CHAPTER 3
AFFECTED ENVIRONMENT

3 AFFECTED ENVIRONMENT

Chapter 3 describes the affected environment at Los Alamos National Laboratory (LANL). This information provides the context for understanding the environmental consequences described in Chapter 4 and serves as a baseline against which any environmental changes brought about by implementing the proposed action can be evaluated. The affected environment at LANL is described for the following impact areas: land use and visual resources; site infrastructure; air quality and noise; geology and soils; surface and groundwater quality; ecological resources; cultural and paleontological resources; socioeconomics; environmental justice; human health; waste management and pollution prevention, and transportation.

3.1 Introduction

In accordance with Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) implementing regulations (40 CFR [*Code of Federal Regulations*] Parts 1500 through 1508) for preparing an environmental impact statement (EIS), the affected environment is "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." The affected environment descriptions presented in this chapter provide the context for understanding the environmental consequences described in Chapter 4. They serve as a reference from which environmental changes brought about by implementing the proposed action can be evaluated; the reference conditions are the currently existing conditions and reflect any changes that have occurred since publication of both the *Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico (CMRR EIS)* (DOE 2003b) and the 2008 *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico (LANL SWEIS)* (DOE 2008a). These changes have included a reduction in the size of Los Alamos National Laboratory (LANL) due to the conveyance and transfer of land; closure of the outfall from the Chemistry and Metallurgy Research (CMR) Building; and progress on environmental remediation in accordance with the Compliance Order on Consent.

Within this *Supplemental Environmental Impact Statement for the Nuclear Facility Portion of the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico (CMRR-NF SEIS)*, the current affected environment at LANL is described for the following resource areas: land use and visual resources; site infrastructure; air quality and noise; geology and soils; surface and groundwater quality; ecological resources; cultural and paleontological resources; socioeconomics; environmental justice; human health; waste management and pollution prevention, and transportation. Additional detailed information on the existing environmental conditions may be found in the *CMRR EIS* (DOE 2003b) and *LANL SWEIS* (DOE 2008a).

The National Nuclear Security Administration (NNSA) evaluated the environmental impacts within defined regions of influence (ROIs) for each resource area. The ROIs are specific to the type of effect evaluated, and encompass geographic areas within which any significant impact would occur. For example, human health risks to the general public from exposure to airborne contaminant emissions were assessed for an area within a 50-mile (80-kilometer) radius of the proposed action, while economic effects were evaluated within Incorporated County of Los Alamos (also informally known as Los Alamos County) and nearby counties in which substantial portions of the site's workforce reside. Brief descriptions of the ROIs are given in **Table 3–1**; more detailed discussions are presented in Appendix B.

Table 3–1 General Regions of Influence for the Affected Environment

Environmental Resources	*Region of Influence*
Land Use and Visual Resources	LANL and the areas immediately adjacent
Site Infrastructure	LANL and Los Alamos County for water and electricity
Air Quality and Noise	LANL, nearby offsite areas within local air quality control regions, where significant air quality impacts may occur (air quality); the site, nearby offsite areas and access routes to the site (noise)
Geology and Soils	LANL and nearby offsite areas
Surface and Groundwater Resources	LANL and adjacent surface water bodies and groundwater
Ecological Resources	LANL and adjacent areas
Cultural and Paleontological Resources	LANL and adjacent to the site boundary
Socioeconomics	The counties in which approximately 90 percent of LANL employees reside
Environmental Justice	The minority and low-income populations within 50 miles of LANL
Human Health	The site and offsite areas within 50 miles of LANL
Waste Management and Pollution Prevention	LANL
Transportation	LANL and adjacent areas

LANL = Los Alamos National Laboratory.
Note: To convert miles to kilometers, multiply by 1.6093.

3.2 Land Use and Visual Resources

LANL is located on 37 square miles (23,680 acres [9,583 hectares]) of land in north-central New Mexico (LANL 2011) (see Chapter 1, Figure 1–1). The site is located 60 miles (97 kilometers) north-northeast of Albuquerque, 25 miles (40 kilometers) northwest of Santa Fe, and 20 miles (32 kilometers) southwest of Española. LANL is owned by the Federal Government and administered by DOE's NNSA. Portions of LANL are located in Los Alamos and Santa Fe Counties.

