, mosses, or lichens (Cowardin et al. 1979). In this case, the shrubs are mostly willows (*Salix* spp.). Cottonwoods (*Populus* spp.) may also be found in the adjacent riparian areas.

As a result of field surveys within the proposed tract, one wetland was located in the eastern portion that had not been included on the NWI maps. This circular wetland, which is approximately 32 ft (10 m) in diameter, contains standing water and supports water-loving plant species, including cattails (*Typha* spp.). In the surrounding area, there are scattered piles of rubble and refuse mixed in with the forest vegetation. The presence of animal tracks and other evidence indicates that wildlife use this and other wetlands in or near the proposed land lease tract.

Field and literature surveys were also conducted to determine the potential for wildlife to use the proposed Research Park tract (Haarmann 1997). As a result of these investigations, it was determined that approximately 27 mammal species, including 10 species of bats, could potentially use the tract. In addition, 68 bird species, 6 species of reptiles and amphibians, and 67 plant species may also occupy the area. Of these species, several game animals including elk (*Cervus elaphus nelsoni*), mule deer (*Odocoileus hemionus*), and black bear (*Ursa americana*) use the area.

Habitat surveys were also conducted to gather baseline information and locate potential habitat for species listed by the Federal government as threatened or endangered under the Endangered Species Act (Haarmann 1997). As a result of these surveys, four major vegetation types were identified in the proposed land lease tract: grass communities, piñon-juniper woodlands, ponderosa pine forests, and mixed-conifer forests. In addition, some of the area is unvegetated. These community types, in combination with the wetlands and riparian environments in Los Alamos Canyon, could potentially support six species that are threatened or endangered (Table 3-3). Of the six species, the Mexican spotted owl (*Strix occidentalis lucida*), peregrine falcon (*Falco peregrinus anatum*), and bald eagle (*Haliaeetus leucocephalus*) potentially occur in the project area (Haarmann 1997).

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[8] The IWMT includes membership from DOE, LANL, U.S. Forest Service, U.S. Park Service, U.S. Bureau of Indian Affairs, San Ildefonso Pueblo, and the County.

Table 3-3. Federal Threatened or Endangered Species Potentially Occurring in the Proposed Research Park Tract

Scientific Name	Common Name	Status*	Habitat
Empidonax traillii extimus	Southwestern willow flycatcher	FE	Nests in riparian areas with willows and cottonwoods.
Falco peregrinus anatum	Peregrine falcon	FE	Nests on cliffs. Forages in a variety of habitats.
Haliaeetus leucocephalus	Bald eagle	FT	Roosts in riparian areas near streams and lakes.
Mustela nigripes	Black-footed ferret	FE	Occupies prairie dog colonies of 80 ac (32 ha) or more in area within 5 mi (8 km).
Falco peregrinus tundrius	Arctic peregrine falcon	FT	Migrates along coastlines and mountains.
Strix occidentalis lucida	Mexican spotted owl	FT	Ponderosa pine and mixed conifer forests. Uneven-aged, multistoried forests with closed canopies.

* FE = Federally listed as Endangered, FT = Federally listed as Threatened

Source: Haarmann 1997

3.6 Waste Management and Environmental Restoration

Waste Management

LANL and Los Alamos County have established procedures to be in compliance with applicable laws and regulations for collecting, storing, processing, and disposing of industrial and municipal solid waste. LANL's solid waste is disposed of at the County landfill, which is operated by the County on LANL property. LANL disposes of an average of about 31,270 yd^3 (23,910 m^3) of solid waste annually at the County landfill (DOE 1996a). This landfill has an expected use life of about 15 more years. Trash from commercial companies in Los Alamos County is collected in County trucks on a regular basis and also on a special request basis and disposed of at the County landfill. In 1996, about 20,000 yd^3 (15,300 m^3) of commercial trash was disposed of at the County landfill. Rubble from LANL, the County, contractors, and individuals is accepted at the County landfill. In 1996, 15,600 tons (14,200,000 kg) of rubble were disposed of at this location. The County also maintains a separate location at the landfill for construction debris which is available for reuse by individuals or companies. In 1996, about 5,870 tons (5,340,000 kg) of construction debris were disposed of at the County landfill. Another location within the County landfill is used to process green waste such as tree limbs, brush, leaves, and grass. This material is shredded and some of it is composted on-site. The processed materials are available to the public, schools, County, and LANL for use as a ground cover or soil conditioner. About 13,200 yd^3 (10,100 m^3) of green waste was disposed of at the County landfill in 1996 (LAC 1996).

There is no permitted treatment, storage, and disposal facility in New Mexico for radioactive waste generated by commercial companies, hospitals, and universities. Envirocare Inc., a facility in Utah, may accept radioactive waste from these types of generators.

The County operates two sanitary wastewater treatment facilities, one in White Rock and one in Bayo Canyon. The latter sewage treatment plant processes the sewage from Los Alamos Townsite. Nearly all of the sanitary wastewater generated at LANL goes to the LANL Sanitary Wastewater Systems Consolidation

(SWSC) plant at TA-46. Table 3-4 shows the volume of sewage processed each day at these three sewage treatment plants and the capacity of the three plants.

Table 3-4. Sanitary Sewer Usage and Capacity

Facility	Usage (gallons per day)	Capacity (gallons per day)	Usage (liters per day)	Capacity (liters per day)
Bayo Canyon Sewage Treatment Plant[1]	900,000	1,370,000	3,400,000	5,200,000
White Rock Sewage Treatment Plant[1]	500,000	820,000	1,900,000	3,100,000
LANL (Sanitary Waste Systems Consolidation Plant)[2]	400,000	600,000	1,350,000	2,300,000

1 Information from Keith Schwertfeger, Los Alamos County Utility Department, telephone conversation with Ellen McGehee, Ecology Group, Los Alamos National Laboratory, April 15, 1997.

2 Information from Ed Hoth, Utilities and Infrastructure Group, Los Alamos National Laboratory, telephone conversation with Ellen McGehee, Ecology Group, Los Alamos National Laboratory, April 16, 1997.

The Bayo Canyon sewage treatment plant is operating below capacity and could handle more sewage per day. There are however, other constraints on the sanitary system as a whole, such as the size of existing pipes and the capabilities of existing lift stations.

The SWSC plant is operating below capacity as shown in Table 3-4. The sewage from different parts of TA-3 is collected and merged before it goes to the SWSC plant at TA-46. The size of these existing pipes limits the amount of sewage that can be handled from TA-3 and, as a result, the TA-3 portion of LANL's sewer system is operating close to capacity.

Environmental Restoration

The ER Project at LANL is part of a national effort by DOE to clean up the facilities involved in its past or present weapons production program. The goal of this effort is to ensure that DOE's past operations do not threaten human or environmental health and safety. The ER Project is governed primarily by RCRA, which addresses the day-to-day operations of hazardous waste management, treatment, storage, and disposal facilities; establishes a permitting system; and sets standards for all hazardous-waste-producing operations at these facilities. Under this law, LANL must have a permit to operate its facilities (LANL Permit is NM 0890010515). RCRA, as amended by the Hazardous and Solid Waste Amendments (HSWA) in 1984, prescribes a specific corrective action process for all potentially contaminated sites. The ER Project is investigating all sites that may have been contaminated by past operations to determine the nature and extent of any contamination. It is also exploring possible measures for cleaning up contamination and selecting and implementing remedies at these sites.

DOE provides the broad definition of activities undertaken by the ER Project at LANL. Budgets, schedules, and many procedural requirements for the ER Project have been set by DOE. DOE is accountable to two regulatory agencies: The Environmental Protection Agency (EPA), Region 6, and the NMED. As required by the HSWA Module of LANL's permit to operate under RCRA, the ER Project established a Records-Processing Facility as the repository for all its documentation. The facility collects, organizes, indexes, stores, and protects all relevant information for use by all ER Project participants and stakeholders, including DOE, EPA, NMED, and the public. The references cited in this section can be found at the Records-Processing Facility or the LANL Community Reading Room. Both are in Los Alamos.

EPA has the primary responsibility for developing, promulgating, and enforcing regulations to implement RCRA and HSWA, although it may delegate, and has delegated all of its regulatory authority to NMED. Whenever there is a need to change information in the HSWA Module, LANL and DOE prepare a proposal to the regulators to modify the permit, such as a Class III modification to remove a PRS from the list in the HSWA Module and take no further clean-up action on the PRS. Before a PRS can be removed from the HSWA permit, a Class III permit modification must be proposed to the regulator. Other changes in the permit also require a Class III permit modification.

SWMUs are potentially contaminated sites that are listed in the HSWA Module of LANL's RCRA Operating Permit. In addition, there are other sites that have been identified as areas of concern but that are not in the HSWA Module. The general term for all potentially contaminated sites is potential release sites (PRSs).

If approved, the PRS is removed from further consideration by the ER Project. If not approved, the ER Project proposes further actions that may include characterization, a corrective measures study, a clean-up plan, an interim action, or a best management practice. No PRS is removed from the HSWA module until the regulators approve no further action. While it is expected that construction would not occur within the lateral extent of a PRS still listed in the HSWA module, it is possible that any necessary remediation may be complicated by the presence of buildings or other infrastructure in the vicinity.

The proposed Research Park lease tract has five PRSs that are either clearly within the boundaries of the proposed Research Park or that have associated areas that are within these boundaries. The identified PRSs on this land tract are listed and described in the following paragraphs. The PRS locations are also shown in Figure 3-1.

- PRS 3-009(b) is a surface disposal area consisting of soil, tuff rubble, and road construction debris. The debris originated in the early 1990s from the site preparation and construction of the parking lot at the Fire Station. Three composite soil samples from the site were analyzed for Target Analyte List elements (metals). All concentrations were below screening action levels[9]. This PRS was recommended for no further action (LANL 1995a), and in December 1996, NMED determined that this PRS could be removed from the permit (Dinwiddie 1996).

- PRSs 3-038(a) and 3-038(b) are part of the former acid and industrial waste treatment facility. Specifically, PRS 3-038(a) is a former acid waste neutralization and pumping building (including two underground concrete storage tanks) and PRS 3-038(b) is a former waste retention tank made of steel. Both PRSs are located at the southwestern end of Los Alamos Canyon bridge. In addition, short segments of decommissioned acid waste lines, beneath the intersection of Jemez Road and Diamond Drive, are associated with these two PRSs. As part of LANL's radioactive liquid waste lines removal project, the building, the tanks, and most of the associated liquid waste lines were removed in 1982. The building, tanks, and contaminated soil were transported to TA-54 for disposal. The soil and bedrock beneath PRSs 3-038(a, b) and associated waste lines were excavated and screened for radioactivity. Excavation was continued until the radiological screening showed levels at or below established guidelines. The excavation was then backfilled with clean soil. The concrete tanks and steel tank apparently had not leaked because the soil and bedrock samples collected from underneath these tanks showed no elevated levels of radioactivity (Vozella 1994).

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[9] Soil screening action levels, as defined in proposed 40 CFR 264 Subpart S, are calculated using the most conservative scenario of residential land use, a maximum cancer risk level of one in a million, and a noncancer hazard index of one. For radiological constituents, a maximum exposure of 10 mrem per year is used to derive screening action levels.

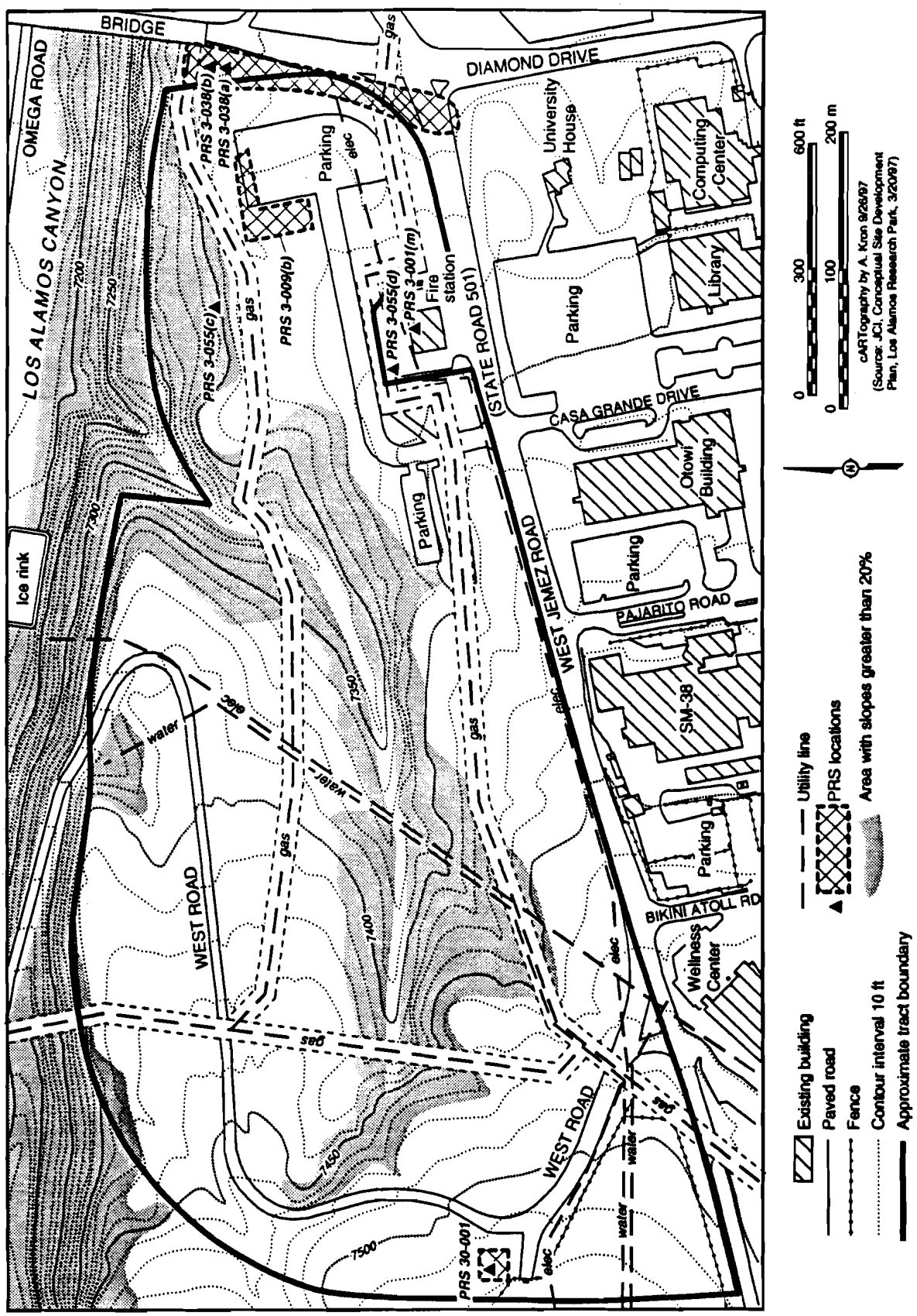

Figure 3-1. Locations of utility lines, PRSs, and slopes greater than 20% within proposed Research Park.

Sections of the waste lines which were beneath the intersection of Jemez Road and Diamond Drive, including about 150 ft (46 m) of one line, about 160 ft (49 m) of a second line, and the lower part of a manhole, were left in place for reasons of access and traffic interference. The abandoned sections of the lines were filled with an emulsion of asphalt, capped at each end with concrete, and marked at each end with a brass monument (Vozella 1994).

