3.0 AFFECTED ENVIRONMENT

The *Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory* (LANL SWEIS) (DOE 1999a) provides a detailed discussion of the affected environment at LANL. It supports the Record of Decision (DOE 1999c) for the level of operation known as the Expanded Alternative and includes new construction activities that were far enough along in planning to have been included in that analysis. While this Proposed Action for constructing and operating a BSL-3 facility was not considered in that EIS, much of the affected environment described therein provides the affected environment baseline for this EA. As much as reasonably possible, this EA tiers off of the LANL SWEIS or includes by reference the information presented in that document. Additionally, immediately after the May 2000 Cerro Grande Fire burned portions of LANL, NNSA issued a Special Environmental Analysis (SEA) (DOE 2000b). Information from the LANL SWEIS and the subsequent LANL SWEIS Yearbooks (LANL 2000e), as well as the SEA will be included when necessary to provide a basis for environmental consequence or accident analysis later in this EA. These documents may be found in the LANL library.

This chapter describes the environmental resources that may be affected as a result of implementing the Proposed Action to construct and operate a BSL-3 facility. Resources are described using the sliding scale approach with more detail provided for resources that might be most affected. Resources are either addressed in this Chapter or eliminated from consideration, as shown in Table 3-1 in Section 3.2.

3.1 REGIONAL AND LOCAL SETTING

LANL is located on a 43-square-mile (111-square-kilometer) area in Los Alamos County, in north-central New Mexico, approximately 60 miles (97 kilometers) north-northeast of Albuquerque, 25 miles (40 kilometers) northwest of Santa Fe, and 20 miles (32 kilometers) southwest of Española in Los Alamos and Santa Fe Counties (Figure 1-1).

The Jemez Mountains to the west and the Sangre de Cristo Mountains to the east dominate the area (Figure 3-1). The Rio Grande lies between these two mountain ranges and bounds part of LANL to the east. LANL is situated on the Pajarito Plateau, a volcanic shelf on the eastern slope of the Jemez Mountains at an approximate elevation of 7,000 feet (2,135 meters) (DOE 1999a). Thirteen steeply sloped and deeply eroded east-to-west oriented canyons containing intermittent streams dissect the Pajarito Plateau. One of these, Los Alamos Canyon, separates the main LANL industrial area, TA-3, from the LANL townsite.

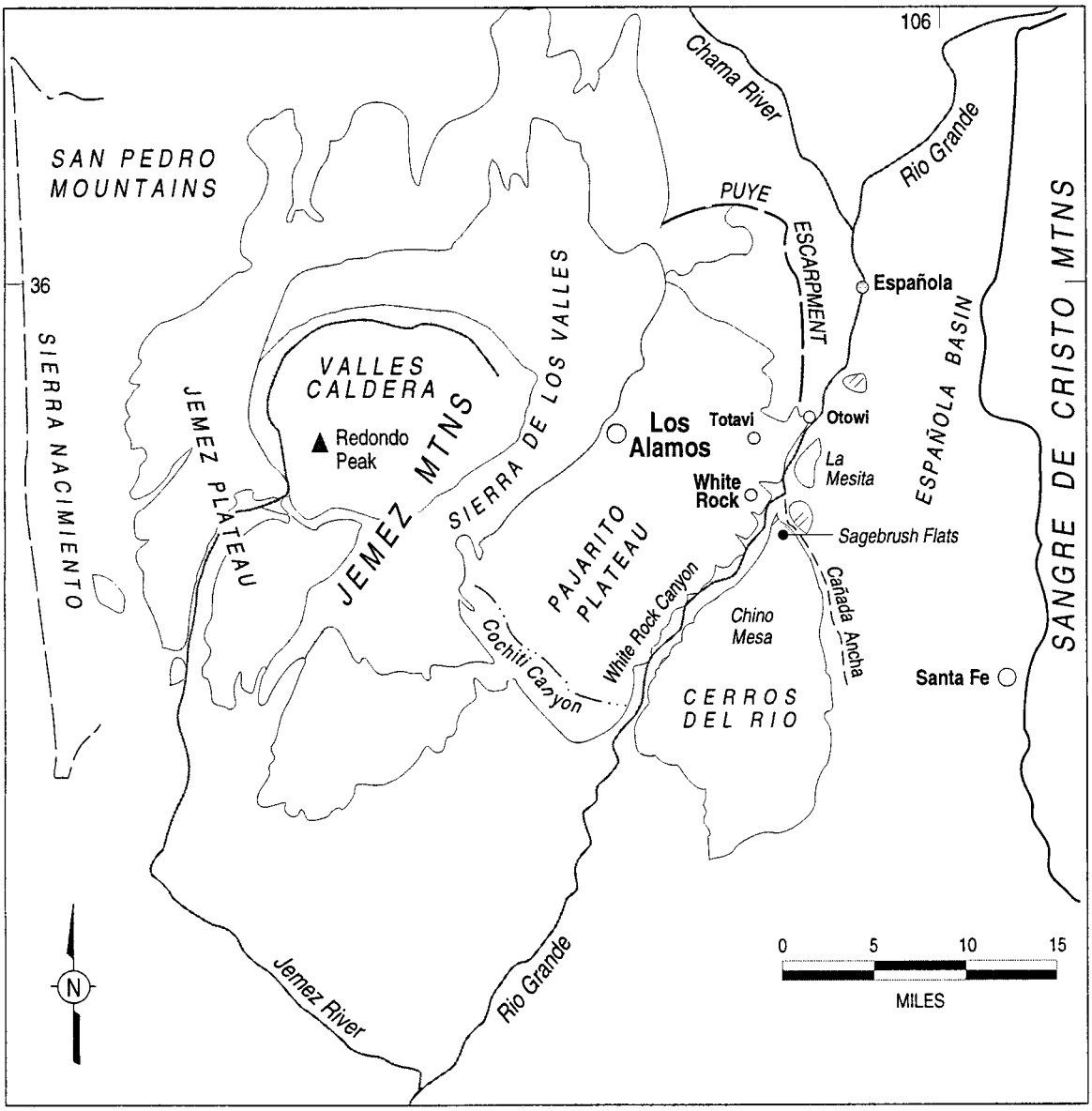

Figure 3-1. Geographic location map showing topographic features near LANL

3.1.1 Climate and Meteorology

Los Alamos has a temperate, semi-arid mountain climate characterized by seasonable, variable rainfall. Precipitation measured at the current official meteorological weather station on the mesa top at TA-6 ranges from 10 to 20 inches (25 to 51 cm) per year with approximately 37 percent of the rainfall occurring in the rainy summer season. Meteorological conditions are influenced by the elevation of the Pajarito Plateau with warmer temperatures near the Rio Grande and cooler near the mountain peaks.