3.2.1 Land Use

LANL is divided into 47 contiguous technical areas (TAs) with location and spacing that reflect the site's historical development patterns, regional topography, and functional relationships (see Chapter 1, Figure 1–2). The various TAs are used for building sites, experimental areas, and waste disposal locations. In total, about 20 percent of the site is developed, with facilities and structures (LANL 2011); however, major constraints to development exist and include such factors as topography, slope, soils, vegetation, geology and seismology, climate, endangered species, archaeology and cultural resources, and surface hydrology," (LANL 2000b). Undeveloped portions of the site provide security, safety, and expansion possibilities for future mission-support requirements.

The *Los Alamos National Laboratory Comprehensive Site Plan 2000: Los Alamos National Laboratory Project Management and Planning* (LANL 2000b), identifies 10 land use categories. These include administration, experimental science, high-explosives research and development, high-explosives testing, nuclear materials research and development, physical/technical support, public/corporate interface, reserve, theoretical/computational science, and waste management (**Figure 3–1**). The 10 land use categories are defined as follows:

- *Administration, Service, and Support*—Administrative functions, nonprogrammatic technical expertise, support, and services for LANL management and employees.

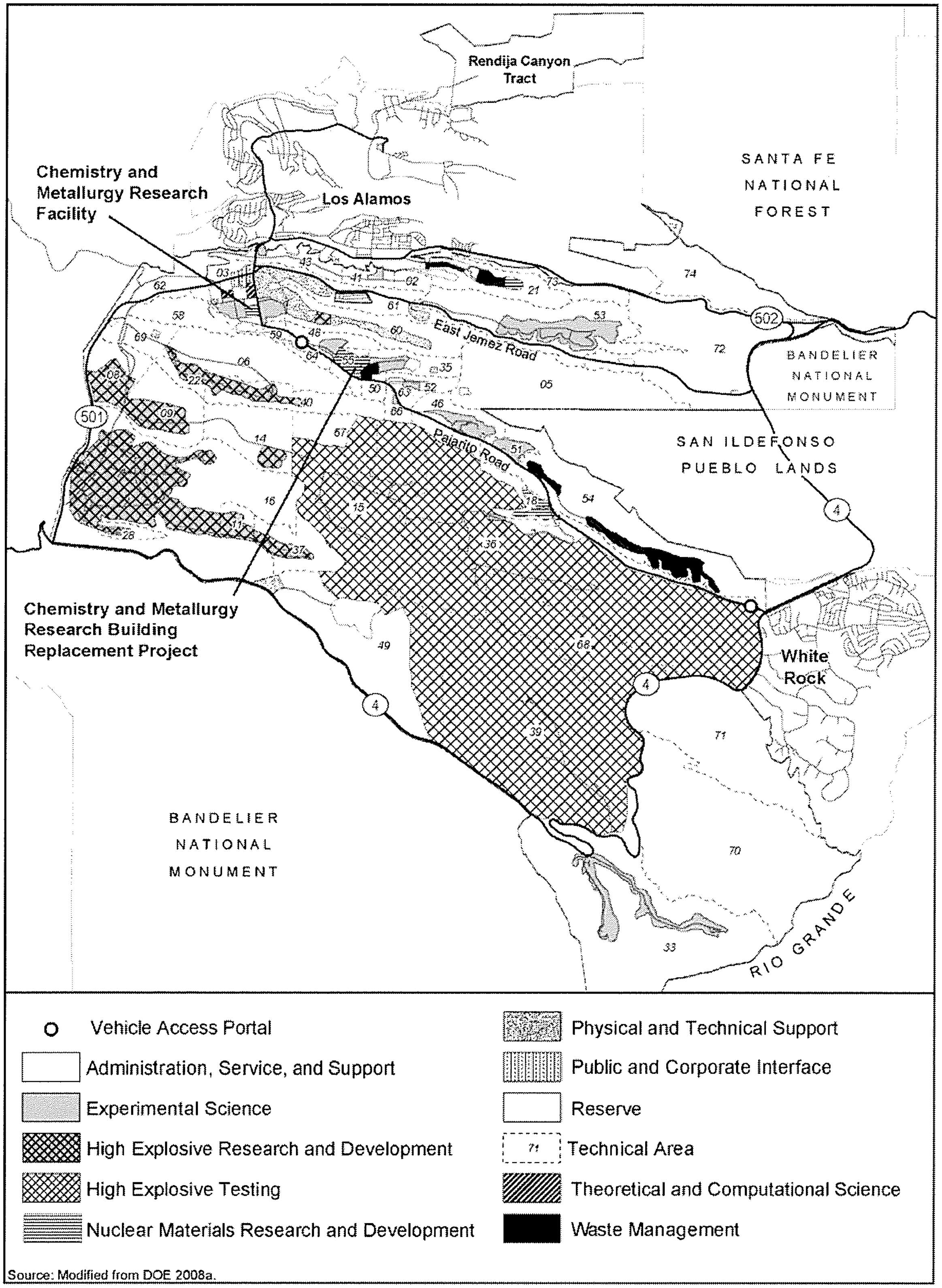


Figure 3–1 Los Alamos National Laboratory Site-Wide Land Use

- *Experimental Science*—Applied research and development activities tied to major programs.
- *High-Explosives Research and Development*—Research and development of new explosive materials. This land is isolated for security and safety.
- *High-Explosives Testing*—Large, isolated, exclusive-use areas required to maintain safety and environmental compliance during testing of newly developed explosive materials and new uses for existing materials. This land also includes exclusion and buffer areas.
- *Nuclear Materials Research and Development*—Isolated, secured areas for conducting research and development involving nuclear materials. This land use includes security and radiation hazard buffer zones. It does not include waste disposal sites.
- *Physical and Technical Support*—Includes roads, parking lots, and associated maintenance facilities; infrastructure such as communications and utilities; facility maintenance shops; and maintenance equipment storage. This land use generally is free from chemical, radiological, or explosives hazards.
- *Public and Corporate Interface*—Provides link with the general public and other outside entities conducting business at LANL, including technology transfer activities.
- *Reserve*—Areas that are not otherwise included in one of the previous categories. It may include environmental core and buffer areas, vacant land, and proposed land transfer areas.
- *Theoretical and Computational Science*—Interdisciplinary activities involving mathematical and computational research and related support activities.