LANL has planned to sample the old waste lines under the intersection when the opportunity presents itself during future road or underground utility work. EPA has been informed of the sampling plan (Vozella 1994) and a schedule for sampling was submitted to EPA (Jansen 1995). Any remediation of the site would be done after samples were taken and analyzed for hazardous and radioactive contaminants. As the units are on the very east side of the Research Park and the lines are mostly under the road, the Research Park would be minimally affected by any required remediation.

- PRS 3-055(c) was identified as an outfall. A visual inspection of the site revealed a stormwater drainage channel but no outfall pipe. Samples from the site were analyzed for various radioactive and hazardous constituents. Only semivolatile organic compounds (SVOC) and heavy metals were detected and these were present at levels below screening action levels. This PRS has been recommended to NMED for no further action (LANL 1995b). Since it is not mentioned in the Notice of Deficiency for the Work Plan for Operable Unit 1114 (EPA 1995; NMED 1996), it can be approved for no further action. PRS-3-055(c) is currently on the HSWA Module of the permit.

- PRS 30-001 lies just along the western boundary of the land proposed for lease. In the early 1940s, this area had an electronics test building and an oil storage tank, both of which were removed before December 1947. Some surface pieces of asphalt north of this area are also part of the PRS. There is no surface or subsurface evidence of any material that might present a threat to human health or the environment so this PRS was proposed to DOE for no further action (LANL 1995c). This PRS is not on the HSWA Module of the permit. In October 1995, DOE determined that this PRS could be removed from further consideration by the ER Project (Taylor 1995a).

There are two additional PRSs that are outside of, but close to, the boundaries of the land proposed for lease. These are identified as follows:

- PRS 3-001(m) is an approved accumulation area located at the fire station just south of the land tract proposed for lease. It is not on the HSWA Module of the permit. EPA and LANL have agreed that accumulation areas are not PRSs provided that they have no history of release and have no credible pathway to the environment. PRS 3-001(m) was proposed to DOE for no further action (LANL 1995a) and in November 1995, DOE determined that this PRS could be removed from further consideration by the ER Project (Taylor 1995b).

- PRS 3-055(d) is just outside the southern boundary of the land proposed for transfer. Although it was identified as an outfall and is on the HSWA Module of the permit, a visual field investigation failed to locate the outfall pipe. This PRS has been recommended to NMED for no further action because an outfall does not exist (LANL 1995b; LANL 1996c). Since this PRS is not mentioned in the Notice of Deficiency for the Work Plan for Operable Unit 1114 (EPA 1995; NMED 1996) it can be approved for no further action when the Work Plan is approved.

3.7 Aesthetics

The general area of the Research Park is forested or developed for research/industrial type purposes. The proposed Research Park lease tract is a largely undeveloped tract bordered by about 2,000 ft (610 m) of West Jemez Road (State Road 501) and by about 800 ft (245 m) of Diamond Drive. West Road borders the tract on the west and crosses through the northern part of the tract for about 2,600 ft (792 m). The tract contains parking areas, gas transmission lines, and various other utilities (Figure 3-1). Where undisturbed,

this portion of the tract contains stands of ponderosa pine; the disturbed or developed areas are either unvegetated or are bordered by some thick new growth of ponderosa pine, grasses, and weedy annuals and perennials. West Jemez Road provides passing views of the eastern edge of the Jemez Mountains. State Road 501 also allows views of the Sangre de Cristo Mountains while driving east.

The predominant characteristic of the area adjoining the Research Park tract to the south is light industrial and office use. Those most likely to view the tract would be workers at LANL facilities at TA-3, commuters on their way to and from work in Los Alamos, joggers and bicyclists along West Jemez Road (State Road 501), tourists visiting Los Alamos, Bandelier National Monument, and Jemez Mountains, and, seasonally, skiers driving to and from the Pajarito Ski Hill. In addition, the northern edge of the tract is visible to local residences on the north side of Los Alamos Canyon.

3.8 Human Health

The radiation environment at LANL and the surrounding communities is continuously monitored and characterized. The results are reported in annual LANL environmental surveillance reports (e.g., LANL 1996a). Air emissions are routinely sampled at locations on LANL property, along the DOE boundary perimeter, and in more distant areas that serve as regional background stations. Atmospheric concentrations of radioactive nuclides (radionuclides) are measured to estimate internal radiation doses. Thermoluminescent dosimeters are used to determine external penetrating radiation doses in the area. Background dose estimates are subtracted from the measured values to determine the effective dose equivalents[10] (EDE) to the public outside the site boundary and at the nearest residence.

The radiation environment at LANL consists of both (1) natural background radiation and induced background levels of radioactivity in the surrounding communities and (2) the workers' radiation environment within their work areas. All individuals are subject to some irradiation even though they may not work with radioactive substances. The annual average EDE from background and induced radiation for 1995 to nearby residents in Los Alamos and White Rock was 349 mrem and 336 mrem, respectively (LANL 1996a). The average EDE attributable to 1995 LANL operations was 0.5 mrem and 0.2 mrem for residents in Los Alamos and White Rock, respectively (LANL 1996a). The maximum annual dose to a potentially exposed member of the public from 1995 LANL operations is estimated to be approximately 2.3 mrem per year. DOE's public dose limit is 100 mrem per year EDE from all pathways and the dose received through the air pathway is restricted by EPA's dose standard of 10 mrem per year. Table 3-5 summarizes the various estimated annual exposures to the public associated with LANL operations during 1995.

3.9 Air Quality

Air quality is a measure of the amount and distribution of potentially harmful pollutants in ambient air. EPA has identified six criteria pollutants: carbon monoxide (CO), lead (Pb), ozone (O_3), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM). The presence of forests and irregular and complex terrain in the Los Alamos area affect atmospheric dispersion of pollutants. The terrain and forests create an aerodynamically rough surface, forcing increased horizontal and vertical turbulence and other dispersion. The dispersion generally decreases at lower elevations where the terrain becomes smoother and less vegetated. The canyons surrounding LANL channel the air flow, which also limits dispersion. The frequent clear skies and light winds typical of the summer season cause daytime vertical air dispersion.

[10] Effective dose equivalent is a term for the estimated radiation dose to the whole body that would result from a dose to any one or more body organs.

Table 3-5. Summary of Annual Effective Dose Equivalents for 1995

Dose Source	Maximum Dose to an Individual[a,b]	Average Dose to Nearby Residents		Collective Dose to Population within 50 mi (80 km) of LANL[b]
		Los Alamos	White Rock	
Dose attributable to LANL operations	2.3 mrem	0.5 mrem	0.2 mrem	3.2 person-rem
Background dose	349 mrem	349 mrem	336 mrem	82,000 person-rem

a Maximum dose to an individual is the dose to any individual at or outside LANL where the highest dose rate occurs (i.e., residence north of TA-53).

b Doses reported are average doses. Source: (LANL 1996a)

LANL and the County are remote from major metropolitan areas and major sources of pollution. Air quality is better than ambient air quality standards set by EPA and NMED. Radioactive and nonradioactive air emissions are in compliance with the Clean Air Act and the New Mexico Air Quality Control Act (LANL 1996a).

The developed area of the tract consists of asphalted parking lots. The parking lots are used by staff that work across the street in the LANL administrative and support offices. The TA-3 land proposed for the Research Park serves as a buffer zone between LANL TA-3 operations and the public residential area across Los Alamos Canyon to the north.

The main LANL administration offices are located across West Jemez Road from the TA-3 portion of the proposed Research Park lease tract. There are no potentially hazardous LANL operations located next to the proposed tract. The nearest potentially hazardous operations that generate radiological air emissions are located at the Chemical and Metallurgy Research (CMR) Building by Pajarito Road about 0.5 mi (750 m) to the southeast. As with all key LANL operations that produce radioactive air emissions, the TA-3 air emissions are controlled at the sources and monitored by LANL air sampling stations and stack monitors.

The proposed lease tract is located along heavily traveled West Jemez Road and Diamond Drive. Automobile exhaust is the main contributor to local air pollution. Within TA-3, the other major contributor to nonradiological air emissions is the LANL gas-fired power plant. The power plant is located in the developed part of TA-3 across State Road 501 off Diamond Drive to the southeast of the tract.

3.10 Noise

Noise is defined as unwanted sound. Sound is a form of energy that travels as invisible pressure vibrations in various media, such as air. The auditory system of the human ear is specialized to sense the sound vibrations. Noise is categorized into two types: *Steady-State Noise* which is characterized as longer duration and lower intensity such as a running motor and *Impulse or Impact Noise* which is characterized by short duration and high intensity such as the detonation of high explosives. The intensity of sound is measured in decibel (dB) units. In sound measurements relative to human auditory limits, the decibel scale is modified into an A-Weighted Frequency scale (dBA).

Noise measured at LANL is primarily from occupational exposures. These measurements take place inside buildings and are made through the use of personal noise dosimeters and instruments. Occupational exposure data are compared against an established Occupational Exposure Limit (OEL). LANL defines the OEL administratively as noise to which a worker may be exposed for a specific work period without probable adverse effects on hearing acuity. The OEL for steady-state and impulse or impact noise at the Laboratory is based on U. S. Air Force Regulation 161-35, "Hazardous Noise Exposure," which has been adopted by DOE. The maximum permissible OEL for steady-state noise is 84 dBA for each 8-hour work

period. The OEL for impulse/impact noise is not fixed because the number of impacts allowed per day would vary depending on the dBA of each impact. LANL Action Levels for steady-state noise and impulse/impact noise are 80 dBA for each 8-hour day and 140 dBA, respectively. The Action Levels trigger the implementation of a personnel hearing conservation program.

Environmental noise exposure is measured outside of buildings. The sound levels measured vary and are dependent on the generator. The following are typical examples of sound levels (dBA) generated by barking dogs (58), sport events (74), local cars (63), aircraft overhead (66), children playing (65), and birds chirping (54). LANL sources of environmental noise consist of background sound, vehicular traffic, routine operations, and periodic high-explosive testing. Measurements of environmental noise in and around LANL average around 80 dBA. Some measurements have been made to evaluate environmental impacts from operational and high-explosive detonation noise. For example, the peak noise level measured at the Pulsed High-Energy Machine Emitting X-Rays (PHERMEX), facility from a 20-lb (9-kg) trinitrotoluene (TNT) explosion ranged from 140 to 148 dBA at a distance of 750 ft (229 m).

The values from limited ambient environmental sampling in Los Alamos County are within the expected sound levels (55 dBA) for outdoors in residential areas. Background sound levels at the White Rock community ranged from 38 to 51 dBA (Burns 1995) and 31 to 35 dBA at the entrance of Bandelier National Monument (Vigil 1995). The minimum and maximum values for the County in this study were 40 dBA and 96 dBA, respectively. Ambient noise levels at the proposed Research Park location are affected primarily by automobile traffic on Diamond Drive and West Jemez Road. Routine LANL operations at the Fire Station may be audible over a portion of the proposed lease tract.

3.11 Cultural Resources

Los Alamos County is rich in cultural resources that include archeological sites, historic buildings and sites, Traditional Cultural Properties (TCPs), and grave sites. As required under Executive Order 13007, the four Accord Pueblos with whom DOE has formal agreements (Cochiti, Jemez, Santa Clara, and San Ildefonso) and the Mescalero Apache, have been asked to identify any sacred or TCP issues that may apply to the Research Park tract. LANL has conducted field surveys for cultural resources at the Research Park tract. As a result of these surveys, two prehistoric Archaic sites and one historic site, a portion of a wagon road, have been identified in this tract (Larson et al. 1997).

3.12 Water Quality

Surface water discharge and soil erosion from annual and 100-year storm events are primary water quality issues associated with the construction and operation of new facilities at LANL. The proposed Research Park tract is situated in an area that is partially developed for use as parking lots and includes vacant land covered by native vegetation and undisturbed rock and soil. The 30 ac (12 ha) proposed for development has a less than 20 percent slope and is divided by a natural drainage channel which flows from the west to the east and northward into Los Alamos Canyon (see Figure 2-2). Los Alamos Canyon contains an established perennial stream, which flows from the west down stream to the east. Currently, it is estimated that the site proposed for development generates 14 acre-feet of runoff per year and could generate 58 cubic feet per second (cfs) during a 100-year flood event (Lemke 1997). Surface water generated during storm events is directly absorbed by soil and vegetation, collected from over a small portion of the site into a small existing retention pond, or flows off the site into Los Alamos Canyon via natural drainage channels.

3.13 Environmental Justice

Under Presidential Executive Order 12898 of February 11, 1994:

"Section 1-1. IMPLEMENTATION.

> 1-101. *Agency Responsibilities.* To the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands."

Minority populations are considered to be all people of color, exclusive of white non-Hispanics, and low-income households considered to be those with incomes less than 15,000 dollars per year. DOE is in the process of finalizing procedures for implementing the Executive Order. The manner in which environmental justice issues should be addressed in an EA is expected to be addressed in DOE's implementing procedures. The analysis of environmental justice in this EA is not intended to establish the direction of DOE's future procedures implementing the Executive Order.

Within a 50-mi (80-km) radius of LANL about 54 percent of the population is of minority status. In terms of low-income populations, approximately 15 percent of the households had 1989 annual incomes below 15,000 dollars. The County is approximately 15 percent minority (the percentage of non-whites, including Hispanics, defined by the US Census) and had a 1989 median family income of 54,801 dollars (US Census 1990). The County, which would be most directly affected by the Proposed Action, has a higher median family income and a much lower percentage of minority residents than the four surrounding counties.

Although populations that are subject to environmental justice considerations are present within 50 mi (80 km) of LANL, activities associated with the Proposed Action would not result in disproportionately high and adverse effects on the human health or human environment of low-income, minority, or Native American populations. No adverse effects to environmental justice populations would be expected if DOE implements the Proposed Action.

In addition, no disproportionately high and adverse effects on low-income, minority, or Native American populations are known to occur from activities conducted on the Research Park tract by the Federal government as the current owner. Therefore, no disproportionate adverse effects to populations subject to environmental justice concerns are anticipated under the No Action alternative.

3.14 Natural Resources

The ROI surrounding LANL includes Natural Resources as part of Federal lands administered by the U.S. Forest Service (Santa Fe National Forest), the National Park Service (Bandelier National Monument), and the Bureau of Land Management. These Federal lands provide access to areas used for recreational and economic purposes by individuals within the ROI and throughout the world. These lands are used for recreational purposes such as sight-seeing, hiking, camping, fishing, and hunting, but are also used for economic purposes such as collecting and selling firewood and other National Forest resources.

Impacts to Natural Resources within the ROI are generally assessed as a function of the total number of individuals using the resources. The estimated population increase presented in Section 3.3 represents a bounding case for the number of individuals within the ROI that could eventually utilize these Natural Resources. These resources are also used by individuals from throughout New Mexico, the nation, and the world, on an annual basis. The increased use of these resources within the ROI due to the number of individuals associated with the proposed Research Park is expected to be negligible when compared to total number of individuals currently using these resources on an annual basis. Therefore, the effects of the Proposed Action on Natural Resources within the ROI would be negligible.