Winds are variable averaging about 7 miles per hour (3 meters per second) with lowest winds in December and January and highest in the spring (March through June) due to the intense storms and cold fronts. Surface winds vary dramatically with the time of day, location, and elevation due to the complex terrain. Winds are generally upslope over the Pajarito Plateau in the morning. By noon, winds from the south usually prevail over the entire Plateau. Cold air drainage from the Jemez Mountains to the west of LANL produces nighttime winds from the west-southwest to the northwest over the western portion of the Plateau. This air flow from the mountains is observed about 75 percent of the time during the night and continues for an hour or two after sunrise until an up-canyon flow develops. Nighttime canyon flows are predominantly weak drainage winds from the west. Because of the stability of these nighttime canyon flows and the relatively weak mesa top winds, the development of rotors (whirls) at night in the canyons is rare (LANL 1992). However, this flow can develop into a turbulent longitudinal rotor that fills the canyon when the wind over the canyon has a strong cross-canyon component.

The irregular and complex terrain of the Pajarito Plateau is accentuated by forested surfaces in upland areas having a significant affect on dispersion or the atmospheric spreading by turbulent motion of the air. The terrain produces an increase in both horizontal and vertical turbulence and dispersion, whereas lower elevation terrain is smoother and less vegetated causing less turbulence. Clear skies and light winds, typical of the summer season, enhance daytime vertical air dispersion (DOE 1999a) (Figure 3-2).

Light wind conditions under clear skies can create strong, shallow surface inversions that trap the air at lower elevations and severely restrict dispersion. These light wind conditions occur primarily during the autumn and winter months, with intense surface air inversions occasionally in the winter (Figure 3-3). Air inversions are most severe during the night and early morning (DOE 1999a).

3.2 ENVIRONMENTAL RESOURCES NOT AFFECTED

Discussion of the Affected Environment is limited to existing environmental information that directly relates to the scope of the Proposed Action and the alternatives analyzed. Table 3-1 shows the resource categories and whether they are not discussed (that is, NA, and why not) or where they are discussed if they have a direct bearing on the analysis.

3.3 ENVIRONMENTAL RESOURCES POTENTIALLY AFFECTED

3.3.1 Human Health

According to the New Mexico Department of Health in the *State of Health in New Mexico: 2000 Report* (NMDH 2001), in early part of the 20th century health conditions in the New Mexico Territory were not good and infectious diseases such as tuberculosis, smallpox, typhoid fever, measles, diphtheria, pertussis (whooping cough), and dysentery were

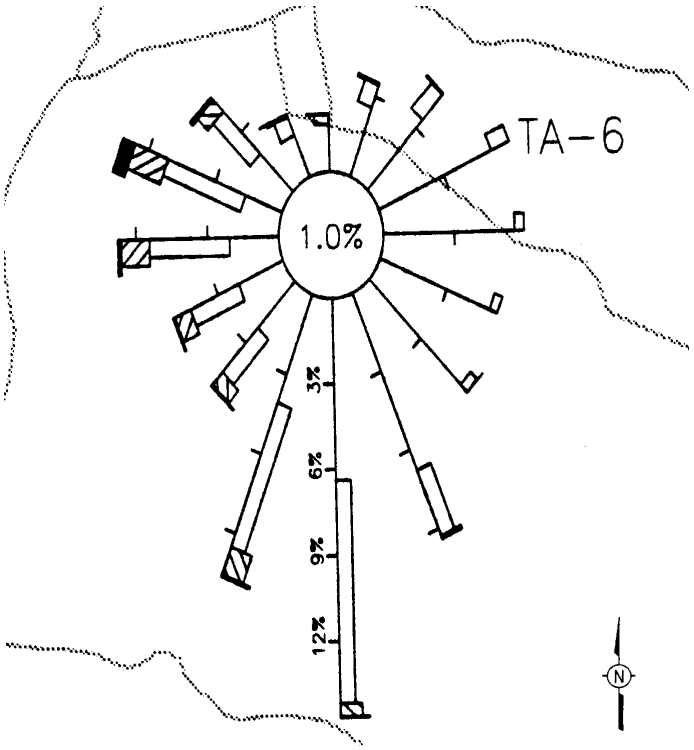

Figure 3-2. 1999 daytime wind rose for TA-6 (LANL 2000d)

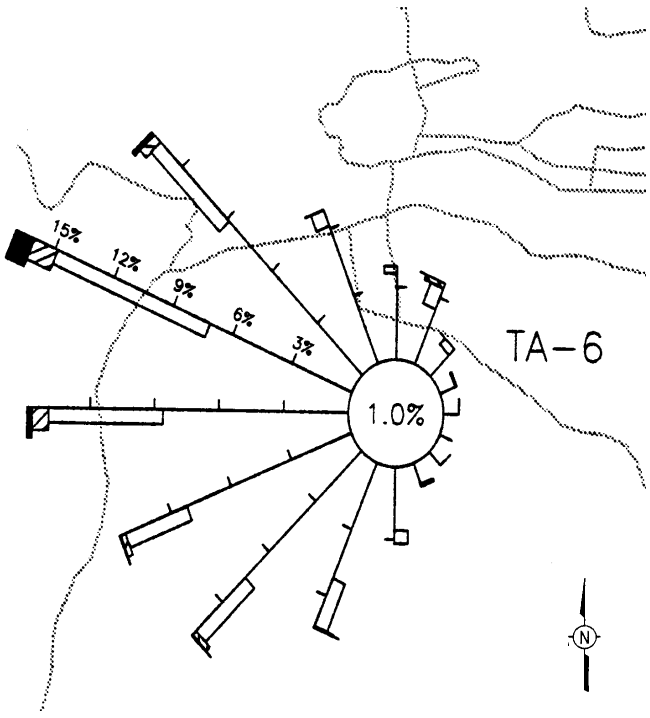

Figure 3-3. 1999 nighttime wind rose for TA-6 (LANL 2000d)