- *Waste Management*—Provides for activities related to the handling, treatment, and disposal of all generated waste products, including solid, liquid, and hazardous materials (chemical, radiological, and explosive).

In 1977, DOE designated LANL as a National Environmental Research Park for use by the national scientific community as an outdoor laboratory to study the impacts of human activities on pinyon-juniper woodland ecosystems (DOE 1996b). In 1999, the 1,000-acre (405-hectare) White Rock Canyon Reserve, located on the southeast perimeter of LANL, was dedicated to preserve its significant ecological and cultural resources (LANL 2000c). In 2000, land on and to the north and west of the site was affected by the Cerro Grande Fire. The fire burned a total of 43,150 acres (17,462 hectares), of which 7,684 acres (3,110 hectares) were within the boundaries of LANL (DOE 2002d). There are no agricultural activities on the LANL site, nor are there any prime or unique farmlands present as defined in the Farmland Protection Policy Act of 1981 located within the Incorporated County of Los Alamos (NRCS 2011).

As a result of the passage of Public Law 105-119, Section 632, 10 tracts on LANL were designated for possible conveyance from DOE to the Incorporated County of Los Alamos or to the Department of the Interior to be held in trust for the Pueblo of San Ildefonso by 2007 (DOE 2008a). This program was analyzed in the *Final Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the U.S. Department of Energy and Located at the Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico* (DOE 1999c). Due to changes in the program, the total acreage designated for conveyance or transfer is now estimated to be 4,032 acres (1,632 hectares) and the completion date is 2022. To date, 2,426 acres (982 hectares) have been turned over (LANL 2011).

Land use in the LANL region is linked to the economy of northern New Mexico, which depends heavily on tourism, recreation, agriculture, and the state and Federal governments. Area communities are generally small, including the Los Alamos townsite and White Rock, which are home to about 11,000 and 7,000 residents, respectively, and primarily support urban uses including residential, commercial, light industrial, and recreational. The region also includes Native American communities; lands of the Pueblo of San Ildefonso share a border with LANL on its east side, while the Santa Clara and Pojoaque Pueblos are located approximately 20 miles (32 kilometers) to the northeast and east, respectively. Numerous other pueblos are also located in the Los Alamos area (DOE 2008a). Major governmental bodies that serve as land stewards and determine land uses within Los Alamos and Santa Fe Counties include county governments, DOE, the U.S. Department of Agriculture (U.S. Forest Service, Santa Fe National Forest), the U.S. Department of the Interior (National Park Service, Bandelier National Monument, and the Bureau of Land Management), the State of New Mexico, and several Native American pueblos. Bandelier National Monument and Santa Fe National Forest border LANL primarily to the southwest and northwest, respectively; however, small portions of each also border the site to the northeast.