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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Proposed Action

This section evaluates the environmental effects of the Proposed Action and the No Action alternative. Each applicable potential environmental issue addressed in Section 3.0 is evaluated in Section 4.0 for probable environmental consequences.

4.1.1 Socioeconomics

A socioeconomic analysis assesses the environmental consequences of demographic and economic changes resulting from the Proposed Action. This section focuses on the potential effects from the development of a research park on the local economy, housing, and utilities.

4.1.1.1 Employment and Local Economy

Development of a research park could provide employment opportunities for local and regional work forces. For the purposes of estimating socioeconomic effects, it is assumed that the proposed tract could have up to 10 buildings averaging 30,000 ft^2 (2,787 m^2) of floor space each. Projected lease payments to the County, at build out, could amount to approximately 4.5 million dollars per year using an assumed rate of 15 dollars per square foot typical of the surrounding County lease rates. At the rate of 1 employee per 200 ft^2 of Research Park office space, there could be about 1,500 employees on-site. Using an employment multiplier developed as part of a recent report on the fiscal year 1995 economic impact of LANL on north-central New Mexico, the estimated 1,500 "direct" jobs would support another 2,565 "indirect" jobs (Lansford et al. 1996). These indirect jobs would be required, at the rate of 1.71 per direct job, to provide the goods and services demanded by the new businesses and their workers. There could also be a construction crew of 40 to 50 people at the tract until completion of the project, which could take up to ten years. Because of the size of the ROI, adverse effects on population density and distribution are not expected.

The approximately 4,000 new jobs could greatly reduce local unemployment since 4,945 persons were unemployed in the ROI as of 1995 (Sunwest 1996). The effects of these jobs could also partially offset job losses that have occurred at LANL in recent years. However, many of the "direct" jobs at the Research Park are anticipated to be highly technical and specialized in nature and may be filled by persons currently residing out-of-state or at least outside the ROI.

Local spending for the procurement of goods and services (including construction materials) would increase economic activity levels in the region. Personal income going to Research Park employees would typically be spent on food, transportation expenses, rent or mortgage payments, medical expenses, new clothing, taxes, and savings. Income multipliers are used to measure indirect (business) and induced (household) effects from new income. For fiscal year 1995, LANL's income multiplier was 1.95. This means that every dollar of personal income earned from LANL generated another 95 cents in personal income for workers located in north-central New Mexico (Santa Fe, Los Alamos, and Rio Arriba counties) (Lansford et al. 1996). For the sake of effects analysis, the average wage for an employee at the Research Park is estimated to be about 56,750[11] dollars per year. Using the LANL income multiplier, the 1,500 "direct" employees could generate 85.13 million dollars in income and could annually contribute an additional 80.87 million dollars in indirect and induced income in the ROI.

[11] As a point of reference, this is the approximate average salary and benefits of University of California employees at LANL (LANL 1997).

4.1.1.2 Housing

If new business opportunities create in-migration, an increase in the demand for housing in the LANL vicinity could stimulate limited housing construction and affect housing costs in the region. Over time, market prices in Los Alamos would be expected to fluctuate. However, because of the lack of available land for building, housing prices in Los Alamos are expected to remain high and this would limit the availability of low-income houses. Low-income residents, especially renters, might be forced to leave the County. Assuming that the estimated 1,500 "direct" employees occupy the ROI in the same proportion as current LANL employees, 50.4 percent, or about 756 employees could potentially reside in the County. Because the estimated 2,565 "indirect" workers would not necessarily work in Los Alamos, they could be spread throughout the three-county ROI more evenly. If 33.3 percent of the "indirect" workers reside in the County, that could amount to approximately 854 additional residents. The total number of additional housing units needed would be about 1,610 for the County and 2,455 for the remainder of the ROI. The current number of vacant units for the County, as projected from the last census, is estimated to be 410 (BER 1992); consequently, many of the new employees would have to reside outside the County. There would, however, be an additional 10,448 vacant units available in Santa Fe County and Rio Arriba County by the year 2000 which would act to minimize long-term effects on the housing market. Given the size and the vacancy rate of the entire ROI, it is anticipated that housing needs for the Research Park's "direct" and "indirect" employees would be accommodated within the existing real estate market and no additional large-scale residential development would be necessary.

4.1.1.3 Utility Demands

The County estimates that operation of commercial research services in the Research Park could involve the use of an additional 4,250 MWh of electricity per year, 38,646 million Btu of natural gas per year, and 17,055,000 gal. (64,553,175 L) of water per year (LAUD 1997). This equates to an approximate increase of 4.88 percent in electrical use, 3.65 percent in gas use, and 1.76 percent in water use over current County usage. If LANL utilities are used, there would be a yearly increase of approximately 1.16 percent in electrical use, 2.83 percent in gas use, and 6.5 percent in water use (see Table 3-2). For a discussion of potential sanitary sewer demands, see Section 4.1.4. With the exception of the electrical transmission concerns identified below, it is anticipated that both LANL and the County have adequate utility capacities to accommodate development of the proposed Research Park.

In the event that utilities are provided by the County, new utility lines would have to connect to existing County utilities located northeast and across the canyon from the proposed Research Park tract. It would be expected that the installation of new utilities would involve trenching for the placement of lines and pipes. One possible scenario would involve the burial of water, gas, electric, and sewer utilities in a new utility right-of-way; however, a thorough engineering study would be needed to determine the location of this right-of-way. For the purposes of analysis only, it was assumed that this corridor could be routed northeast from the Research Park tract and could continue down into Los Alamos Canyon, crossing the canyon bottom east of the intersection of West Road and Omega Road. The corridor could then be routed out of the canyon, ending near the Los Alamos Medical Center where there is a County system capable of handling commercial utility demands. If new utility lines originate from the northeastern boundary of the Research Park, about 1,300 linear ft (396 m) of new utility corridor would be required. If the utilities originate from a location near the fire station on the southern boundary of the tract, approximately 2,000 linear ft (610 m) of new corridor would be needed.

Although some of the land in upper Los Alamos Canyon has been disturbed by previous construction (i.e., the County Ice Rink, the Los Alamos Canyon bridge, various utility corridors, and paved and dirt roads), any proposed corridor alignment has the potential to disturb undeveloped riparian, wetland, and forest environments. Best management practices would be established to control storm water runoff and minimize erosion. Cultural resource and threatened and endangered species surveys conducted for the

Research Park tract would need to be supplemented in order to include the location of a proposed utility corridor. As with any trenching, this action could uncover buried materials or artifacts and standard procedures for unanticipated discoveries would be followed. Separate NEPA review and compliance with floodplain regulations would be undertaken if DOE and the County decided to pursue this option; construction effects would need to be mitigated in wetland areas and mitigation for sensitive species may be required. Since any construction activities related to the installation of these utilities is speculative and not enough is known about the possibility of new construction to include a complete description in this analysis, these contemplated activities would be subject to additional NEPA review, if and when they are proposed.

The Research Park could be tied in to the nearby LANL electric utility lines. The existing underground power distribution lines in the TA-3 area are committed to supplying LANL programmatic needs. A limited upgrade to the local TA-3 underground electrical distribution system would be needed prior to the development of the Research Park tract. There are a limited number of spare underground 13.8 kV electrical ducts in TA-3, but enhancements would be necessary in some areas to provide adequate ductbank space to accommodate the installation of 13.8 kV cables for the Research Park area. Specific upgrades to the local TA-3 distribution system may include the installation of a pair of dedicated, networked 13.8-kV underground feeder lines and appropriate 13.8 kV to low-voltage transformations and ancillary equipment (Hinrichs 1997). The existing underground electrical corridor extends east along the Research Park tract on the north side of West Jemez Road to the area of the Fire Station at which point the corridor crosses over to the south side of West Jemez road. The corridor then continues east, crossing the Diamond Drive intersection. The corridor would then continue south along the east side of Diamond Drive and terminates at the TA-3 Power Plant switchgear building, SM-1682 (Hinrichs 1997). This upgrade could require trenching and installation of concrete reinforced ducting for about 1,650 ft (503 m) (if the line originates from the southeastern end of the Research Park) to about 3,750 ft (1,143 m) (if the line originates from the southwestern end of the Research Park boundary). The new electrical corridor would be within existing utility right-of-ways or newly established right-of-ways located in previously disturbed roadway and roadside areas.

The development of the Research Park would place relatively small additional electrical demands on the county-wide power pool. The development of the Research Park tract is estimated to contribute an additional 1.3 MW or 1.23 percent in peak usage to the peak pool usage (Hinrichs 1997). The pool is facing existing regional 115 kV power transmission import limitations. These transmission limitations are a function of insufficient levels of power transmission contractual rights, aging equipment and bulk transmission facility inadequacies in the overall northern New Mexico bulk electrical power system. Adequate regional 115 kV power import capability to Los Alamos may not be available during peak hours in the near future and this may necessitate short-term increases in power generation at the TA-3 power plant (Fox 1996 and Hinrichs 1997). Alternatively, natural gas fired combustion turbines could be installed on a short lead-time basis to meet pool's electrical requirements during peak load periods. Through various options, the power pool is in a position to provide for the increase in power requirements due to the Research Park and other new small projects at LANL. The 1997 installation of the 115 kV Static Var Compensator at TA-5 enhances power stability for the region. This enhancement is in turn expected to provide a major increase in bulk transmission import capability to Los Alamos once the applicable contract is negotiated between the pool and the neighboring electric utilities. The LANL 115 kV transmission limitations are not currently affecting the availability of electrical power as indicated by fiscal year 1996 power pool figures: peak pool usage was about 77 percent of the peak pool capacity (Table 3-2). With the local TA-3 13.8 kV distribution system upgrades and if Research Park tenants do not require unusually high new energy demands, there should be adequate electrical power available for the Research Park. The regional (northern New Mexico) power needs are being evaluated and methods to meet the needs of the region are under consideration by DOE with the suppliers to the general area.

4.1.2 Land Use and Traffic

Land Use

The LANL Site Development Plan designates the future land use of the developable portion of the tract as largely a mix of "public and corporate interface" with areas of "physical support and infrastructure" (for parking). The future land use of the drainage which bisects the site and would not be disturbed is designated as "environmental research/buffer." Thus, development of the tract as a research park is consistent with the Site Development Plan (LANL 1990).

Although the land would be leased and therefore retained by DOE, development of the Research Park would convert about 30 ac (12 ha) of land that now serves as parking for TA-3 and as a buffer between the community and LANL to office/light industrial uses by the County or third parties. Development of the tract would result in some changes to small portions of the existing footpaths. It is expected that some portions of these footpaths would be replaced by walkways in the Park.

The size of the proposed development is notable in terms of the employee population in the area. The TA-3 area currently houses roughly half the LANL total site population. Development of the Research Park will increase that population by about 20 percent. This would have some potential effects on the TA-3 infrastructure.

Traffic

A Research Park of this proposed size would generate between 2,300 and 3,000 vehicle trips per day (ITE 1976). As a result, traffic congestion is anticipated to increase on West Jemez Road, Diamond Drive, East Jemez Road, West Road, and Pajarito Road. Without intersection and roadway improvements, the level of service of the West Jemez and Diamond Drive intersection and others would be diminished as a result of the development of the Research Park. A projected increase in pedestrian and vehicular conflicts in the area, particularly along Pajarito Road between West Jemez Road and Diamond Drive, is also a concern. Already a recognized problem, development of the Research Park could aggravate the situation (Fox 1996).

The first 200 to 300 people at the park would be accommodated with relatively minor roadway improvements. Acceleration and deceleration lanes on the north side of West Jemez Road and modifications to the traffic signals at Casa Grande and Pajarito Roads would be required. As construction at the park continues, the segment of West Road within the park would be widened and a segment (about 800 feet) relocated along with the intersection at West Jemez Road, so as to create a more efficient and safer "T" type intersection. This relocation would involve only a minor disturbance of land outside the existing road corridor with a correspondingly minor removal of potential wildlife habitat. No effects to cultural, sensitive, or other resources or PRSs would be expected. Demolition of the existing segment of West Road would generate approximately 100 tons of asphalt rubble.

Accommodating subsequent construction at the research park would require additional traffic improvements in the TA-3 roadway network. A TA-3 master planning effort is currently underway and final improvements proposed as a result of the development of the Research Park would be coordinated with the completed plan. The traffic improvements related to the Research Park would likely include the widening of West Jemez Road from Diamond Drive to the new West Road intersection to six lanes with a continuous protected left turn lane. Upgrading of traffic signals along West Jemez Road at Casa Grande Road and Pajarito Road may also be warranted. In addition, it is likely that Diamond Drive between West Jemez and Pajarito Roads would need to be widened to five lanes, so as to include a continuous protected left turn lane and enable an unrestricted right turn southbound from Jemez Road. These improvements would adequately service the Research Park and would be accommodated within the existing road

corridors. It is anticipated that the lease would require the County to prepare a master plan for the Research Park which would include a traffic impact study specifying the details of these associated traffic improvements.

For the purpose of potential effects analysis, it is expected that the widening of segments of West Jemez Road and Diamond Drive as proposed would result in the generation of several hundred tons of road rubble, temporary disruption of traffic, and require the temporary disruption and permanent relocation of utility lines bordering the current roadway. No effects to cultural, sensitive, or other resources or PRSs would be anticipated.

In addition, the elimination of the existing parking areas on the site that now serve the core area of TA-3 would have a noticeable effect on conveniently available parking in this vicinity. These existing lots contain approximately 300 spaces. A recent count recorded over 100 cars parked in this area during a weekday afternoon. It is anticipated that employees now using these lots would park in existing underutilized lots within TA-3. This may result in some inconvenience to employees because of the greater distances between available parking and employee work areas.

In terms of traffic management during an emergency, residents of the Research Park would be required to comply with LANL's emergency and evacuation plans. Additionally, routine movement of LANL materials resulting in road closures could affect Research Park traffic.

4.1.3 Ecological Resources

Approximately one-half of the proposed land lease tract would be developed as part of the Proposed Action. This would result in the removal of trees and ground cover in selected portions of the tract. These vegetated areas would be replaced by buildings and parking lots. However, there would be no placement of buildings on areas with greater than 20 percent slopes. Effects such as erosion or alteration of drainage patterns within the canyon bottoms or along canyon slopes would not be expected to occur because of standard mitigation measures that are incorporated into the proposed action (see Section 2.1.2). The wetland at the site would be maintained and enhanced. The refuse and rubble in this area would be removed, erosion control measures would be implemented, and native plant species would be planted.

DOE and LANL would periodically evaluate the Research Park's vegetation cover for compliance with the IWMT plans and practices. Trees may be thinned within the site, including those areas with a slope greater than 20 percent, to facilitate wildfire management. The trees requiring thinning would be determined in consultation with the IWMT. Trees over the site could be thinned during the period of time from September 1 through February 28, as necessary, to avoid the bird breeding season. The first thinning action could be conducted along with early site development activities at the Research Park to ensure the least amount of disruption. Successive thinnings for fuel break maintenance could be done frequently to avoid any major site disturbances or effects to the site, tenants, or surrounding areas. Maintaining a thinned forest condition at the Research Park could slightly change the use of the area by some wildlife species. The balance of plant life would slightly shift to those that can tolerate more sunlight than previously available. In addition, tree thinning could cause a change in prey species and foraging habitat as well as an alteration in wildlife use of the area.