Table 3-1. Applicability of Resource Categories to the BSL-3 Analysis

Resource Category	Applicability	BSL-3 EA Section
Air Quality	Yes	3.3.10
Ecological Resources	Yes	3.3.2
Geology/Soils/Seismology	Yes	3.3.8
Human Health	Yes	3.3.1
Noise	Yes	3.3.6
Socioeconomics	Yes	3.3.7
Transportation	Yes	3.3.3
Utilities/Infrastructure	Yes	3.3.5
Visual Resources	Yes	3.3.9
Waste Management	Yes	3.3.4
Cultural Resources	All three sites would be within or adjacent to the well developed area of TA-3. No cultural issues would be located at or adjacent to these sites (LANL 2001e).	NA
Environmental Justice	There is no disproportionately high or adverse human health or environmental effects on minority or low-income populations (DOE 1999a).	NA
Environmental Restoration	There are no potential release sites at or adjacent to the three optional locations (LANL 2001e).	NA
Floodplains/Wetlands	There are no floodplains or wetlands at or adjacent to the three optional locations (LANL 2001e).	NA
Land Use	The area surrounding each of the proposed LANL sites is made up of office buildings, laboratories, storage and warehouse facilities, and parking lots, all illuminated at night. The proposed construction and operation of a BSL-3 facility would not alter the character of the site areas or introduce new land use elements (LANL 2000b).	NA
Water Resources	There would be no effect on surface water or groundwater quality and no perceptible increase in potable water use. A stormwater prevention plan would be enforced during construction. BMPs such as the use of straw bales, silt fences and other similar devices would control sediment/surface water runoff into local arroyos, canyons, and streams. There are no outfalls on these proposed locations (LANL 2001e).	NA

common. The leading causes of death were infectious diseases. Vaccines other than for smallpox didn't exist, antibiotics hadn't been discovered, water supplies were untreated, and public health treatments were largely unavailable. Sanitation, pasteurization, and vaccination made headway in the 1930s to 1950s and many diseases saw significant reductions or eliminations. New Mexico had one of the Nation's highest rates of hepatitis A, a viral disease of the liver, for many years. Today, rates of the disease in New Mexico are below the national average. New Mexico has a relatively low vaccination rate, but this has not led to any known outbreaks or increases in most diseases (NMDH 2001). However, New Mexico has a persistent problem with pertussis with a reported 224 cases in 1999. New Mexico is also known for its rodent-borne diseases and leads the Nation in hantavirus (57 total cases) and plague (232 total cases) (NMDH 2001).

DOE and NNSA maintain equipment and procedures to respond to situations where human health or the environment is threatened. These include specialized training and equipment for the local fire department, local hospitals, state public safety organizations, and other government entities that may participate in response actions, as well as specialized response teams. These programs also provide for notification of local governments whose contingencies may be threatened. Additional information regarding the Emergency Management and Response Program is provided in the 1999 SWEIS (DOE 1999a).

Because of nationwide concerns about terrorist attacks using biological warfare agents (for example, anthrax, plague, smallpox) or chemical agents, health departments around the country are upgrading their healthcare programs. The New Mexico Department of Health is using Federal Government grants to upgrade public health laboratories, disease surveillance systems, and public alert networks. For example, LANL UC staff are collaborating with several institutions SNL, University of New Mexico Emergency Medicine Department, and the New Mexico Department of Health, Office of Epidemiology on the Rapid Syndrome Validation Project (RSVP) to support these efforts. The RSVP is a system that provides early warning and response to emerging public health threats from infectious diseases. The RSVP includes:

- Network-based reporting that is extremely fast and easy to use in the clinical setting
- Syndrome-based reporting rather than diagnostic-based reporting to facilitate physician participation
- Rapid analysis of information, preferably in an automated fashion
- Interconnectivity between multiple participants to tie disparate and geographically separated sources of information together to provide a clear understanding of the evolving situation
- Clear understanding of the natural background of infectious disease in the general population

- Ability to characterize a disease outbreak and trigger appropriate responses within 24-48 hours

The New Mexico Department of Health, Office of Epidemiology feels that while these efforts would hopefully not be needed for terrorist actions, they would be valuable in helping to detect and respond to future routine infectious-disease outbreaks (NMDH 2001).

Additional information on human health conditions at LANL can be found in the LANL SWEIS (DOE 1999a), Section 4.6, Human Health: Worker and Public Health in the Region Affected by LANL Operations. The supporting information for this is presented in Appendix D of the LANL SWEIS. That analysis, which evaluated continuing operations and projected future operations, looked at several possible exposure scenarios.

Radiation. Workers and the public working or visiting LANL receive a radiation dose from LANL operations. Chapter 3 of the 1999 LANL Environmental Surveillance Report (LANL 2000d) states: "Health effects from radiation exposure have been observed in humans only at doses in excess of 10 roentgen-equivalent man (rem). We conclude that the doses calculated here, which are in one one-thousandth of a rem (mrem) range, would cause no human health effects. They are also much smaller than typical variations in the background radiation dose." The calculated maximum off-site radiation dose to a member of the public from LANL sources in 1999 was 0.7 mrem, which is less than 1 percent of the DOE dose limit of 100 mrem in Section 208 of 10 CFR 835 (§ 835.208 *Limits for members of the public entering a controlled area*) and also well below the level at which health effects would occur. The calculated on-site maximum individual exposure in 1999 to a member of the public who passes along Pajarito Road near the TA-18 Criticality Facility is 3 mrem (LANL 2000d). Information about radiation in respect to microorganisms in the environment appears in Section 3.3.2.

Chemicals in the Environment. Chemical emissions at LANL operations have been sufficiently small that they are not routinely measured (DOE 1999a). Environmental media and foodstuffs have also been selectively analyzed for chemical contaminants since the early 1990s. For those chemicals in the surveillance program, there are no significant differences in concentrations between media at the perimeter of LANL and those of the general region (DOE 1999a).

3.3.2 Ecological Resources

LANL is located in a region of diverse landform, elevation, and climate-features that have contributed to producing one of the most diversified plant and animal communities. Plant communities range from urban and suburban areas to grasslands, wetlands, shrublands, woodlands, and mountain forest, and provide habitat for a wealth of animal life. The richness of animal life includes herds of elk and deer, bear, mountain lions, coyotes, rodents, bats, reptiles, amphibians, invertebrates, and a myriad of resident, seasonal, and migratory bird life. Because of restricted access to LANL lands and management of contiguous

Bandelier National Monument (BNM) for natural biological systems, much of the region provides a refuge for wildlife (DOE 1999a).

No threatened or endangered species habitat or buffer areas are located at or adjacent to the three proposed BSL-3 facility optional locations (DOE 1999d; LANL 2001e). Historically, however, the Pajarito Plateau has undergone habitat fragmentation[16] as a result of land clearing for agricultural use (DOE 1999a). These flat areas have subsequently been used by LANL for buildings, roads, and experiment areas. The three location options for the proposed BSL-3 facility would be located on previously cleared areas. Most LANL development is within the piñon-juniper woodland and ponderosa pine forest (DOE 1999a) vegetational zone.