Land use within Los Alamos and Santa Fe Counties is controlled by the counties' comprehensive plans. LANL is designated as "Federal" in the Los Alamos County Plan (DOE 2008a). The Santa Fe County Plan designates LANL as "Agricultural and Residential"; there are no agricultural activities on the site, nor are there any residential uses on LANL property (DOE 2003b). However, the privately owned Royal Crest Trailer Park, located along East Jemez Road, is surrounded by TA-61. Although the county governments have no jurisdiction over Federal lands, they seek Federal cooperation to achieve the goals set forth in their comprehensive plans.

Table 3–2 provides information on the TAs of concern considered for the analysis of impacts across the three alternatives analyzed in this SEIS. The table provides the following information for each TA: a description, land use categories present, and total acreage.

3.2.2 Visual Resources

The topography of northern New Mexico is rugged, especially in the vicinity of LANL. Mesa tops are cut by deep canyons, creating sharp angles in the landform. In some cases, slopes are nearly vertical. Often, little vegetation grows on these steep slopes, exposing the geology, with contrasting horizontal planes varying from fairly bright reddish orange to almost white in color. A variety of vegetation occurs in the region, the density and height of which may change over time and can affect the visibility of an area within the LANL viewshed. Undeveloped lands within LANL have a Bureau of Land Management Visual Resource Contrast rating of Classes II and III. Management activities within these classes may be seen, but should not dominate the view. The contract rating system was developed by the Bureau as a guide in evaluating the visual impacts of a project (BLM 1986).

Table 3–2 Technical Areas of Concern

Technical Area	*Technical Area Description*	*Land Use Category*	*Size (acres)*
3	The main technical area housing approximately half of the LANL employees and about half of its floor space. Site of the present Chemistry and Metallurgy Research facility. The area is nearly completely developed.	Administration, Service, and Support; Experimental Science; Nuclear Materials Research and Development; Public and Corporate Interface; Reserve; Theoretical and Computational Science	357
5	Contains five physical support facilities, an electrical substation, test wells, as well as archaeological sites and environmental monitoring and buffer areas. The area is largely undeveloped and includes vegetated mesas and canyons.	Administration, Service, and Support; Reserve	824
36	Contains four active sites that support explosives testing. The area is largely undeveloped, with predominantly natural vegetation.	High Explosives Testing	2,779
46	Supports basic laboratory research and site of the Sanitary Wastewater Systems Plant. The central and southeastern portions of the TA are highly developed, while the remainder is forested.	Administration, Service, and Support; Experimental Science; Reserve	258
48	Supports research in nuclear and radiochemistry, geochemistry, production of medical isotopes, and chemical synthesis. The central portion of the TA is developed. Remaining portions of the mesa top are open or sparsely vegetated, and Mortandad Canyon is largely forested.	Experimental Science; Reserve	116
50	Contains 33 waste support structures. Much of the TA is developed or disturbed grassland. The southern portion of the TA within Twomile Canyon is forested.	Reserve	62
51	Used for research and studies on the long-term impact of radioactive materials on the environment. Development within the TA is scattered; the north wall of Pajarito Canyon is the most heavily vegetated area.	Experimental Science; Reserve	149
52	Supports theoretical and computational research and development. The central portion of the TA is developed; the remainder is largely vegetated, especially the south wall of Mortandad Canyon	Administration, Service, and Support; Experimental Science; Reserve	69
54	Supports management of radioactive solid and hazardous chemical wastes. Some development and open fields occur in the western portion of the TA; remaining areas are largely vegetated.	Waste Management; Reserve	848
55	Supports research of and applications for the chemical and metallurgical processes of recovering, purifying, and converting plutonium and other actinides into many compounds and forms, as well as research into material properties and fabrication of parts for research and stockpile applications. The TA is largely developed; only the south wall of an extension of Mortandad Canyon has significant vegetative cover.	Nuclear Materials Research and Development; Reserve	93
63	Contains physical support facilities, a trailer, and transportable office space. The mesa-top portion of this TA is largely developed; however, the south-facing wall of Twomile and north-facing wall of Mortandad Canyon are forested	Administration, Service, and Support/Experimental Science; Reserve	50
64	Contains Central Guard Facility, office and storage space for the Hazardous Materials Response Team, as well as several storage sheds and water tanks. Development and open fields dominate the mesa top within this TA; however, the south-facing wall of Twomile Canyon is forested.	Administration, Service, and Support; Reserve	49
72	Contains the live firing range used by LANL protective force personnel for required training, as well as a truck inspection station. The area is sparsely developed and remains largely in a natural vegetated state.	Administration, Service, and Support; Reserve	1,192