The land lease tract currently supports suitable nesting, foraging, and perching habitat for a variety of bird species, as well as foraging and wintering habitat for large mammals. Although the affected area is less than 0.25 percent of the vegetated landscape at LANL, certain species of wildlife may be affected by the following:

- Excessive noise, movement, or light disturbance generated by construction activities during critical reproductive periods may cause nest abandonment or nest failure by birds.

- During the construction phase of this project, migration routes used by game animals may be temporarily altered by excessive noise or by the use of heavy vehicles and equipment. In addition, movement corridors and breeding areas for these species may be permanently altered by the presence of the park and by the additional automobile traffic that it would bring.

However, the construction and operation of the Research Park are not expected to have any major effects on these wildlife species.

There are three species that are Federally listed as threatened or endangered that may potentially use the proposed land lease tract. The construction and operation of the Research Park would eliminate a very small percentage of available LANL and adjacent area foraging habitat for the bald eagle, the peregrine falcon and the Mexican spotted owl. With respect to the bald eagle, this area has a low level of use for foraging (Keller et al. 1996). The peregrine falcon is likely to use the area for foraging, but the proposed land lease tract represents less than 0.25 percent of the total LANL foraging habitat available to this species. The Mexican spotted owl is also likely to use the area for foraging but the proposed land lease tract represents less than 1.0 percent of the total LANL foraging habitat available to this species. Therefore, the development of the Research Park may affect but is not likely to adversely affect the foraging of any of these threatened or endangered species.

The Mexican spotted owl may also nest in the vicinity of the proposed land lease tract. There is potential nesting habitat for this species in Los Alamos Canyon, within a quarter mile of the proposed land lease tract. Since this potential nesting habitat is nearby, there may be loud noises produced in conjunction with construction of the Research Park that could affect nesting success. Field measurements were conducted in this area and it was determined that noise levels, similar to construction noises, would dissipate to background within 98 ft (30 m) of the source. An approximate 328 ft (100 m) buffer zone would be established along the northern boundary of the proposed Research Park tract (Figure 4-1). No new building construction would be allowed to take place within the boundary of this buffer zone. The 328 ft (100 m) buffer zone would serve to further insulate potential nesting habitat from any loud noises movement or light sources. This would thereby preclude potential habitat degradation and provide protection to any future nesting owls. Since the distance to the nesting habitat is greater than the distance of potential propagation of loud noises, there may be an effect on Mexican spotted owls that might nest in Los Alamos Canyon from construction activities but it is not likely to be an adverse effect.

Protocol for the Mexican spotted owl, established by the USFWS, requires that two consecutive years of presence-absence field surveys by conducted in the potential nesting habitat. The first year of these surveys was completed in August 1997 and the Mexican spotted owl was not found. The second year of the survey would be conducted from April through August of 1998. Implementation of a seasonal restriction of Research Park activities within one-quarter of the potential Mexican spotted owl nest/roost habitat would be required until the second year of surveys is completed in 1998. If owls are found during that survey time, construction within 0.25 mi (0.40 km) of the actual nest site would be restricted from occurring during the duration of the breeding seasons to follow until subsequent protocol surveys determine that the owl no longer occupies the area, or reevaluation of the impacts on the Protected Activity Center (PAC, to be developed) revealed that such measures were not required. Reinitiation of informal consultation by DOE with the USFWS would also occur. If owls are not found during the 1998 breeding season surveys, project activities within 0.25 mi (0.40 km) of the habitat may occur and continue uninterrupted over the next 10-year period (ending at the close of the calendar year 2007).

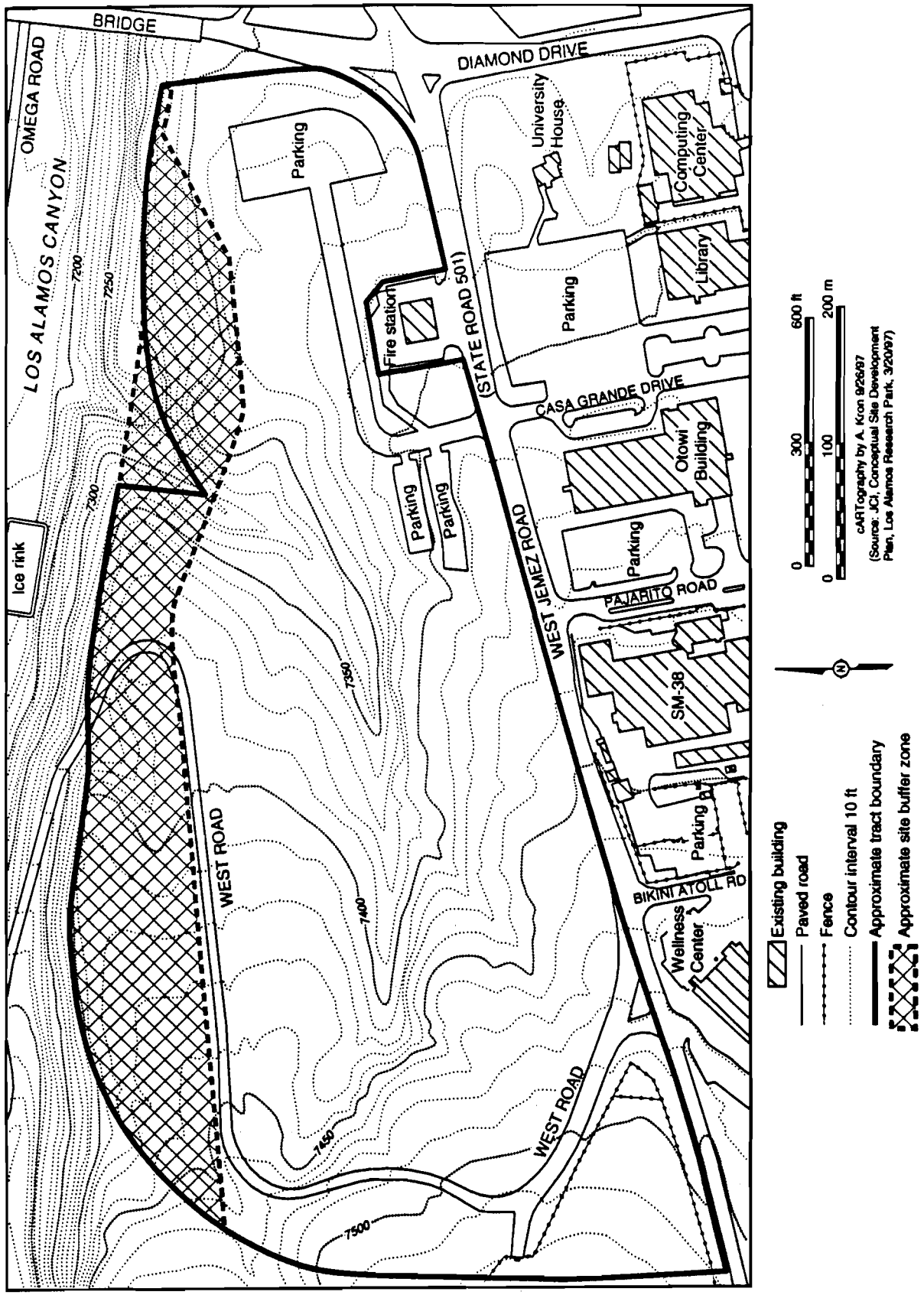

Figure 4-1. Location of proposed Research Park showing approximate site buffer zone.

4.1.4 Waste Management and Environmental Restoration

Waste Management

Development of the tract under the Proposed Action could potentially result in the removal of approximately 30 ac (12 ha) of trees and other vegetation. Some of this vegetation would be suitable for mulch or compost and would be taken to the County landfill and processed for this purpose. The remainder would be disposed of as refuse at the County landfill. Construction and building activities would generate noncontaminated construction waste such as waste planks, wall board, roofing material, and concrete. This would be collected and disposed of at the County landfill. Construction waste from a typical metal building or a building with many interior walls and finishes such as the Los Alamos National Bank ranges from 1 yd^3 (0.76 m^3) per 125 to 160 ft^2 (12 to 15 m^2) of floor space in the finished building (Rice 1997, Malcolm 1997). Ten buildings of 30,000 ft^2 each could generate as much as 2,400 yds^3 (1,820 m^3) of construction waste. Upgrading West Jemez Road, Diamond Drive, and West Road and installing other infrastructure such as utilities at the proposed Research Park tract may generate rubble such as asphalt, concrete, pipes, boxes, packaging and dirt, which would be disposed of at the designated location at the County landfill. When the businesses and industries are in operation, as much as 12,000 yd^3 (9,100 m^3) of commercial trash would be generated annually and disposed of at the County landfill. This estimate is based on the eventual construction of 300,000 ft^2 (28,000 m^2) of commercial space and assuming trash generation at the same rate as existing large, commercial buildings. This amounts to an increase of 59 percent in the volume of commercial trash handled by the County landfill, which is a 14 percent increase in the volume of total refuse handled by the County landfill annually.

After the Research Park has been fully developed, there would be about 1,500 employees at the tract and 2,565 employees who found employment as an indirect effect of the development. Assuming that 33.3 percent of the "indirect" employees work in the County, that means that about 2,355 additional employees would be likely working in the County. Since each employee generates approximately 20 gal. (76 L) per day of sanitary wastewater while on the job, there would be up to an additional 47,100 gal. (178,000 L) per day of sanitary wastewater in the County. This amount is 5.2 percent of the volume of sanitary wastewater currently processed at the Bayo Canyon sewage treatment plant or 12 percent of the volume processed by LANL. Some of the employees who work in the County as a result of development of the tract may move into the County from other areas of the state or nation and bring their families with them. These new residents would generate an additional amount of sanitary wastewater at their residences, with the actual amount dependent on the size of the household.

Addition of the projected amount of sanitary wastewater during operation of the Research Park to the current volumes processed does not appear to be beyond the capabilities of either the SWSC Facility or the Bayo Canyon sewage treatment plant to handle. However, the capacities of pipelines bringing sewage to the sewage treatment plants may be a restrictive factor. Although the SWSC Facility is operating below capacity, the TA-3 sanitary sewer system is presently operating to capacity and needs construction of a relief sewer. The Fire Station near TA-3, which ties into the TA-3 sewer system, is presently serviced by an inadequate lift station. If the Research Park planned to discharge sewage into LANL's TA-3 system, even during the start-up phase, it would be necessary to upgrade the system first (Fox 1996). The upgrade would involve trenching through disturbed areas such as streets, parking lots, and sidewalks to install a new 10-in. (0.254-m) pipeline in the vicinity of the Fire Station. This would provide the necessary additional capacity. Two lift stations would no longer be needed if this upgrade were implemented; removal of the 2 lift stations would be easily accomplished as part of the upgrade (Hoth 1997.)

If the Research Park planned to discharge sewage into the County sewage system to be processed at the Bayo Canyon sewage treatment plant, a thorough engineering analysis of how to tie into the existing system would be required. Pipelines and a lift station would be installed to take the sewage in a northerly direction down to and then upward out of Los Alamos Canyon to tie into the system at either Fairway

Drive or the Los Alamos Medical Center. This option would require installing lift station(s) and trenching up to 2,200 linear ft (670 m) for pipes. (It is assumed that the sewage pipes would be installed within the utilities corridor discussed in section 4.1.1.3.) Best management practices would be established to control storm water runoff and minimize erosion. The threatened and endangered species survey may need to be supplemented in areal extent, and construction would need to be mitigated in wetland areas. Separate additional NEPA analysis and steps to assure compliance with floodplain regulations would be implemented if DOE and the County decided to pursue this option.

Environmental Restoration

Each of the seven PRSs [PRS 3-001(m), PRS 3-009(b), PRS 3-038(a), PRS 3-038(b), PRS 3-055(c), PRS 3-055(d), and PRS 30-001] are discussed in detail in Section 3.6. Until the appropriate agency (EPA or NMED) determines that PRSs meet regulatory clean-up standards applicable to planned future uses, the areas at or near each PRS would not be developed. Five of the PRSs at and near the Research Park tract have been recommended by DOE to NMED for no further action regarding site clean-up and three have already been determined to have met the necessary criteria. These PRS status recommendations are part of either an RFI Work Plan or a Request for Permit Modification. They are based on PRS published information, such as suspected outfalls not existing or contaminants present at levels below screening action levels. Two of the sites [PRS 3-001(m) and PRS 30-001] in the proposed Research Park have been determined by DOE to require no further action by the ER Project. A third site [PRS 3-009(b)] has already been removed from the HSWA Module of the permit and requires no further action. Because of the recommendations for no further action, no adverse effects on the development of the Research Park tract would be expected from construction activities occurring in the vicinity of these PRSs. However, Research Park activities may be temporarily interrupted from time to time by remediation activities.

Sampling plans and a schedule for sampling of PRS 3-038(a) and PRS 3-038(b) have been submitted to EPA. The sampling plan outlines the sampling, analysis, and possible remediation of these PRSs. The waste lines and manhole associated with these two PRS are buried underneath the Diamond Drive/Jemez Road intersection and are not within the Research Park boundary although possible past leakage contamination may extend to within the Research Park boundary. Sampling of the sites is difficult due to the intersection being a busy traffic hub. Sampling would be conducted in conjunction with maintenance, widening, or repair of the roadway. Any remediation would be done after the sample analysis and would be based on the analytical results.

DOE would have the right of site reentry to PRSs within and near the Research Park boundaries to accommodate remediation in the future should it be deemed necessary. To prevent any disturbance or development within a PRS, each PRS located on the Research Park tract would be temporarily fenced during site construction activities and would remain fenced until a no further action determination at the PRS is final and DOE has evaluated the site and made a determination regarding its release to the County for development. This includes PRSs that are not listed on the HSWA module of the LANL RCRA permit as well as those that are listed on the HSWA module. A determination of no further action considers ecological as well as human health effects. DOE's evaluation of the site would serve to determine if, due to any residential site contamination, there was any need for additional site clean-up or other actions based on other potential regulatory requirements. Upon approval from EPA or NMED that no clean-ups are required at the PRSs, DOE would allow the development of these sites.

4.1.5 Aesthetics

Development of the Research Park would alter the visual character of the western two-thirds of the tract and the adjoining undeveloped areas by removing natural vegetation and interspersing office and commercial buildings. The eastern third of the tract would not be affected by vegetation removal. Removal of trees would not open up new vistas toward either the Sangre de Cristo or Jemez Mountains.

Three- to five-story buildings in the currently undeveloped western part of the tract would alter the visual character of these areas and would create a visual field more similar to the commercial appearance of the eastern portion. They would not be likely to obscure views of the mountains to the east or west. The proposed Research Park would be visible from LANL facilities adjoining the tract on the southeast, from Diamond Drive, West Road, and West Jemez Road. About 2,000 ft (610 m) of West Jemez Road would front on the Research Park. There would be a partial change in the view experienced by drivers, joggers, or bicyclists. Retention of existing vegetation and replanting with native species within the Research Park would lessen the visual effect of introducing buildings into the tract. No designated scenic areas or parks would be affected. During development of the tract, construction would introduce an industrial view for the expected 5 to 10 years of developments. Local recreational use of the tract may be reduced and use of the Devaney-Longmire Trail could be impeded. The tract would be expected to remain in this altered state for the foreseeable future.