A literature search did not establish the microflora content of soils on the Pajarito Plateau. Although not usually considered as such, soils are an ecological resource (Burden and Sims 1999). Soils are known to naturally contain a diversity of numbers and types of micro-organisms. The range is substantial as it depends upon the environmental conditions, which dictate the bacteria and fungi microflora (plant microorganisms) that can survive. Microbial ecologists have identified ranges or "Critical Environmental Factors" which represent the conditions necessary to support microbial growth. These factors show that a soil must be moist (25 to 85 percent of water holding capacity), have sufficient oxygen (greater than 0.2 milligrams per liter and minimum air-filled pore spaces of 10 percent), be neutral in acidity (pH between 5.5 and 8.5), contain sufficient (non-limiting) nitrogen, phosphorus, and other nutrients, and maintain a temperature between 59 and 113 degrees Fahrenheit (°F) (or 15 and 45 degrees Celsius [°C]) (Burden and Sims 1999). Fungi are more tolerant of soil moisture and acidity (less than pH 5.0) than bacteria (Gray 1978). Various genus[17] and species[18] of bacteria can be found in soils from the most common genus *Arthrobacter* and *Bacillus* species (spp.) to the least common, *Staphylococcus* and *Mycobacterium spp*. Although most types of fungi can be found in soil, the most common include genus *Imperfecti*, *Ascomycetes*, and *Basidomycetes spp*.

Infectious microorganisms can also be found in soils. One of the most well known infectious microorganisms through ancient history is *Bacillus anthracis* (*B. anthracis*), which causes the disease anthrax. Prior to the advent of antibiotics, anthrax was the foremost cause of uncontrolled death in herbivores (plant-eating mammals) such as cattle, sheep, goats, horses, and pigs worldwide (WHO 1998). *B. anthracis* is unique as a bacteria in that it forms spores which can survive in the environment, reportedly for decades (Cieslak and Eitzen 1999). Spore forming conditions exist where slightly acidic (pH less than 6.0) organic rich soils

[16] Habitat fragmentation is the division of natural habitat areas into smaller segments or the destruction of animal access corridors between natural areas.

[17] A genus is the usual major subdivision of a family or subfamily in the classification of plants and animals, usually consisting of more than one species.

[18] A species is the major subdivision of a genus or subgenus regarded as the basic category of biological classification, composed of related individuals that resemble one another and are able to breed among themselves but not able to breed with members of another species.

undergo dramatic climatic variations of abundant rainfall followed by prolonged drought (Cieslak and Eitzen 1999). Anthrax zones in the United States reportedly follow cattle drive trails of the 1800s (Coker et al. 1998). Herbivores may acquire the disease from grazing in soils containing *B. anthracis* spores possibly derived from the mechanical spread of the organism by vultures eating carcasses containing *B. anthracis* spores, or from the bite of certain flies. In the United States there have been sporadic human cases of anthrax in South Dakota, Nebraska, New Mexico, and Oklahoma apparently related to old graves of individuals that died from anthrax. Since 1991, there have also been deaths in California, Kansas, Mississippi, and Arkansas (Hugh-Jones 1998). In 2000 there were several cases of humans contracting anthrax in Minnesota and North Dakota (WHO 2001).

B. anthracis spores are resistant to extremes of heat, cold, pH, desiccation, chemicals, irradiation, and other adverse conditions (WHO 1998). It is through the uptake of spores that animals and humans contract anthrax. The process of spore formation (sporulation) mainly occurs in the affected animal carcasses but can also occur outside the carcass if conditions are right. However, researchers believe that germination, multiplication, and resporulation are unlikely to occur very often under natural conditions (WHO 1998).

Radiation. As radioactive materials have been and are used at LANL, there is some public interest in the effects of radiation on microorganisms. According to the CDC (CDC 2001a), "When microbes are subjected to irradiation, the energy from the rays is transferred to the water and other molecules in the microbe. The energy creates transient reactive chemicals that damage the DNA in the microbe, causing defects in the genetic instructions. Unless it can repair this damage, the microbe would die when it grows and tries to duplicate itself. Disease-causing organisms differ in their sensitivity to irradiation, depending on the size of their DNA, the rate at which they can repair damaged DNA, and other factors." Also: "The size of the DNA 'target' in the organism is a major factor. For instance, parasites and insect pests, which have large amounts of DNA, are rapidly killed by extremely low doses of irradiation…" (CDC 2001a). It takes more irradiation to kill bacteria because they have a somewhat smaller DNA, and viruses have so little nucleic acid that they are hard to kill (CDC 2001a). The safety of irradiating microbes in food has been tested in mice, rats, and dogs for over several generations. "There is no evidence of adverse health effects in these well controlled trials" (CDC 2001a). The safety of irradiating food to kill microbes has been endorsed by the World Health Organization (WHO), the CDC, the Assistant Secretary of Health, the U.S. Department of Agriculture (USDA), and the Food and Drug Administration (FDA) (CDC 2001a).

Radiation effects on infectious microorganisms have been studied extensively with regard to the irradiation of foods (CDC 2001a). The killing effect of irradiation on microbes is measured in D-values. One D-value is the amount of irradiation needed to kill 90 percent of that organism, 2-D kills 99 percent, and 3-D kills 99.9 percent. D-values are different for each organism, and vary by temperature and the material containing them. The amount of radiation needed for one D-value is a thousand or more times the amount of radiation dose given to a person for a single chest x-ray (CDC 2001a). The maximum individual

radiological exposure to a member of the public at LANL, mentioned in Section 3.3.1, for a passer-by in 1999 was 3 millirems which is a fraction of the dose from a chest x-ray which is estimated at about 53 mrems (LANL 2000d).

These data help describe why there would be no reason to expect negative effects to microbes in the environment. Radiation-induced genetic changes to naturally occurring microorganisms are not expected.

Wildfire Protection. Aside from the Cerro Grande Fire in May 2000, there have been four other major wildfires in the Los Alamos area (DOE 2000a). Concerns about these wildfires that were considered during the preparation of the LANL SWEIS (DOE 1999a) and the occurrence of a major wildfire in 1996 (the Dome Fire) led to the undertaking of several activities to reduce the threat of wildfire to LANL. The UC created firebreaks along State Road (SR) 4 near LANL's boundary with the Santa Fe National Forest around key facilities determined to be at risk, and expedited its routine maintenance of fire roads to enhance forest accessibility. UC has recently begun to lower the density of trees (thinning) on about 10,000 acres (4,047 hectares) of LANL and has a goal of reducing the current 400 to 800 trees per acre to 50 to 150 trees per acre within LANL boundaries. Forests needing thinning are predominantly ponderosa pine and mixed conifer. Tree thinning activities have been prioritized through an assessment of facility vulnerabilities combined with knowledge of the chemical and radiological inventories. Tree thinning and brush removal has been initiated at TA-3 and at TA-59 in the areas near the locations for the proposed BSL-3 facility. No structures were burned or destroyed during the Cerro Grande Fire within the areas surrounding the three proposed optional locations for the Proposed Action (DOE 2000b).