LANL = Los Alamos National Laboratory; TA = technical area.
Note: To convert acres to hectares, multiply by 0.40469.
Source: LANL 2002a, 2011.

For security reasons, much of the development within LANL, which is generally austere and utilitarian, has occurred out of the public's view. Passing motorists or nearby residents can see only a small fraction of what is actually there. Prior to the 2000 Cerro Grande Fire, the view of most LANL property from many stretches of area roadways was that of woodlands and brushy areas. Views from various locations in Los Alamos County and its immediate surroundings were altered by the Cerro Grande Fire. Although the visual environment is still diverse, interesting, and panoramic, portions of the visual landscape are dramatically stark with rocky outcrops forming the mountains now visible. Grasses and shrubs initially will replace forest stands and will contribute to the visual contrast between the burned and unburned areas for many years. Since the fire, mechanical thinning of the forests has been in progress within LANL and nearby areas to reduce the existing fuel loads. This tree-thinning process has increased the visibility of industrial and residential areas within LANL and Los Alamos County (DOE 2000). A total of 955 acres (386 hectares) were thinned from 2008 through 2010; an additional 397 acres (161 hectares) will be thinned in 2011 (LANL 2011, 2010f).

The most visible developments at LANL are a limited number of very tall structures; facilities at relatively high, exposed locations; or those beside well-traveled, publicly accessible roads. A number of new buildings have been constructed in recent years, including the National Security Sciences Building in TA-3 and the Radiological Laboratory/Utility/Office Building (RLUOB) in TA-55. The National Security Sciences Building is eight stories high and is visible from most locations throughout the Los Alamos townsite. RLUOB is visible from a number of locations throughout LANL and is the key visible structure along Pajarito Road. Many of the older structures on the site have been demolished over the past several years, which has improved the appearance of the built environment. Developed areas within LANL are consistent with a Class IV Visual Resource Contrast rating, in which management activities dominate the view and are the focus of viewer attention (BLM 1986).

At lower elevations, at a distance of several miles away from LANL, the site is primarily distinguishable in the daytime by views of its water storage towers, and white dome storage structures at TA-54. Similarly, the Los Alamos townsite appears mostly residential in character, with its white water storage towers visible against the backdrop of the Jemez Mountains. At elevations above LANL, along the upper reaches of the Pajarito Plateau rim, the view of LANL is primarily of scattered austere buildings and groupings of several-storied buildings. Similarly, the residential character of the Los Alamos townsite is predominantly visible from higher elevation viewpoints. At night, the lights of LANL, the Los Alamos townsite, and the community of White Rock are directly visible from various locations across the viewshed and as far away as the towns of Española and Santa Fe.

Table 3–2 presents a general description of the appearance of the various TAs that may be affected by actions proposed in this *CMRR-NF SEIS*. In general, development along Pajarito Road decreases toward the east; there is little development to the south of the road. The visual resources along the road generally are consistent with BLM Visual Contrast Ratings of Class III and Class IV. Under a Class III rating, development may attract attention, but the natural landscape dominates; however, under a Class IV rating, development dominates the view and is the major focus of the landscape. However, these views are limited to LANL workers, as the road is closed to the public. When viewed from higher elevations to the west along the upper reaches of the Pajarito Plateau rim, development along Pajarito Road would be most prominent within TA-3 and would become more scattered to the east. Development in the eastern portion of TA-72 (the area of a proposed parking lot) is limited to a shooting range and temporary truck inspection station. Considering the presence of these facilities, the visual resources of this area would be consistent with a BLM Visual Contrast Ratings of Class III.