4.1.6 Human Health

Human health effects would be expected from construction and operations in the Research Park. The construction workers would have the potential of encountering physical hazards during erection of the research facilities. Construction activities can expose workers to a variety of risks such as crush hazards, back injuries, electrical injuries, and confined space hazards that are regulated by the Occupational Safety and Health Administration (OSHA) and various DOE orders. After the Research Park is operational, the researchers would have the potential of being exposed to chemicals from inventories and radiation from radioactive sealed sources and ionizing-radiation-producing equipment (such as x-ray machines possibly located within the Research Park). Engineering controls, radiation protection and safety training, radiation monitoring, and standard operating procedures (SOPs) developed by the established businesses for in-house use would be applied to protect the workers and visitors from various exposures. Physical and chemical hazards from the Research Park laboratories and operations would be subject to OSHA regulations, Nuclear Regulatory Commission (NRC) regulations, and applicable SOPs.

Estimates of human health risk from the radiation environment are made based upon currently accepted radiation risk models (ICRP 1991). These risk estimates show the ultimate effects of radiation on humans, an estimate of the added cancer fatalities in the exposed population. Human health risk is determined by converting the estimated dose into the probability of developing an excess fatal cancer. The dose-to-risk conversion factors used for estimating excess cancer fatalities were five cancer deaths per 10,000 person-rem dose (5×10^{-4} deaths per person-rem) for the general population. The health risk to an exposed individual is best expressed as the added chance or risk of that individual developing a fatal cancer. As the individual's risk approaches 1, the chances of development of a fatal cancer increase. As the risk decreases, the individual's chances of development of a fatal cancer similarly decrease. The maximum radioactive dose rate at the Research Park tract from routine LANL operations would be approximately 1 mrem per year. The main source of this radiation dose is from LANSCE operating at full capacity. The risk from this dose is 5 in 10,000,000 (5×10^{-7}). In other words, the probability of a worker developing a fatal cancer from LANL's radioactive air emissions is less than one in a million. For the purpose of comparison, at present, one in five individuals in the United States dies of cancer; stated another way, the risk of dying from cancer is 0.2 per person.

If all 1,500 new workers at the Research Park were exposed to radiation from LANL operations at this dose rate, it would result in a collective dose of 1.5 person-rem per year. Assuming that these workers all work at the Research Park for 50 years, their cumulative collective dose would be 75 person-rem. For exposed populations, the probability is considered as the number of excess additional cancer deaths. If the probability is less than 1.0, no additional cancer deaths are expected. If it exceeds 1.0, then additional cancer deaths are likely to occur. Using the risk conversion factor from the preceding paragraph, the calculated risk of excess cancer fatalities for this total Research Park population of workers is 0.038.

Therefore, no adverse health risks to Research Park workers would be expected from exposures due to routine LANL operations because no excess cancer fatalities would be expected to occur.

Potential exposures to Research Park employees could occur if industries at the proposed Research Park purchase small quantities of low-specific activity radioactive materials, obtain NRC licenced quantities of radioactive materials, or operate radiation generating devices. The radiological risk to Research Park employees from routine operations cannot meaningfully be estimated until the type of industry that will occupy the park is known. However, employers and employees would be required to maintain doses as low as reasonably achievable consistent with NRC or professional industry standards. It is unlikely that such low doses could pose a serious health threat to either the Research Park or LANL employees.

4.1.7 Air Quality

No radioactive air emissions would be released or expected during the construction phase of the Research Park. An operating laboratory at the Research Park could potentially release trace amounts of radioactive air emissions. Only DOE approved and appropriately licensed radioactive sealed sources, unsealed sources less than Nuclear Facility Category 3 levels of radioactive materials, and ionizing producing equipment (such as x-ray machines) would be allowed to be used and stored at the Research Park. Category 3 is the lowest of the nuclear hazard categorizations. A Category 3 nuclear facility is defined as a facility whose hazard analysis shows only the potential for major localized consequences (DOE 1992). Sources of radioactive materials may be regulated by the NRC and would only be used for research and quality control purposes. No special nuclear materials would exist, be used, or generated within the Research Park laboratories. Special nuclear material is defined as plutonium and uranium enriched in the isotope 233 or in the isotope 235 (USC 1996). The current DOE site boundary would remain unchanged around the Research Park. For the purpose of calculating radiological exposures, the radiological exposure limits for health protection of the public would be applied to the Park workers.

Los Alamos County has been classified as an attainment area for air pollutants identified in the National Ambient Air Quality Standards (NAAQS) and the New Mexico Ambient Air Quality Standards (NMAAQS). The construction of and subsequent operation of businesses within the Research Park would have the potential of releasing regulated nonradioactive air emissions. The construction and operation of office buildings, laboratories, and parking lots would provide a source of these regulated pollutants. Under current Federal, state, and local requirements, emissions are regulated on a facility by facility basis. For purposes of air quality compliance, multiple facilities under common ownership or control are treated as one for air emissions reporting. The owner, the operator of the facility, or both can be responsible for operating in accordance with the Clean Air Act Amendments of 1990. Therefore, it is possible that the companies occupying the Research Park together with DOE may be required to have an air emission permit to operate. Air emission permits are required before a facility can begin operations. Emissions of regulated air pollutants could be expected from daily Research Park operations. These pollutants originate from the combustion of natural gas and diesel fuel. Automobile exhaust would also be a major emission source. Park operations would be maintained so releases would be kept below criteria pollutant standards for protection of the worker, public, and environment. Nonradiological air emissions would be generated during the construction of office buildings, research laboratories, and associated parking lots. The development of the Research Park is assumed to initiate within a year after issuance of the lease. Completion of the park construction is expected to occur within 5 to 10 years.

Approximately ten buildings each of approximately 30,000 ft^2 (2,787 m^2) of floor space would be constructed. The buildings would be used for offices and laboratories. Approximately 70,000 ft^2 (6,503 m^2) of surface area would be disturbed for the construction of each building. The disturbed area would be used for staging construction, storage of materials, and construction of a building. The building construction would require the operation of heavy equipment, associated machinery, and manpower. The use of vehicles, such as bulldozers, drill rig, dump truck, crane, and cement mixer truck, would generate air

pollutants. Welding operations and the daily operation of gasoline and diesel small engines would also contribute to the air pollution. The nonradiological air emissions estimated for the construction of ten buildings are shown in Table 4-1.

Asphalt parking lots would also be constructed for each of the ten buildings for a total of 1,400 spaces. Each parking lot size was determined from the assumed 1,400 vehicles that would visit the Research Park daily. For planning purposes, the average parking space for a car is 150 ft^2 (14 m^2). This value was used to estimate the total parking lot area. The total parking lot area, including lanes, would be about 420,000 ft^2 (39,018 m^2). A bulldozer and grader would be required to clear and grade the surface in preparation for the new parking lots.

Table 4-1. Building Construction Emission Estimates

Emissions Source	Estimated Annual Emissions* (tons)			
	PM	CO	NO_X	SO_2
Surface Disturbance	0.06	NA**	NA**	NA**
Bulldozer/Grader Operation	0.02	0.08	0.2	0.03
Drill Rig Support	0.002	0.007	0.03	0.002
Welding	0.05	NA**	NA**	NA**
Cement Mixer Truck	0.07	0.2	0.9	0.07
Dump Truck	0.005	0.04	0.08	0.009
Crane Lift	0.07	0.3	0.8	0.07
Generator	0.02	0.07	0.3	0.02
TOTAL	0.3	0.7	2.3	0.2

* Annual emissions were estimated by summing emissions from the construction of all 10 buildings and dividing over a 5-year period

** Not applicable

The construction of the buildings and parking lots are based on typical construction operations. These construction and earth moving activities would temporarily increase particulate emissions. The emissions from construction activities would not exceed the NMAAQS. These emissions were used in an EPA-approved computer model to estimate the concentration of the pollutant constituents at selected public receptor sites. The uninvolved workers and public would not be affected by these emissions primarily because of engineering controls and the distance from the construction sites to the nearest public area.

After the surface is cleared and prepared, the asphalt is laid. A depth of 3 in. (7.6 cm) was assumed for the laid asphalt. The slow cure of the asphalt and the equipment required to lay it would also generate air pollutants. Volatile Organic Compounds off-gassed from the curing of the asphalt would total approximately 20 tons per year during the 5-year paving process. The estimates for nonradiological air emissions bulldozer clearing are shown in Table 4-2.

Table 4-2. Parking Lot Clearing and Asphalt Paving Emission Estimates

Emissions Source	Estimated Annual Emissions* (tons)			
	PM	CO	NO_X	SO_2
Bulldozer/Grader/Paving	0.02	0.07	0.2	0.03

* Annual emissions were estimated by summing emissions from the construction of all 10 parking lots and dividing over a 5-year period.

Increased vehicular traffic from employee automobiles would also be anticipated at the Research Park area. After completion, the Research Park would be visited daily by approximately 1,400 cars, light duty trucks, and diesel trucks. It was assumed that these vehicles would be present 220 working days out of the year. In order to estimate the vehicular emissions, it was assumed that two-thirds of the Research Park employees would drive to the Research Park via Pajarito Road or East Jemez Road, traveling 14 mi (23 km) daily round trip within LANL boundary, while the other third would drive across the Omega Bridge or from West Jemez Road, traveling just 1 mi (1.6 km) daily round trip within LANL boundary. The estimated emissions from these vehicles for this work scenario is provided in Table 4-3.

Table 4-3. Vehicular Traffic Emission Estimates

Pollutant	Estimated Annual Emissions (tons/yr)
CO	204
NO_x	10

The nonradiological air emission concentrations from the Research Park construction were estimated at 27 locations along the north boundary of TA-3 and TA-62 facing the closest public receptors. The effects analysis performed describes the amount of regulated pollutants a receptor would be exposed to from an emission source. Table 4-4 lists the New Mexico State Air Quality Standards, Screening Levels, and the estimated values for Research Park vehicle traffic, parking lot construction, and building construction. The estimated air emissions from the Research Park construction at these receptors are well below the state air standards.

The pollutant emissions were determined by using an EPA-approved computer model for estimating automobile emissions. The model accounts for local meteorological conditions, terrain, and emission release height. For modeling purposes, conservative 1990 EPA emission factors were used. Based on these emissions, the air quality of LANL and the County would experience a minimal deterioration but the air quality attainment status for the County under the Clean Air Act would not be lost.

Table 4-4. Estimated Maximum Receptor Concentrations for Research Park

Pollutant	NM Ambient Air Quality Standard	NM Significant Ambient Air Concentration (Screening Level)	Averaging Period	Vehicle Traffic	Parking Lot Construction	Building Construction	Units
Total Suspended Particulate	60.0 ug/m³ 90.0 ug/m³ 150.0 ug/m³	1.0 ug/m³ none 5.0 ug/m³	annual 30 day 24-hour	none none none	0.0037 0.0051 0.17	0.030 0.042 0.20	ug/m³ ug/m³ ug/m³
SO_2	50.0 ug/m³ 270.0 ug/m³ none	1.0 ug/m³ 5.0 ug/m³ 25.0 ug/m³	annual 24-hour 3-hour	none none none	0.0043 0.020 0.11	0.021 0.14 na[a]	ug/m³ ug/m³ ug/m³
NO_2	100.0 ug/m³ 190.0 ug/m³	1.0 ug/m³ 5.0 ug/m³	annual 24-hour	0.95 5.2	0.035 0.16	0.25 1.7	ug/m³ ug/m³
CO	10.1 mg/m³ 15.2 mg/m³	0.5 mg/m³ 2.0 mg/m³	8-hour 1-hour	0.07 0.43	0.00011 0.00051	0.0011 0.0054	mg/m³ mg/m³

a not analyzed

Once the Research Park is completed, power would be provided to run the electrical systems from the existing Los Alamos Resource Pool. During routine operations, the Research Park would release minimal amounts of regulated air pollutants from sources such as boilers for building heat and water heaters (Table 4-5). Any other released pollutants would originate from laboratory research activities. It is assumed that

the Research Park buildings would not have any routine power generating systems that would produce pollutants. A few of the buildings, however, may have diesel-powered backup electrical generators for use during emergencies. When used, the air emissions from the generators would be minimal. NMED, in administrating the Clean Air Act Amendments, has determined that emissions generated by small building boilers, water heaters, and emergency power generators are insignificant and exempted from regulator reporting requirements.

Table 4-5. Anticipated Emissions from Building Operations

Emission Source	Capacity (MM Btu/hr)	Annual Operating Hours (hrs)	Estimated Annual Emissions (tons)			
			NO_x	CO	SO_2	PM
Boiler	0.5–5.0*	4,320	0.3	0.06	0.002	0.04
Water Heater	0.03–0.2**	4,320	0.1	0.03	0.009	0.009
Emergency Generator	350 hp ***	24	0.02	0.01	0.0002	0.003
Total per Building			**0.4**	**0.1**	**0.01**	**0.05**
Total for 10 Buildings			**4.5**	**1.0**	**0.1**	**0.5**

* Average heat input value of 1.4 MM BTU/hr used. Emission factors from EPA's AP-42, Section 1.4.
** Average heat input value of 0.12 MM BTU/hr used. Emission factors from EPA's AP-42, Section 1.4.
*** Emission factors from EPA's AP-42, Section 3.3; Diesel generator.

4.1.8 Noise

The erection of ten buildings and paving of parking lots for the Research Park would require the use of heavy equipment for the clearing, leveling, and construction of the buildings. Equipment such as front-end loaders and backhoes would produce noise levels at around 73 to 94 dBA at 50 ft (15 m) from the work site under normal working conditions (Cantor 1996, Magrab 1975). The finishing work within the building structures would create noise levels slightly above normal background. Noise levels may go up to around 80 dBA at the work site if light machinery is used in this stage of construction (Cantor 1996). Workers would be required to have hearing protection if site-specific work produced noise levels above the LANL action level of 80 dBA for steady-state noise. Sound levels would be expected to dissipate to background levels by the time they reach the northern edge of the canyon where residential areas are located. The presence of the additional 1,400 automobiles of the Research Park employees would not be expected to increase the present noise level produced by vehicular traffic on West Jemez Road during rush hour. The employees cars would usually remain parked at the Research Park during the day. Therefore, noise levels are not expected to exceed the established OEL. No adverse noise effects would be expected to occur from Research Park construction or operation.

4.1.9 Cultural Resources

DOE has determined that the one historic site located at the lease tract is not eligible for the National Register of Historic Places (NRHP) or for protection under the National Historic Preservation Act (NHPA); the two Archaic sites are eligible for the NRHP (Larson et al. 1997). The New Mexico State Historic Preservation Officer (SHPO) has concurred with these determinations. Prior to allowing any disturbance of the two National Register-eligible sites, LANL and DOE would prepare and implement a data recovery plan under a Memorandum of Agreement with the SHPO. It is anticipated that the data recovery plan would require excavation of the sites as the acceptable method for mitigating any adverse effects. Following implementation of the data recovery plan, construction could occur at each of the cultural resource sites. No TCP concerns have been identified to date.

4.1.10 Water Quality

As a provision of the DOE lease on the proposed Research Park tract, the County would be required to apply for, and attain, an NPDES permit through the State of New Mexico or EPA. As part of the NPDES construction permit application, the County would prepare and submit an NPDES SWPP Plan. The NPDES SWPP Plan would formally identify all site surface water drainage plans and the BMPs that would be implemented to avoid unnecessary soil erosion during the construction and operation of the proposed Research Park. The BMPs would include designs for constructing and maintaining all necessary surface water flow check dams, storm water retention ponds, and other erosion control measures. Specific measures would be implemented to avoid disturbance, stormwater run-on and run-off from existing PRSs as deemed necessary by the NMED and EPA under the NPDES permit.