Additional post-Cerro Grande Fire forest treatment thinning activities at LANL are planned to be ongoing over the next several years of the Wildfire Hazard Reduction Program (WHRP) (DOE 2000a). Almost all of the TAs at LANL will be included in areas treated by the WHRP, especially areas at LANL burned during the Cerro Grande Fire and on the remaining ponderosa pine and piñon-juniper woodlands. Activities conducted for the WHRP will include mechanical thinning of trees and thinning of trees using hand-held tools (primarily within such areas as those with sensitive resources or steep slopes); construction of access roads and fire breaks; the installation of various BMPs for prevention of erosion and resource protection in treatment areas and beyond; the removal of wood materials and disposal of wastes generated; and end-state conditions and post-treatment assessments. The initiation and conduct of periodic long-term maintenance projects to maintain the desired end-state conditions of the subject forest areas will be ongoing after the initial forest treatments have been completed. Implementation of the WHRP and the subsequent long-term maintenance projects would drastically reduce the potential risk and damages from an uncontrolled and catastrophic wildfire within the boundaries of LANL.

3.3.3 Transportation

Vehicles. Motor vehicles are the primary method of transportation and highways are the primary access to LANL and the rest of Los Alamos County. LANL has a number of roads, including major thoroughfares which allow public access. However, since NNSA controls the entire area within the LANL boundaries, NNSA has the option to restrict traffic on LANL roadways and does for certain on-site radioactive shipments (DOE 1999a). There are four main access points to LANL that convey about 43,000 average daily trips (ADTs). These roads and their average daily trips are shown in Table 3-2. The State of New Mexico reports that Los Alamos County has an annual average of 118 accidents per 100 million vehicle miles (161 million kilometers) driven (NMTSB 1998). The total number of accidents in Los Alamos County from 1990 to 1994 ranged from 258 to 387 with about 90 percent of them being accidents with privately owned vehicles. LANL Government vehicles were involved in about 5 percent of these accidents (DOE 1999a).

Table 3-2. LANL Main Access Points

Location	Average Daily Trips (ADT)
Los Alamos Canyon Bridge	28,000
Pajarito Road	8,000
East Jemez Road	6,000
State Road 4/West Jemez Road from the west	1,000
Total	**43,000**

The proposed BSL-3 facility locations would be accessed from Diamond Drive or Pajarito Road. Traffic on these roadways can be heavy, particularly during peak commuting hours. At present, the intersection of Diamond Drive with West Jemez Road exhibits considerable congestion during peak traffic periods (DOE 1997b). Adequate parking is also an issue around TA-3. The current parking area at location Option A is full for the better part of the day as it is the closest parking outside Building 3-66. Parking for location Option B is currently unoccupied most of the time. There is no parking area at location Option C.

LANL Shipments. During routine operations, all types of materials and wastes are shipped to and from LANL. Commercial carriers (cars, trucks, and air-freight) transport these shipments offsite while Government-owned vehicles do most onsite. Numerous regulations govern the transportation of hazardous materials including those of the U.S. Department of Transportation (DOT), DOE, Federal Aviation Agency (FAA), and the International Air Transport Association (IATA). During 1990 through 1994, an average of about 1,000 shipments per year (including waste shipments), of which about 800 were hazardous. These are tracked in the LANL Shipment Mobility/Accountability Collection (SMAC). The designated hazardous materials route for Los Alamos County is East Jemez Road to SR 4 to SR 502 (DOE 1999a).

Currently, the LANL Bioscience Division operations sends out about two samples per month and receives four samples per month of select and non-select agent DNA and non- select agent microorganisms. There have been no reported incidences at LANL related to the shipment of biological samples (PC 2001g).

3.3.4 Waste Management

UC has established procedures for compliance with all applicable laws and regulations for collecting, storing, processing, and disposing of sanitary liquid wastes, solid wastes and hazardous wastes for LANL. These three waste types are discussed in the following paragraphs.

Sanitary Liquid Waste. The sanitary liquid waste or sewage from LANL TA-3 is processed at the LANL Sanitary Waste Systems Consolidation (SWSC) Plant located at TA-46 (Figure 2-1). The SWSC Plant is capable of processing approximately 600,000 gallons (2.27 million liters) per day; its current use is an estimated 0.3 million gallons (1.1 million liters) per day (LANL 2000e). There is an existing 8-inch (20-centimeter) sanitary sewer in place along Pajarito Road about 100 feet (30 meters) south of Mercury Road. The capacity of this line is approximately 0.442 million gallons (1.673 million liters) per day and its present peak flow is 0.084 million gallons (0.318 million liters) per day (DOE 1999b). Sanitary sewer liquid waste from all three optional locations would discharge into this line.

Solid Waste. Solid waste is regulated under RCRA (40 CFR 261). Solid waste generated at LANL is currently disposed of at the Los Alamos County Landfill, which is operated by the county on land within the LANL boundaries. The landfill receives an average of about 18,850 tons (17,100 metric tons) per year of solid waste with LANL contributing about 2,860 tons (2,600 metric tons) per year. The county maintains a separate location at the landfill for construction debris that is available for salvage and reuse by individuals or companies. In 1996, an estimated 11.8 million pounds (5.35 million kilograms) of construction debris were disposed of at the county landfill (DOE 1997b). Waste from the Cerro Grande Fire also went to the county landfill and has reduced its capacity. Los Alamos County plans to close the landfill by June 30, 2004, but may maintain a part of the landfill site as a transfer station. Other existing landfills will be used for LANL waste disposal after this one has been closed. Several existing landfills within New Mexico could possibly be used after 2004, such as the one located at Rio Rancho, which is about 85 highway miles (137 kilometers) south of Los Alamos.