A maximum of about 30 ac (12 ha) would be disturbed during construction of the proposed Research Park, and after construction, the developed area would consist of an estimated 14.2 ac (5.6 ha) of rooftops, asphalt, and concrete surfaces. Based on this and other site-specific information, LANL analyzed the potential storm water discharge that could be generated during and after the construction of the proposed Research Park. During construction, the site under development could generate a peak surface water discharge of 58 cfs during a single 100-year flood event. Once constructed, the developed area of the proposed Research Park would generate 27 ac-ft of storm water runoff annually, and could generate as much as 118 cfs during a single 100-year flood event (Lemke 1997).

The EPA has established regulations and guidelines for the development of a SWPP Plan for construction sites. The EPA regulations state that for a common drainage serving an area with 10 or more disturbed ac (4 or more ha), a storm water retention pond providing 3,600 ft^3 (100 m^3) of storage capacity must be provided to sufficiently control erosion from surface water discharges. During both construction and operation of the proposed Research Park, surface water discharges off the site would be controlled using the BMPs specified in the NPDES permit and SWPP Plan. Under these conditions, the proposed action is not expected to adversely affect water quality.

4.2 Potential Accident Scenarios

This EA evaluates two hypothetical accident scenarios that have a reasonable probability of occurrence at the proposed Research Park. The accident scenarios selected consider both a radiological accident and an industrial chemical accident at the park site. The two accidents are "bounding" cases, meaning that other potential credible accidents related to the Research Park are expected to pose less serious risks. Also, the assumptions made to evaluate the accidents tend to lead to an overestimate of risk. This is described in further detail below. Additional details on the accident scenarios are provided below and in Appendix A.

4.2.1 Scenario 1: Radiological Material Spill at the Proposed Research Park

This scenario is based on a postulated accident at the proposed Research Park that would affect only the Research Park. This scenario assumes that an accident occurs at a research park laboratory that would cause the release of trace levels of radiological material used for biological tracer studies. It is assumed that the Research Park would include several facilities that would be staffed by approximately 1,500 employees. The postulated accident occurs at a laboratory facility in the Research Park when a technician drops the radiological material during a routine procedure initiating the accident. The consequences resulting from this radiological release could have potential effects on the laboratory facility and the personnel located there.

It is assumed that a beaker containing technicium-99m is dropped and spills. This type of accident would have an estimated likelihood of occurrence of between once in 100 years and once in 10,000 years (1×10^{-2} to 1×10^{-4} per year) (Gonzales 1996), which makes it a "very unlikely event." For this scenario it is

assumed that the source is in a 500-milliliter solution. The exposure to radiological material resulting from an accident is dependent on the amount of material released. It is assumed for this accident scenario that the MAR is in the amount of 10 microcuries (μCi). The source term or amount of technicium-99m released and dose are estimated from the MAR and other factors as shown in the Appendix. The dose from this accident is estimated to be much less than 0.1 mrem, which places the consequence in the "low" consequence severity category (DOE 1994a). Adverse health effects are unlikely to result from this accident scenario.

4.2.2 Scenario 2: Human Error Release of Arsine Gas from Semiconductor Laboratory

This scenario is based on a postulated chemical accident at the proposed Research Park. It is assumed that a semiconductor research and development laboratory could be located in the proposed Research Park. An accident occurring at this postulated laboratory is assumed to cause the release of a chemical used in the semiconductor industry. The postulated accident is assumed to be the inadvertent (human error) release of a compressed gas called arsine that is used to produce wafers. The release is postulated to occur in a compressed gas safety cabinet located in the laboratory. The maximum amount of MAR is assumed to be 0.35 ft^3 (0.01 m^3) of gas (approximately a 1 liter bottle) at less than 500 psi. The consequences resulting from this chemical release would have potential effects on the personnel located there. The human error causing the accident is considered a "failure of administrative control" which has a published failure rate of between once in 20 years and once in 2,000 years (5×10^{-2} to 5×10^{-4} per year) (Benhardt et al. 1994). DOE considers this an "unlikely" event (DOE 1994a).

The Emergency Response Planning Guideline (ERPG) level 3 concentration for arsine is 5 ppm. This is the level at which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects. It is very unlikely that the postulated accident involving this quantity of arsine would expose anyone for one hour at ERPG level 3 without evacuation occurring at the proposed location.

The assumed amount of arsine considered to be at risk would be mitigated upon release by the compressed gas safety cabinet and by the ventilation system of the laboratory. This event consequently would not have any effects outside of the laboratory building.

4.3 Cumulative Effects

Cumulative effects on the environment result from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes them. These effects can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7). This section considers the cumulative effects of the Proposed Action together with other actions occurring at the site and on adjacent tracts along with other potential area effects.

The Research Park Site

Past land uses at the Research Park tract and on the neighboring mesas and canyons during the late 1800s and the early part of the 1900s primarily consisted of forest management, livestock grazing, dryland farming, and widely scattered homesteading. Land in the areas that would later become parts of the community of Los Alamos and LANL was either owned by the federal government, homesteaders, and ranchers or leased for use as grazing land, for farming, and for firewood and timber harvesting purposes.

Approximately half of the currently defined Research Park's 60 ac (24 ha) was cleared of timber as seen in the earliest available aerial photographs of the area taken in 1936. About two-thirds of the site has since

regrown in timber within recent years; the Proposed Action would remove less than 30 ac (12 ha) of the total site from a forested condition with about 30 ac (12 ha) remaining forested with large trees. Human occupation of the site would occur. This would represent less than 1.0 percent of the total currently available forested habitat land at LANL. Since the drainage portion of the Research Park would be left intact, no appreciable fragmentation of the site area's habitat would occur. Increased vehicular road traffic would, however, be of increasing concern with regards to area migration corridors for game species. Current limited available information obtained from radio collared elk indicates that most of the local herds primarily use migration corridors closer to State Road 4 located several miles to the south of the Research Park area for their semi-annual migration to and from the Valle Grande area west of the Pajarito Plateau and the Rio Grande. Deer have occasionally been seen in the vicinity of Los Alamos Canyon and individuals of this species may use the canyon and adjacent areas for grazing and migration purposes as well. Information on their typical migration patterns is not available.

LANL Operations

Workers at the Research Park would be located adjacent to the principal laboratory and administrative areas of LANL where about one-half of its employees are concentrated. This area is presently the site of many of the research and development activities performed at LANL and where many of the LANL material shipping and storage functions are conducted. As discussed in Chapter 3.0, the Affected Environment, LANL's routine operations contribute to the total background radiological setting for the Research Park. The main source of these radioactive emissions is LANSCE, which is located to the east of the Research Park tract along the south side of Los Alamos Canyon about two miles away. Another, although much lesser, source of emissions is the CMR Building located about one-half mile to the south of the Research Park. As discussed in Chapter 4.0, Environmental Consequences, the calculated risk of excess cancer fatalities for the total population of 1,500 workers at the Research Park from routine LANL operations, assuming they all work there for 50 years, is 0.038. Since the risk is less than one, no excess cancer fatalities would be expected for that population from routine operations located nearby. However, in the event of a major laboratory accident or catastrophic occurrence it is possible that there could be a release of radioactive materials, toxic or hazardous chemicals from nearby LANL facilities that could potentially affect tenants of the Research Park. Such releases of materials or chemical substances could result in near term illness or excess latent cancer fatalities. Potential hypothetical accident scenarios for facilities located near the Research Park were considered and screened to identify bounding potential accident analyses considered to be credible (i.e., their estimated annual probability of occurrence ranged from "anticipated" to "extremely unlikely" [10^{-1} to 10^{-6}]). One overriding potential accident involving an aircraft crash into the roof of the CMR Building that could result in an airborne release of radioactive material and one potential process-oriented accident were identified as bounding for potential adverse effects to Research Park tenants through this process. The hypothetical accidental plane crash could potentially result in a release of radioactive materials from the CMR Building; the resulting estimated number of excess latent cancer fatalities among the maximum of 1,500 people at the Research Park would be 0.2. Similarly, the hypothetical accidental process-related accident scenario could potentially result in a release of radioactive material from a fire in the CMR Building; as a result about four estimated excess latent cancer fatalities among the maximum of 1,500 people at the Research Park would be possible. A bounding hypothetical chemical accident resulting in a release of toxic material was also identified. This potential accident scenario involved the release of hydrogen cyanide, that could marginally result in acute adverse health effects for tenants located at the Research Park. This effect could result if events that are necessary for the accident to occur actually happen under somewhat unusual weather conditions. Analytical details regarding these accident scenarios are provided in Appendix B. Although these computed results do not represent the entirety of effects possible from such accident events, they do represent the potential increase in cumulative effects that could result from increasing the population in close proximity to the LANL nuclear and hazardous facilities by 1,500 people. Additional consideration of accidents occurring at LANL and their effects to the human health and the environment are analyzed in the 1979 LANL SWEIS and in the new LANL SWEIS currently being prepared.

CMR Building Upgrades

DOE is planning to perform upgrades to the CMR Building located in TA-3 within the next one to five years. The upgrades have been analyzed in the CMR Building Upgrades Environmental Assessment (DOE/EA-1101). A finding of No Significant Impact was issued for these upgrades on February 11, 1997. In addition, parts of the CMR Building may be reconfigured within the next ten years in order to meet future changes in the mission of LANL. Reconfiguration of the CMR Building is currently planned for incorporation of pit production, which is to be analyzed in the LANL SWEIS under development or in a separate NEPA review at a later time. The accidents discussed in the previous paragraphs do not consider the incorporation of additional material into the CMR Building that would result from pit production. It is expected that additional radioactive material amounting to about 1 percent of the total of that currently stored at the CMR Building storage vaults could be added to that facility due to pit production activities; this would result in more material that could be available for transport off-site in the event of an accidental release and marginally greater environmental and human health affects that could result from increased potential dose amounts for the tenants located at the Research Park if an accident occurred at the CMR Building after incorporation of pit manufacturing activities. Qualitative analysis is not currently possible to explore the likely estimated increases in materials available for release and their potential affects if such a release were to occur; however, this information is being generated for consideration in the LANL SWEIS which is currently under preparation.

LANL Electric Utility Supply Capability

At LANL, the capability of the current electric utility supply system is adequate to meet the demands of existing and reasonably foreseeable future operations. The electricity requirements of current operations as well as reasonably foreseeable projects that have completed the NEPA review process and that DOE has committed to implementing at LANL, including the proposed Research Park, would have an incremental effect on the ability of the current system to support anticipated operations. However, this incremental increase is not expected to result in a major change in the demands on the existing system. This increase would not require extensive modifications or upgrades to either the supply system or to the manner in which operations are conducted at LANL. Therefore, only minimal cumulative effects are expected on the electric utility supply system at LANL.

Santa Fe National Forest Lands

The U.S. Forest Service (the Forest Service) manages land located to the west of the Research Park designated as the Santa Fe National Forest. The projected future uses of this land within the foreseeable future for recreation, timber production and habitat management purposes are not expected to change.

Hiking and winter-time skiing are the primary recreational uses of the land within the immediate vicinity of the Research Park tract; the Pajarito Ski Slope is accessible along the Camp May Road to the west of LANL's TA-62. Use of the Santa Fe National Forest is expected to increase slightly from the Proposed Action, but this increase should be well within the anticipated loading capacity for this area.

Activities to reduce overall fuel loading for potential wildland fire protection and to create and maintain a continuous fuel break within the close vicinity of the Los Alamos Townsite and LANL are expected to continue. These fuel load reduction actions could include both cutting trees, and then chipping the timber for use as mulching material, and controlled burns of forested areas that would periodically result in widespread moderate levels of smoke for short periods of time in the vicinity of the Research Park. Controlled burns could reduce local visibility and result in temporary degradation of air quality. Since the proposed Research Park would be situated adjacent to forested areas on two sides, it would be important to maintain the area and reduce the potential for crown fires that tend to spread very swiftly and are not easily controllable. The vegetated areas at the Research Park and on adjacent tracts would be managed

according to the IWMT and LANL operating procedures. The addition of the Research Park next to LANL's main facility complex is not expected to appreciably affect the fire protection pressures or overall wildland fire control strategies.

A portion of the forested land to the northwest of the Research Park tract is managed by the Forest Service as spotted owl habitat under the Recovery Plan for the Mexican Spotted Owl (USFWS 1995). No Mexican spotted owls have been found to use the area for breeding purposes to date. The development of the Research Park track is within about one-quarter mile of such habitat; about 30 ac (12 ha) of potential roosting and foraging habitat would be removed by the project. This removal of habitat represents less than 1.0 percent of the total available habitat within LANL, and a correspondingly very small percentage of the total available habitat within the east flank of the Jemez Mountains. Building out the Research Park is not expected to have a cumulative effect on overall available use habitat for the Mexican spotted owl or other federally listed species that occupy areas along the eastern flank of the Jemez Mountains.

DP Road Tract Ownership Transfer

DOE is planning to transfer ownership of a 28-ac (12-ha) tract of undeveloped land along DP Road to the County (DOE 1997). The County has indicated that its preferred use of the land tract would be to develop the property within five to ten years for their own use with the construction of a new office building to house County employees, paved parking areas, and new warehouses, garages, and support buildings for the transfer of the school bus yard, equipment maintenance, and school supply warehousing activities to the site. Developed land within the County consists of private, county, and federal property and includes commercial, residential, and industrial developments in the Los Alamos Townsite and White Rock communities and at LANL technical areas. Development of the total of about 58 ac (23 ha) of land between the two sites would add about 1 percent to the already cleared and developed land within Los Alamos County. The purpose of the proposed land lease and transfer is to help the County become economically self-sufficient. Developing the Research Park tract along West Jemez Road and the DP Road tract would increase the financial base for the County. By developing both tracts in a unified way, it would be possible to maximize the benefit to the County. The cumulative economic benefit of jointly developing the tracts under consideration may be greater than the sum of economic improvement that would occur if each tract were developed without regard for the type of development in other tracts. The County plans to develop the DP Road tract with commercial and light industrial uses. When considered with the Research Park, the County would realize a total increase of about 88 ac (36 ha) of land in commercial and light industrial use. Positive economic effects are anticipated as a result.

Activities at both the proposed Research Park tract and the DP Road tract would generate commercial refuse. When fully developed and in operation, the Research Park would generate about 12,000 yd^3 (9,100 m^3) and the DP Road tract would generate about 3,600 yd^3 (2,700 m^3) of commercial trash annually. The combined effect of these two developments would therefore be an increase of 15,600 yd^3 (11,800 m^3) of commercial trash being disposed of annually. This volume represents an increase of 77 percent in the volume of commercial trash handled by the County landfill annually, which is a 19 percent increase in the volume of total refuse handled by the County landfill per year.

Development of the Research Park tract would result in 2,355 additional workers in the County who would generate an additional 47,100 gal. (178,000 L) of sanitary sewage per day. Development of DP Road tract would result in 645 additional workers in the County who would generate an additional 13,000 gal. (49,000 L) of sanitary sewage per day. If both tracts were developed, an additional 60,000 gal. (227,000 L) of sanitary sewage would be generated per day. Comparing these volumes with the usage and capacities shown in Table 3-4, it appears that either the Bayo Canyon sewage treatment plant or LANL could adequately process these quantities of sewage.

In terms of potential cumulative traffic concerns, the effects of the two developments would be moderated by the several-mile distance between the two developments. However, the general road network in the County and beyond would experience a fairly large increase in traffic, which may require general improvements to the system in order to accommodate the actions. Additionally, closure of Diamond Drive from its intersection with West Jemez Road located immediately south of the Los Alamos Canyon bridge is being contemplated to accommodate new LANL missions and to provide enhanced security to LANL. Closure of Diamond Drive through TA-3 would force all internal traffic to access LANL sites by turning west on West Jemez Road. This would complicate traffic flows which would be compounded by a large working population located at the Research Park.

Approximately 1,035 new employees (both direct and indirect) could reside in the ROI as a result of developing the DP Road tract in downtown Los Alamos (DOE 1997). If this projected figure is added to the projected 4,065 direct and indirect employees associated with the proposed development of the Research Park tract, this would amount to a total of about 5,100 additional employees residing in the ROI (Santa Fe, Rio Arriba, and Los Alamos Counties). Approximately 10,858 vacant housing units are projected to be available in the ROI by the year 2000 (see Section 3.3). The projected number of vacant units indicates that there will be adequate housing in the ROI to accommodate both the development of the DP Road tract and the proposed Research Park tract. Housing in the County, however, is anticipated to be near capacity, with only 410 vacant units projected for the year 2000. Many of the new employees would not be able to live in the County and would have to reside in either Santa Fe County or Rio Arriba County. Rental prices in the County, both in White Rock and the Townsite, would probably increase.

Based on figures provided in the EA for the transfer of the DP Road tract to the County, the operation of new light industry on the DP Road tract could involve the use of an additional 54,000 kW of electricity per month, 900 million ft^3 of natural gas per month, and 1,200,000 gal. of water per month. By multiplying these numbers by 12, converting the end result to corresponding units as necessary, and adding the numbers to the projected Research Park utility demands (Section 4.1.1.3), this could amount to an increase of 4,898 MWh of electricity per year, 49,446 million Btu of natural gas per year, and 31,455,000 gal. (119,057,170 L) of water per year over current County usage. Cumulative effects from the DP Road tract and the proposed Research Park tract on LANL electrical, water, and gas usage are not being considered since the DP Road tract only uses the County utility system. The combined projected usage from the Research Park and the DP Road Tract would be a yearly increase of approximately 5.6 percent in electrical usage, 4.7 percent in natural gas use, and 3.2 percent in water use. With the exception of the electrical transmission limitation discussed in Section 4.1.1.3, the County utility system should be able to accommodate both the proposed Research Park and the DP Road tract developments. A new electric transmission line into LANL or an enhanced power plant at LANL is currently being contemplated as part of a regional power upgrade. A proposal may be ready soon for consideration by the decision makers. Separate NEPA analysis would be performed.

Air pollutants from planned projects and ongoing operations at LANL together with emissions from the proposed Research Park and development of land on DP Road could have a cumulative effect on the ambient air quality in Los Alamos County. The potential effects that each new project might have at LANL would be reviewed for compliance with the Clean Air Act. Projects outside the jurisdiction of DOE are also subject to the Clean Air Act. Emissions that exceed National Ambient Air Quality Standards established by the Act would require the issuance of a permit with strict limits on emissions before the activity would be allowed to proceed.

Additional Transfers or Leases of DOE Land and Properties

The potential transfer(s) or long-term lease(s) of approximately 8,000 ac (3,200 ha) of land presently within the LANL boundaries is being contemplated for the near future. The County of Los Alamos and San Ildefonso Pueblo are expected to be named as recipient parties in legislation currently under draft for

consideration by Congress. The acreages under consideration are located adjacent to the west of the Research Park (TA-62), northeast of the Los Alamos Canyon bridge (TA-43 and TA-41), along DP Road (TA-21), near the Los Alamos Airport (TA-73 and TA-74), at the intersection of State Road 502 and State Road 4 (TA-72), and near the White Rock community (TA-54, TA-36, TA-71, and TA-70). The anticipated probable future uses of these tracts would include a combination of industrial, commercial and residential uses together with both cultural and resource preservation. Effects of future development of this land are purely speculative at this time; no information is available regarding the percentage of land anticipated to be cleared or the amount anticipated to remain as buffer or lands set aside for resource preservation, nor is information available to consider overall changes to the social structure or economic baseline for Los Alamos County. Cultural resources and wildlife habitat, including potential habitat for federally listed threatened or endangered species are present over portions of the land under consideration, and these resources could be adversely affected by potential land development and increases in human occupation of the areas either in whole or in part. It is likely that effects would be similar in nature to those considered for the Research Park and DP Road Tract but at a much larger scale commensurate with the level of development activities and the time it would take to complete them. It is expected that this action would be the subject of a project specific EIS that would commence within the year following passage of the proposed legislation and funding of the project reviews.

4.4 No Action Alternative

4.4.1 Socioeconomics

The proposed Research Park tract would remain undeveloped and would offer no employment opportunities or revenue generating opportunities under the No Action alternative. The tract would not be used for any specific purposes other than parking and to serve as a buffer between LANL operations and public or private property. The tract would continue to be used for infrequent recreational uses.

For the sake of effects analysis, the average wage for an employee at the Research Park is estimated to be 56,750 dollars per year. In the ROI, this could amount to about 81 million dollars in indirect (business) and induced (household) income that would not be achieved under this alternative. This income would have been generated by the respending of the income from the estimated 1,500 "direct" Research Park employees. Also, there would be no procurement of goods, services, or construction materials associated with development and operation of new business. The No Action alternative would not change current housing market conditions.

Not leasing the tract would have a negative effect on the County's future revenue potential. Projected lease payments, about 4.5 million dollars per year, would not be realized. The County would have fewer opportunities to find sources of income to offset the loss of dollars in assistance payments from DOE. If the loss of assistance payments is not offset, there may be an effect on human welfare. Some community activities may become unavailable, and the level of police and fire protection may be reduced if the County cannot afford to maintain current levels of operation. Regional electric utility demands are expected to increase sufficiently over the foreseeable future to require the installation of new or additional major transmission lines and substations to bring power to the County grid. Additionally, LANL's power supply uses need to be upgraded or replaced. Under the No Action alternatives, the upgrades to the TA-3 area would still be required.

4.4.2 Land Use and Traffic

Under the No Action alternative, DOE would not lease the land to the County. The potential effects associated with the Proposed Action would not occur. There would be no change in land use at the tract for the near future. Use of the Research Park tract for parking and as a buffer to the townsite would continue. In the near term, the tract would remain generally undeveloped since DOE has no current plans

to move or expand LANL operations into this land area. Traffic in the area would not increase as a result of development of the tract. No roadway widening or traffic improvements would be necessary.

4.4.3 Ecological Resources

The flora and fauna in and around the Research Park tract would continue to be managed in accordance with LANL policies in the event that the Proposed Action is not implemented. This area would be managed by LANL to comply with Federal environmental laws. The current ecological conditions on the tract would not be expected to change under the No Action alternative.

4.4.4 Waste Management and Environmental Restoration

Under the No Action alternative, no construction waste, operational waste, or new sanitary wastewater would be generated at the land tract. Environmental restoration activities would continue as necessary in accordance with approved EPA and state permits.

4.4.5 Aesthetics

If the land tract remains under DOE ownership and is not developed further, no changes in the visual or aesthetic character of the Research Park tract would occur The aesthetic character of the tract would be retained as mainly undeveloped but previously disturbed forested lands.

4.4.6 Human Health

There would be no change in the potential radioactive, chemical, biologic, physical, or environmental hazards that could affect human health under this alternative. The tract would remain in its present natural state and continue to serve as a buffer between LANL and the public.

4.4.7 Air Quality

Under this alternative the Research Park tract would not be leased to the County for development of a research park. The tract would remain in its present, generally natural state and continue to serve as a buffer between LANL and the public. Therefore, no radioactive or nonradioactive air emissions would be generated at the tract under this alternative.

4.4.8 Noise

If the land tract remains under DOE ownership and is not further developed, no changes in the noise levels at the Research Park tract would occur. Ambient noise levels would remain at their current acceptable levels.

4.4.9 Cultural Resources

Under the No Action alternative, DOE would not lease the land at West Jemez Road to the County. The land would remain in its current, mainly undeveloped state and the cultural resources that are on that part of DOE property would not be affected. Mitigation of the cultural resources on the Research Park tract would not be necessary.

4.4.10 Water Quality

Under this alternative the Research Park tract would not be developed. There would be no additional site disturbance and the surface water generated during storm events would continue to be absorbed by site soil

and vegetation, collected in an existing small retention pond, or flows off the site into Los Alamos Canyon via natural drainage channels.

4.5 Comparison of Alternatives

The following summary table (Table 4-6) compares the two alternatives presented in this EA and the expected consequences under each alternative. More detailed information as to the anticipated effects under each alternative is provided in the text of this document in Section 4.0.

Table 4-6. Summary of the Potential Effects of the Proposed Action and the No Action Alternative

Factor	Proposed Action	No Action
Socioeconomics	• Approximately $4.5 M in annual lease payments and 1,500 direct jobs • Up to 2,565 indirect jobs • New utility lines required	• No additional persons employed or income generated
Land Use and Traffic	• Maximum of 30 ac (12 ha) disturbed • Increase in vehicular traffic, road widening required	• No land leased • No change in traffic volume
Ecological Resources	• Some trees and animal habitat loss • Mexican spotted owl habitat within one-quarter mile may be affected	• No change to ecology • No potential habitat loss
Waste Management and Environmental Restoration	• Commercial and industrial waste managed by the County landfill or commercial facilities off-site • Sewage system modifications would be required • Some future environmental restoration may be required	• No waste generated • Some future environmental restoration may be required
Aesthetics	• Construction of up to 10 buildings with parking lots	• No changes
Human Health	• Potential physical and chemical hazards • Possible use of radioactive materials • No excess cancer fatalities	• No adverse effects to humans • Land continues to act as a buffer zone
Air Quality (radiological and nonradiological)	• Emissions below Federal and State standards Negligible increase in emissions	• No emissions generated
Noise	• Noise levels below OEL at public boundary • Steady state and impulse	• None generated
Cultural Resources	• No adverse effect • Requires mitigation of 2 archaeological sites	• No effect
Water Quality	• No adverse effects with implementation of NPDES permit	• No changes

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5.0 AGENCY CONSULTATIONS

DOE would be responsible for compliance with environmental restoration regulations under RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act at the Research Park tract for any contamination caused by DOE or predecessor agencies which exist on or within the tract at the time of the lease. The County and its sublessees would be responsible for seeking and obtaining applicable Federal, state, and local permits for activities at the Research Park tract. Regulations implementing the Clean Air Act, Federal Water Pollution Control Act (Clean Water Act), RCRA, Safe Drinking Water Act, Toxic Substances Control Act, Emergency Planning and Community-Right-to-Know Act, and others may apply to development activities at the tract.

DOE is required under (1) Sect. 7 of the Endangered Species Act to consult with the U.S. Department of Interior, USFWS, regarding potential effects of the proposed actions on any listed threatened and endangered species, and under (2) Sect. 106 of the NHPA to consult with the SHPO regarding the presence of archaeological and historic sites and potential for adverse effects on the resources by proposed actions.

The following agencies were contacted for information and data used in this EA:

- On September 20, 1996, DOE LAAO initiated informal consultation with the USFWS, with a request for concurrence with a DOE finding that the proposed action "may affect but was not likely to adversely affect any threatened or endangered species or their critical habitat." On October 1, 1996, the USFWS provided to DOE a list of endangered, threatened, and candidate species, and species of concern that may be found in Los Alamos County. On November 22, 1996, USFWS provided comments on a Draft Biological Assessment submitted by DOE. These comments and the changes to the scope of the proposed action that occurred between October 1996 and March 1997 were incorporated into the biological assessment and the document was resubmitted to the USFWS. Between March 1997 and early August 1997, additional discussions and correspondence as well as a site visit by USFWS to the proposed park site took place. On August 29, 1997, USFWS concurred with the DOE finding that the proposed action "may affect but is not likely to adversely affect any threatened or endangered species or their critical habitat."

- DOE LAAO has formally consulted with the SHPO regarding the two Archaic sites and one historic site located within the Research Park tract. The SHPO has concurred with its determination that the two Archaic sites are eligible for the NRHP and that the historic site is not eligible. DOE would enter into a Memorandum of Agreement with the SHPO to define further DOE action to comply with 36 CFR 800 at affected eligible sites within the Research Park tract.

- On July 3, 1997, DOE LAAO contacted the Forest Service, Los Alamos Office, to consider any land development plans the agency might be considering in proximity to the Research Park tract. As of this date, the Forest Service is considering upgrading the Los Alamos reservoir site (e.g. road, trail, and recreational area improvements) and possibly allowing a small communications site but no other actions are planned near the Research Park tract.

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APPENDIX A

1.0 Scenario 1: Radiological Material Spill at the Proposed Research Park

Accident Scenario Release Source Term

For material released in the form of respirable particulate matter or oxides, the amount of material released or source term can be estimated by the following expression:

Source Term = MAR × DR × ARF × RF (DOE 1994b)

MAR = amount of material at risk (technicium-99m)
DR = damage ratio (the fraction of the MAR affected by the accident conditions)
ARF = airborne release fraction (fraction of the affected material that is made airborne)
RF = respirable fraction (fraction of the airborne particles that are respirable)

For this accident the source term is estimated to be:

Source Term = (10 μCi) × (1) × (0.01) × (0.001) = 1.0 E-04 μCi

Conservatively assuming no dispersion of the radioactive material, the source term is then equal to the intake. The dose is then estimated as:

Dose = Intake × Dose Conversion Factor (EDE)

Dose = 1.0 E-04 μCi × 2.1 E-05 rem/μCi

Dose = 2.1 E-09 rem

Dose = 2.1 E-06 mrem

2.0 Scenario 2: Human Error Release of Arsine Gas from Semiconductor Laboratory

This accident scenario is highly qualitative in nature. No calculations were required to develop this scenario. All of the details and assumptions used in this scenario are provided in Section 4.2.2 of this EA.