Hazardous Waste. Hazardous waste is regulated under the RCRA Subtitle C (40 CFR 261). From 1990 through 1995, LANL generated an annual average of about 1.9 million pounds (860 thousand kilograms) of hazardous chemical waste (DOE 1999a). Included in these numbers is chemical waste from what is now the Bioscience Divisions, HRL facility, which produced from 10,000 to 34,000 pounds (4,600 to 15,000 kilograms) of chemical waste per year for an average (baseline) of 11,000 pounds (4,900 kilograms) per year. A subcategory

of hazardous waste is biomedical waste. HRL contributed about 40 to 1,500 pounds (18 to 705 kilograms) per year of biomedical waste with an average of about 287 pounds (130 kilograms) per year (DOE 1999a) of the total of hazardous waste generated by LANL through 1998. In 1999, HRL had a zero generation rate when LANL eliminated their animal colony and the associated waste which had been previously incinerated. All biomedical waste generated by HRL is now converted to solid waste after treatment with autoclaving (PC 2001h).

3.3.5 Utilities and Infrastructure

LANL has about 8 million square feet (743,200 square meters) of structural space. Approximately 7.3 million square feet (678,000 square meters) of this total exists in 1,835 buildings, and about 0.7 million square feet (65,000 square meters) in 208 other structures (such as meteorological towers, manholes covers, and small storage sheds). According to LANL's Needs and Institutional Plan, the administration area in TA-3 occupies 25 percent of LANL space; storage and support services including power generation occupy about 23 percent. Thus, almost half of LANL's structural space is occupied by the utilities and infrastructure; most of this is located in the TA-3 area or within TA's immediately adjacent to TA-3 (DOE 1999a).

Electrical power service to LANL comes from an electrical power generation and transmission pool with Los Alamos County. This pool has a contractually limited capacity of 73 (winter) to 95 (summer) megawatts. This capacity is provided by external transmission lines owned by the Public Service Company of New Mexico (PNM) and the Plains Electric Generation and Transmission Cooperative over two 115-kV power transmission lines from the Norton substation near White Rock, and the Bernalillo-Algodones substation near Albuquerque (LANL 2000b). A steam and electrical power plant is located at LANL's TA-3 for use on an as-needed basis. Approximately 34 miles (55 kilometers) of 13.2 kV distribution lines connect to low-voltage transformers around LANL (DOE 1999a). The existing electric transmission system has been evaluated and found to be deficient (DOE 1999a). Therefore, all facilities that require safe shutdown capability for power outages are equipped with emergency generators to assure their needs are met (DOE 1999a). An additional 114-kV electric transmission line is planned for LANL but may not be operational for several years.

The natural gas system includes a PNM-owned high pressure main and distribution system to Los Alamos County and DOE-owned pressure reducing stations at LANL buildings. About 90 percent of the natural gas used at LANL is for heating (steam and hot air) and the rest for electric power generation (LANL 2000b). The natural gas-fed TA-3 steam plant has the capacity of producing 200,000 pounds (91,000 kilograms) of steam pressure per hour to generate electricity and steam for heating with two boilers in operation and one on standby. On-site electrical generating capacity is 12 megawatts in the summer and 15 megawatts in the winter. The peak winter demand on the plant is 125,000 pounds (57,000 kilograms) of steam pressure per hour (DOE 1999a).

In 1997, LANL used only about 71 percent of the water rights and rights to water available through water supplied from the deep wells and surface water (LANL 2000b). The DOE water rights were transferred in 1998 to Los Alamos County and LANL no longer tracks Los Alamos County water usage. The general TA-3 area is supplied by water service for both potable and fire protection by a network of 10-in (25-cm) lines or larger. There is an existing 10-in (25-cm) water main located along Pajarito Road. Fire hydrants are in place all around TA-3 (LANL 1998a).

3.3.6 Noise

Noise generated by LANL operations is regulated by Los Alamos County ordinance and by LANL worker protection standards established in *LANL Performance Requirements* (LANL 2001d). The standard unit used to report noise or sound pressure levels is the decibel (dB); the A-weighted frequency scale (dBA) is an expression of adjusted pressure levels by frequency that accounts for human perception of loudness. Los Alamos County has promulgated a local noise ordinance that establishes noise level limits for residential land uses. Noise levels that affect residential receptors are limited to the maximum of 65 dBA during daytime hours and 53 dBA during nighttime hours (between 9 p.m. and 7 a.m.). Activities that do not meet these noise standards require a permit (DOE 1999a).

Noise levels to protect worker hearing at LANL are based on DOE orders (DOE 1984), OSHA regulations (29 CFR 1910.95), U.S. Air Force Regulations (USAF 1973), and recommendations of the American Conference of Governmental Industrial Hygienists (ACGIH 2000).

Noise levels at the optional locations for the proposed BSL-3 facility would be generated primarily by vehicle traffic and facility HVAC systems except during facility construction. Ambient noise measurements taken nearby at the NISC location averaged 52 dBA during morning and evening rush hours; 51 dBA during non-rush hours; and 47dBA during nighttime hours (PC 1999a). These measurements are typical of a lightly industrialized area, such as TA-3, and are comparable to outside noise levels generated at urban centers during daytime hours and common indoor sounds such as the background noise in a large occupied conference room. Measurements were also taken before and after construction activities along the perimeter fence at the SCC adjacent to the NISC (Knight and Vrooman 2000). Before construction the average sound level was 56.5 dBA. During construction the average sound level increased 25.6 dBA to 82.1 dBA, but measurements were only taken when heavy equipment was operating.

3.3.7 Socioeconomics

The UC at LANL is the largest employer in the tri-county region (Los Alamos, Santa Fe, and Rio Arriba Counties), directly employing approximately 12,412 workers, including Johnson Controls Northern New Mexico, Protection Technology Los Alamos, and other subcontract

labor personnel. LANL's activities result in a total increase in economic activity in New Mexico of about $3.2 billion dollars in 1998. Over half of the employees at LANL reside in Los Alamos County (LANL 2000b) accounting for over one third of the county residents (Table 3-3).

Table 3-3. Population of New Mexico and the Seven County Area of Los Alamos and Surrounding Areas

Counties	Total Population 1999	Increase Rate 1998-1999	Increase Rate 1990-1999	White Population 1999	Percent White 1999	All Other Population 1999
Bernalillo	523,405	0.8	8.6	469,494	89.7	53,911
Los Alamos	18,272	0.4	5.2	17,395	95.2	877
Mora	4,945	0.3	4.0	4,886	98.8	59
Sandoval	90,298	0.9	11.7	67,633	74.9	22,665
San Miguel	28,478	0.5	6.6	27,453	96.4	1,025
Santa Fe	124,193	0.7	7.6	117,859	94.9	6,334
Taos	27,123	0.5	6.8	24,818	91.5	2,305
New Mexico	1,740,071	0.8	9.4	1,501,681	86.3	238,390

Source: DOC 2001

The overall economic impact from operations at LANL was evaluated for FY 1996 (Lansford et al. 1999). In that year it was found that the following multipliers applied:

- For every dollar spent by DOE or its contractors on materials, labor, benefits, equipment, services, etc., another $2.39 is generated in the state.
- For every $1 of income, another $1.39 is generated in the state.
- For each person employed by LANL, another 2.62 jobs are supported in the state.