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APPENDIX B: SUPPORTING QUALITATIVE ASSESSMENT OF LANL-ORIGINATED ACCIDENTS

Available sources of information on potential hypothetical accidents originating at LANL were reviewed in order to identify a representative suite of accidents that could have impacts to occupants of the Research Park. The sources of information included Safety Analysis Reports, NEPA documents such as EISs, and other documentation resulting from recently completed site-wide or facility-specific accident analyses. Several screening criteria were used to select the representative accidents. The criteria which an accident met in order to be selected for inclusion were:

- ***Category of Accident:*** accident is representative of one of three categories of accidents: 1) results in a radiological material release that is initiated by an external event (e.g. airplane crash), 2) results in a radiological material release that is initiated within a facility and is associated with a LANL operation (e.g. fire initiated within a laboratory module), 3) results in a non-radiological chemical release;

- ***Likelihood of Accident:*** accident estimated frequency of occurrence is credible (i.e., the estimated annual probability of occurrence ranges from once in ten years to once in one million years [10^{-1} to 10^{-6} per year]);

- ***Consequence of Accident:*** consequence is "bounding" (i.e., potentially exposes Research Park workers to the hypothetical maximum amount of radiological or nonradiological chemical materials compared to other accidents of the same category); for purposes of the screening activity, this was assessed qualitatively from existing accident analyses that had different receptor locations (e.g. Los Alamos townsite);

- ***Future Credibility of Accident:*** accident estimated frequency of occurrence will not become incredible ($<10^{-6}$ per year) within the reasonably foreseeable future resulting from reasonably expected actions at LANL; and

- ***Preclusion of Indirect Effects:*** radiological or nonradiological chemical hazards to Research Park workers are not preceded by the direct effects of the accident itself (e.g., for accidents initiated by earthquakes that cause a release of radiological materials, if the hazards from the direct effects of the earthquake, such as falling objects, occur substantially sooner than the radiological hazards, then the radiological accident was screened from further consideration; consequently only earthquake-initiated accidents that would cause the release of material from LANL but which would not affect Research Park buildings to any appreciable degree were considered for selection as a bounding accident).

Two accidents, one operations-related and one unrelated to operations at LANL, were selected for assessment of the possible consequences from radioactive materials to Research Park workers. The assumptions and supporting calculations are summarized as Scenarios 1 and 2 below. One hypothetical accident releasing a nonradiological chemical was selected for qualitative analysis and is summarized as Scenario 3 below.

1.0 Scenario 1. Bounding Hypothetical Accident Unrelated to LANL Operations—Plutonium Release Caused by Aircraft Crash at CMR

The hypothetical accident unrelated to LANL operations selected for qualitative analyses involves an aircraft crash into the roof of the CMR building. The LANL SWEIS currently under development will present a full discussion of the accident and the results of quantitative analyses that are summarized in this appendix. The accident involves the crash of an aircraft into the CMR Building causing an explosion, a fire, and a release of radiological materials. The source of information on this accident was (Sholly 1997).

Estimated Annual Likelihood of Occurrence

Development of the crash frequency follows the methods and procedures in DOE-STD-3014-96 (DOE 1996b). The frequency analysis considers aircraft landings and take-offs at Los Alamos Airport as well as in-flight accidents not associated with the airport. The analysis also considers different aircraft types. The overall crash frequency at the CMR Building is slightly over five crashes in one million years (5.5×10^{-6} per year). This was calculated as

2.8×10^{-6} (aircraft landings) + 2.6×10^{-6} (in-flight accidents) + 5.3×10^{-8} (aircraft take-offs) = 5.5×10^{-6} (overall crash frequency).

The overall crash frequency of 5.5×10^{-6} per year makes the accident an "extremely unlikely"event according to Table B-1.

Table B-1. Qualitative Likelihood Classification

Descriptive Word	Estimated Annual Likelihood of Occurrence	Description
Anticipated	$10^{-1} \geq p > 10^{-2}$	Incidents that may occur several times during the lifetime of the facility (incidents that commonly occur).
Unlikely	$10^{-2} \geq p > 10^{-4}$	Accidents that are not anticipated to occur during the lifetime of the facility. Natural phenomena of this probability class include Uniform Building Code-level earthquake, 100-year flood, maximum wind gust, etc.
Extremely Unlikely	$10^{-4} \geq p > 10^{-6}$	Accidents that will probably not occur during the life cycle of the facility. This class includes the design basis accidents.
Beyond Extremely Unlikely	$10^{-6} \geq p$	All other accidents.

Source: DOE 1994a

DOE-STD-3014-96 (DOE 1996b) should be consulted for more technical detail on frequency calculations for this accident.

Accident Scenario Consequence

The consequence to a human being from exposure to radiation resulting from an accident can be determined by calculating the "dose equivalent" to an individual. Dose equivalent is defined as a measure of biological damage caused by radiation. Dose equivalent is estimated from the amount of radioactive material released into the air, called "source term," and the amount inhaled, called "intake." The analysis shows the results of calculating the source term that results from the explosion and fire caused by the crash. Based on the calculations, the source term for this accident was 3.7 grams of Pu-239 from the initial 30-second impact of the accident, and 1.5 grams that becomes resuspended over a 24-hour period.

The MACCS2 computer code was used to model the consequences of the accident at various distances from the CMR Building. The results of the computer modeling are shown in Table B-2 below.

To qualitatively estimate the dose to the maximally exposed individual (MEI) at the Research Park, a simple extrapolation was performed to obtain a dose by distance relationship. This relationship was used to predict dose at the Park's closest proximity to the CMR, which was taken to be 0.6 mi (750 m). The predicted dose of 3.8 rem is a 50-year committed effective dose equivalent (CEDE), meaning that it represents the predicted dose equivalent to all organs and tissue affected over a 50-year period after an intake of radionuclide into the body. A CEDE of 3.8 rem could cause minor effects but no lost work time

nor disability (NRC 1995, DOE 1990). Ongoing CMR Facility and site-wide safety analysis efforts may alter these results but substantial changes to the proposal under evaluation are not expected.

Table B-2. Predicted Mean Doses from Airplane Crash at the CMR Building

Maximum Exposed Individual (MEI) Dose (rem, 50-year committed effective dose equivalent [CEDE])	
MEI Location	**Dose**
Closest public access (SA): Diamond Drive (40 m)	1.6×10^{1}
Nearest residence (CMR SAR): Los Alamos Townsite (1,000 m)	1.8×10^{-1}
Nearest special population distance: Los Alamos Medical Center (1,100 m)	1.5×10^{-1}
Other nearest residences (CMR SAR): Royal Crest Trailer Park (1,200 m)	1.3×10^{-1}
Nearest population distance: San Ildefonso Pueblo (4,500 m)	2.2×10^{-2}
Farthest population distance: San Ildefonso Pueblo (18,600 m)	$4.5 \times 1\ 0^{-3}$

Source: Sholly 1997

Long–Term Effects

Estimates of long-term or chronic human health risk from the radiation environment are made based upon currently accepted radiation risk models (ICRP 1991). These risk estimates show the ultimate effects of radiation on humans, namely, an estimate of the added cancer fatalities in the exposed population. Human health risk is determined by converting the estimated dose into the probability of contracting a fatal cancer. The dose-to-risk conversion factor used for estimating cancer deaths was four cancer deaths (LCFs) per 10,000 person-rem dose (4×10^{-4} cancer deaths per person-rem) for exposed workers (NRC 1991, DOE 1993). The health risk to an exposed individual is best expressed as the added probability of that individual developing a fatal cancer. As the probability approaches 1.0, the chances of developing a fatal cancer increases. As probability decreases, the chances of developing a fatal cancer similarly decrease. For exposed populations, the probability is more meaningful when it is considered as the number of additional cancer deaths. If the probability is less than 1.0, no additional cancer deaths are expected. If it exceeds 1.0, then additional cancer deaths are likely to occur.

To compute the potential number of LCFs at the Research Park resulting from this accident, the dose at 0.6 mi (750 m) from the CMR was extrapolated from the dose by distance information in Table B-2. A dose (CEDE) of 0.34 rem at 0.6 mi (750 m) was used to estimate LCFs at the Research Park as follows:

LCFs per year = person-rem × dose-to-risk conversion factor,

where,

person-rem = population × dose (rem)

and

dose-to-risk conversion factor for a population of adults = 4×10^{-4} deaths per person-rem.

Table B-3 shows the results of the LCF estimation.

Table B-3. Latent Cancer Fatalities at the Research Park

Dose (rem)	Affected Park Population	Person-rem	Dose-to-Risk Conversion Factor (LCFs per person-rem)	Individual Risk	LCFs	Probability
0.34	1,500	510	4×10^{-4}	8.2×10^{-5}	0.20	4.5×10^{-10}

Using the risk conversion factor, a dose of 0.34 rem results in an increase in individual risk of slightly over eight in one hundred thousand (8.2×10^{-5}), i.e., the risk of a Research Park worker contracting a fatal cancer from this accident is 8.2 in 100,000. For comparison, one in five individuals in the United States dies of cancer from other causes, i.e., a risk of 0.2 per person. Considering both the estimated frequency of the accident (5.5×10^{-6}) and the individual risk, the probability of the accident occurring and a fatal cancer being contracted by a Research Park worker is about 4.5×10^{-10} per person per year.

If all 1,500 workers at the Research Park were exposed at the rate of 0.34 rem, it would result in a collective dose of 510 person-rem. This results in a total of 0.20 additional cancer fatalities (i.e., less than 1.0) for the entire population of 1,500 park tenants.

2.0 Scenario 2: Bounding Process-Related Hypothetical Accident—Wing-Wide Fire at the Chemical and Metallurgical Research Facility

The accident selected for application to the Research Park is a fire that originates inside a laboratory module of the Chemical and Metallurgical Research (CMR) Facility and spreads to include an entire wing (Faust 1997). The postulated fire originates when combustibles come in contact with any of many ignition sources that exist in the CMR, such as a hotplate used in a mass spectroscopy process. Although fires could conceivably originate in several locations within the CMR, the fire is conservatively assumed to originate in Wing 5 because it has the highest material at risk potentially dispersed by the accident. In this regard, the fire is said to be "bounding" of all other fires that could be postulated for the CMR.

The fire is assumed to begin in an enclosure, then is postulated to spread beyond the confines of the original enclosure, ignites combustibles elsewhere within the laboratory involving several adjacent offices or laboratory modules, and finally to the entire wing. Details of the accident scenario, including discussions of several aspects of mitigation of potential releases can be found in recent documentation of analyses (Faust 1997).

The postulated accident has an estimated frequency of occurrence of about once every ten thousand years (9.7E-05/yr). With the implementation of planned upgrades to the CMR, the frequency may decrease to approximately once in 100,000 years (9.7E-06/yr), which still makes it a credible accident.

For determining radiological dose consequences to the maximally-exposed individual (MEI) at the Research Park, analysis consisted of two parts: air dispersion calculations and radiation dose calculations (Faust 1997). SCRNLANL computer code was used for modeling air dispersion, and GENII-S was used for modeling dose calculations. Descriptions of these computer codes may be found in numerous LANL documents. Analyses of this type can have a margin of error of one order of magnitude. Ongoing CMR Facility safety analysis efforts may alter these results somewhat, but substantial changes to the proposal under evaluation in the Research Park EA are not expected.

A 50-year CEDE of 8.5 rem was estimated for the MEI at 0.6 mi (750 m) to the Research Park. A CEDE of 8.5 rem could cause minor effects but no lost work time nor disability (NRC 1995, DOE 1990). This analysis is very conservative (overestimates risk) in the following ways:

- The amount of radiological material that is assumed to be involved in the accident is the maximum that is permitted into the wing (this is rarely, if ever, true).
- All of the radiological material is exposed to the fire.
- All of the radiological material postulated to be involved in the accident is assumed to be in the physical form that is most easily released by fire.
- Winds are assumed to blow in the direction of the Research Park.

- The ventilation system is assumed to be inoperable.
- No filtration of radioactive particles by high-efficiency particulate air filters is assumed.
- It is assumed that the building structure is not in tact, and therefore does not confine the radioactive material.

With the implementation of planned upgrades to the CMR Building, it is expected that the estimated dose to the MEI will decrease.

To compute the dose for calculating LCFs, the source term can be integrated across an area of concern, in this case the 60 ac^2 (24 ha^2) of the Research Park (Heindel 1997). This resulted in an average dose of approximately 6.3 rem. Using the risk conversion factor of 4×10^{-4} cancer deaths per person-rem, a dose of 6.3 rem results in an individual risk of approximately three in 1,000 (2.5×10^{-3}). For comparison, one in five individuals in the United States dies of cancer from other causes, i.e., a risk of 0.2 per person. Considering the estimated frequency of the accident (9.7E-05/yr) and the individual risk, the probability of the accident occurring and a fatal cancer being contracted by a Research Park worker is about 2.4×10^{-7} per person per year.

If all 1,500 workers at the Research Park were exposed to the average dose, which is a conservative assumption, it would result in a collective dose of 9,450 person-rem. Applying the dose conversion factor, this results in a total of approximately four latent cancer fatalities in the event that this extremely unlikely accident occurs.

3.0 Scenario 3: Bounding Chemical (Nonradionuclide) Accident—Earthquake-Initiated Release of Hydrogen Cyanide from the Sigma Building

The accident selected to represent those causing a release of nonradionuclide toxic material from LANL and potentially affecting Research Park tenants was a moderate earthquake on the Pajarito Fault resulting in structural damage or internal damage to the Sigma building at TA-03-66. Built in the late 1950s, the Sigma building is subject to damage from earthquakes of low to moderate-intensity (Sholly 1997, Volkman 1996). This accident is estimated to occur approximately three times every thousand years (2.9 to 3.5×10^{-3} per year). This places the accident in the "unlikely" category.

The release of hydrogen cyanide (HCN) occurs when the earthquake causes mixing of metal cyanide solution and nitric acid. This accident is currently under analysis for the LANL SWEIS (Sholly 1997). The accident consequence analysis is being performed using the ALOHA computer code, which predicts the rate at which chemical vapors may escape to the atmosphere from broken gas pipes, leaking tanks, and evaporating solutions such as the HCN mixture. The code also predicts how the resulting hazardous gas cloud disperses horizontally and vertically into the atmosphere following release. Specific features and limitations of ALOHA, as well as a discussion of earthquake analyses, will be discussed in the LANL SWEIS.

The most useful result of ALOHA is the distance estimate from the source of the HCN release to which ERPGs concentrations are reached. ERPG levels are defined as the maximum airborne concentrations below which it is believed that nearly all individuals could be exposed for up to one hour without

- experiencing or developing life-threatening health effects (ERPG 3) or experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action (ERPG 2).

Emergency evacuation procedures for the Research Park and timely emergency notification from LANL should keep either of these ERPG levels from being exceeded for the one-hour period.

Preliminary results (Sholly 1997) of the consequence modeling are as follows:

Stable[12] Meteorology (1.5 m/s wind, F class stability), instantaneous release, 2 gal. (7.6 L) of HCN:
ERPG-2 distance, 1,040 to 1,060 yd (951 to 969 m) (winter-summer)
ERPG-3 distance, 742 to 757 yd (678 to 692 m) (winter-summer)

Stable Meteorology (1.5 m/s wind, F class stability), 10-min release at 0.2 gal./min (0.76 l/min):

ERPG-2 distance, 776 to 798 yd (710 to 730 m) (winter-summer)
ERPG-3 distance, 472 to 485 yd (432 to 443 m) (winter-summer)

Average Meteorology (2.8 m/s wind, B/C class stability), 10-min release at 0.2 gal./min (0.76 l/min):

ERPG-2 distance, 81 to 119 yd (74 to 109 m) (winter-summer)
ERPG-3 distance, 51 to 75 yd (47 to 69 m) (winter-summer)

Since the Research Park is approximately 922 yd (844 m) from the Sigma building at TA-03-66, serious health effects to Research Park tenants could marginally occur only under an instantaneous release and stable weather conditions. Life-threatening health effects from this hypothetical accident are not expected under any of the modeled conditions.

[12] Stable meteorology refers to weather conditions that would least disperse a pollutant plume (i.e., worst case with regard to the HCN concentration).