In the year of that economic impact evaluation (FY 1996), DOE expended approximately $149 million dollars in northern New Mexico in the construction sector (Lansford et al. 1999). Using these multipliers, this could have produced another $365 million dollars in New Mexico.

3.3.8 Geology, Soils, and Seismicity

LANL and the communities of Los Alamos townsite and White Rock are located on the Pajarito Plateau that abuts the north-south trending Sierra de los Valles Mountains on the west (Figure 3-4). Water erosion from these mountains formed east-west oriented canyons separating the Plateau into fingerlike mesas. The Plateau also lies within one of several

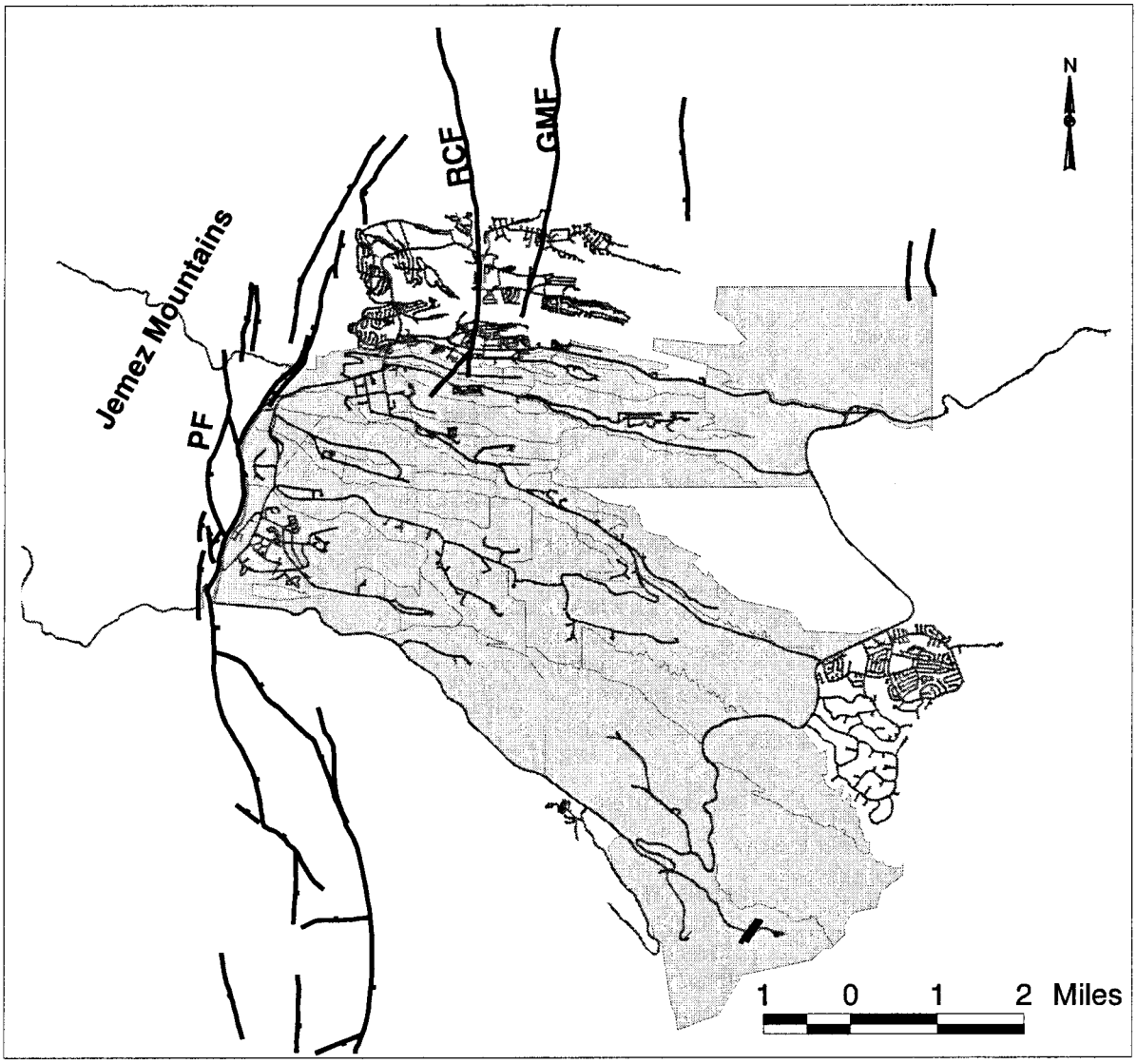

Figure 3-4. Map showing LANL and faults of the Pajarito Fault System (Krier et al. 1998a)

north-trending basins formed by the Rio Grande Rift because of the downfaulting of large blocks of the earth's crust (Dransfield and Gardner 1985). Faults are breaks in the earth's crust involving horizontal or vertical movement, or both, along a zone of weakness called a fault plane. There are three major faults and numerous secondary faults that cross the Plateau in a system known as the Pajarito Fault system. This system, formed by the rift, crosses the Plateau in a roughly north-south direction in a series of interconnecting faults that are nearly parallel.

The three optional locations of the Proposed Alternative would all be located on the South Mesa between Los Alamos and Mortandad Canyons. The near-surface geology of the

immediate area is comprised of volcanic and sedimentary materials. The uppermost volcanic rock unit is the Bandelier Tuff that is overlain by a veneer of clay-rich soils and sediments. All soils in the soil series identified at LANL (Reneau 1994) are well-drained and range from a very shallow 0 to 10 in (0 to 25 cm) to a moderately deep 20 to 40 in (51 to 102 cm) (Nyhan et al. 1978). None of the soils at the BSL-3 facility optional locations exhibit slope stability, subsidence, or soil liquefaction potential (DOE 1999a). During building construction activities at LANL it is customary for these soils to be removed. Only location option Site C has a significant amount of these soils due to it being the location used for temporary storage of fill excavation soils from previous LANL excavation projects.

A comprehensive seismic hazards study was completed at LANL in 1995 to evaluate earthquake hazards (Wong et al. 1995). Site-specific studies at TA-3 were completed in 1998 for the SCC, the NISC, and the Chemical and Metallurgy Research (CMR) Building (Krier et al. 1998a, 1998b). The 1995 study included a detailed assessment of uncertainties, including those associated with the rates of movement for earthquake faults around LANL. Results of both studies are summarized in the LANL SWEIS (DOE 1999a) in an appendix report entitled "Status and Implications of Seismic Hazard Studies at LANL." The studies identified only one major fault, the Rendija Canyon Fault, exhibited at TA-3 in the vicinity of the three potential locations for the Proposed Action. A 1999 study of the area extending from TA-3 to TA-55 was completed for seismic surface rupture potentials. Of the three site options, only the Option A site has any evidence of a subsurface fault trace within the identified option "circle" (along the southwestern edge of the site) (Gardener, et. al., 1999). The 1995 study reports that faults in the TA-3 area show vertical displacements ranging from 1 to 10 ft (0.3 to 3 m). While surface rupture indicated by near-surface vertical displacements can cause significant structural damage, surface rupturing earthquakes are low probability events (DOE 1999a). The 1998 study conclusions for the CMR building are that the probability of damaging ground motion is at least 20 times greater than the probability of damage caused by surface rupture. Design criteria established by DOE (DOE 1996a) and implemented through LANL requirements (LANL 1999a) take into consideration the ground movement associated with these low-probability events to minimize effects to the structure, if any, during earthquakes. The LANL SWEIS (DOE 1999a) indicates on the Observed Effects of Earthquakes Table 4.2.2.2-3 (pg. 4-32) it would take something like an earthquake of magnitude 6 to produce an effect of "damage moderate in well-built ordinary structures."

Volcanic activity has occurred in the Jemez Caldera region from about 1.22 million to 520,000 years ago followed by a dormant period of about 460,000 years (DOE 1999a, p. 4-27). The most recent volcanic activity occurred from 50 to 60,000 years ago. Volcanic activity levels of the order which occurred 100's of thousands of years ago would give years of prior warning. Activity like that of 50 to 60,000 years ago would give weeks or days of warning due to its much subdued level of activity. However, it is projected this type of activity also produced only ashfalls in the LANL area (DOE 1999a, pg. 4-27). In either case sufficient warning should exist to take precautions with hazardous materials.

The 1995 report also relates earthquake magnitudes to ground acceleration movement; however, the relationship is approximate. This seismic hazards study found that TA-3 would have ground accelerations as shown in Table 3-4 below, as a result of earthquakes centered within 10 mi (16 km) including earthquakes on the other two major faults on the Plateau.

Table 3-4. Peak Horizontal Ground Acceleration Corresponding to Return Periods from 500 to 10,000 years for TA-3

Return Period (years)	500	1,000	2,000	10,000	100,000 (est.)
Ground Acceleration (g)	0.14	0.21	0.3	0.56	>1.0

* Source: Wong et al. 1995

Although large uncertainties exist, an earthquake on the Pajarito Fault system with a magnitude greater than or equal to 6 on the Richter Scale is estimated to occur once every 4,000 years while a magnitude of 7 on the Richter Scale would occur once every 100,000 years (DOE 1999a).

3.3.9 Visual Resources

The area surrounding the three optional locations for the proposed BSL-3 facility around TA-3 is largely developed for research/industrial type purposes but still has unoccupied areas covered with natural vegetation (as shown in Figure 2-2). For security reasons, much of the development of the area is not seen by the general public except for the main administrative complex at TA-3. This administrative area is a visually discordant assembly of structures and functions, equipment, parking, and outside storage (DOE 1999a). More recent development in the area includes many facilities with designs and materials more visually appropriate and compatible with the natural environment (such as the SCC and NISC).

Most of the view of LANL property in the area of the three Proposed Action optional site locations is from well-traveled and publicly accessible roads within the core area of TA-3. Passing motorists or nearby residents can only see a fraction of the smaller buildings spread out over the TA-3 area. The proposed optional site locations would be adjacent to parking areas, gas transmission lines, and various other utilities. Where undeveloped, the location areas contain stands of ponderosa pine; the remaining disturbed or developed areas are either not vegetated or are bordered by young growth of ponderosa pine, grasses, and herbaceous plants. Diamond Drive and Pajarito Road both have views of the Sierra de los Valles at the eastern edge of the Jemez Mountains.

Those most likely to view the potential optional site locations would be workers at LANL facilities at TA-3, commuters on their way to and from work in Los Alamos townsite and White Rock, joggers and bicyclists along Diamond Drive and Pajarito Road, tourists visiting LANL, BNM, and the Jemez Mountains, and seasonally, some skiers driving to and from the Pajarito Ski Hill. Option C Site, however, would have minimal visibility from these roads.

Nighttime light pollution is an issue with respect to the TA-3 complex. The Los Alamos viewshed already has a substantial nighttime visual effect both directly related to the view of light sources and indirectly related to the cumulative and reflected light that creates an unnatural glow in the sky and reduces the visibility of stars and other celestial bodies (DOE 1999a). More detailed information about LANL and Los Alamos County light pollution can be found in the LANL SWEIS (DOE 1999a).

3.3.10 Air Quality

Air quality is a measure of the amount and distribution of potentially harmful pollutants in ambient air. Congress passed the *Clean Air Act* (CAA) to mandate that the U.S. Environmental Protection Agency (EPA) regulate those potentially harmful pollutants through the National Ambient Air Quality Standards (NAAQS) for pollutants of concern known as the criteria pollutants. EPA has identified six criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), ozone (O_3), lead (Pb), and particulate matter (PM). These pollutants are emitted primarily from combustion sources such as boilers, emergency generators, and motor vehicles. LANL and Los Alamos County are within attainment areas for the six pollutants, meaning that the concentrations of these pollutants are below the State and Federal maximum allowed limits. Only a limited amount of monitoring ambient air has been performed for nonradiological air pollutants within the LANL region. The New Mexico Environment Department (NMED) operated a DOE-owned ambient air monitoring station adjacent to BNM 0between 1990 and 1994 to record SO_2, nitrogen dioxide, O_3, and PM levels. LANL and NMED discontinued operation of this station in FY 1995 because recorded values were well below applicable standards (DOE 1999a).

NMED has issued LANL a "Notice of Completeness" with regards to air emissions but has not yet issued LANL an operating permit. The purpose of the permit is to identify all State and Federal air quality requirements so that these can be monitored and tracked under one permit. As of the most recent reporting, nonradioactive air emissions are in compliance with the CAA and the *New Mexico Air Quality Control Act* (LANL 2000b).

The Proposed Action optional site locations would be located along Diamond Drive and adjacent to Pajarito Road. Automobile exhaust is a contributor to local air pollution, but within TA-3 the other major contributors to nonradiological air emissions are the LANL gas-fired steam plant, and the asphalt heater. Neither the steam plant nor the heater would be located adjacent to any of the Proposed Action optional siting locations.