3.3 Site Infrastructure

Site infrastructure characteristics are summarized in **Table 3–3**. Each infrastructure characteristic is further discussed in the following paragraphs.

Table 3–3 Los Alamos National Laboratory Site-Wide Infrastructure Characteristics

Resource	*Usage* [a]	*Site Capacity*	*Available Capacity*
Transportation			
Roads (miles)	80 [b]	Not applicable	Not applicable
Railroads (miles)	0	Not applicable	Not applicable
Electricity			
Energy (megawatt-hours per year)	LANL 563,000 Other 150,000	1,314,000 [c]	601,000
Peak load demand (megawatts)	LANL 101 Other 23	150 [c]	26
Fuel			
Natural gas (million cubic feet per year)	LANL 1,197 Other 1,018	8,070 [c]	5,860
Water (million gallons per year)	LANL 412 Other 1,241	LANL 542 [d] System Total 1,807	LANL 130 Total 153

LANL = Los Alamos National Laboratory.
[a] Usage values for electricity, fuel and water are shown for FY 2010 or the projected levels of usage included in the *LANL SWEIS* adjusted for decisions made in the associated Records of Decision, whichever is higher. Other usage is shown when capacity is shared by all Los Alamos County users including LANL.
[b] Includes paved roads and paved parking areas only.
[c] Capacity values are for the entire service area, which includes LANL and other Los Alamos County users.
[d] Equivalent to DOE's leased water rights.
Note: To convert miles to kilometers, multiply by 1.6093; cubic feet to cubic meters, by 0.0283; gallons to liters, by 3.7853. A decatherm is equivalent to 1,000 cubic feet.
Values may be rounded.
Source: DOE 2008a; LANL 2011.

3.3.1 Ground Transportation

About 80 miles (130 kilometers) of paved roads and parking surface have been developed at LANL (see Table 3–3). There is no railway service connection at the site. Local and linking regional transportation systems, including roadways, are detailed in Section 3.13.

3.3.2 Electricity

Electrical service to LANL is supplied through a cooperative arrangement with Los Alamos County, known as the Los Alamos power pool, which was established in 1985. Electric power is supplied to the pool through two existing regional 115-kilovolt electric power lines. The first line (the Norton-Los Alamos line) is owned by DOE and originates from the Norton Substation east of White Rock; the second line (the Reeves Line) is owned by the Public Service Company of New Mexico and originates from the Bernalillo-Algodones Substation south of LANL. Both substations are owned by the Public Service Company of New Mexico (DOE 2008a).

Import capacity is now limited only by the physical capability (thermal rating) of the transmission lines, that is, to approximately 110 to 120 megawatts supplied from a number of hydroelectric, coal, and natural gas power generators throughout the western United States (LANL 2010a). In addition, renewable energy sources such as wind farms and solar plantations are providing a small (about 5 percent) but growing percentage of Public Service Company of New Mexico's total power portfolio (DOE 2008a).

Within LANL, NNSA operates a natural gas-fired steam and electrical power generating plant at TA-3 (TA-3 Co-Generation Complex or Power Plant), that when fully operational produces 20 megawatts. Due to equipment constraints, the TA-3 Co-Generation Complex currently produces up to 10 megawatts of electric power that is shared by the power pool under contractual arrangement. LANL also has one combustion turbine located at the TA-3 power plant. The TA-3 combustion turbine has an additional 25 megawatt capacity. In 2009 this combustion turbine operated for 74 hours.

The DOE-maintained electric distribution system at LANL consists of various low-voltage transformers at LANL facilities and approximately 34 miles (55 kilometers) of 13.8-kilovolt distribution lines. It also consists of two older power distribution substations: the Eastern TA Substation and the TA-3 Substation and a new substation built in 2002: the Western TA Substation. This 115-kilovolt (13.8-kilovolt distribution) substation has a main transformer rated at 56-megavolt-amperes or about 45 megawatts. The new substation provides redundant capacity for LANL and the Los Alamos Townsite in the event of an outage at either of LANL's two older substations (DOE 2008a).

Electric power availability from the existing transmission system of the power pool is conservatively estimated at 963,600 megawatt-hours (reflecting the lower thermal rating of 110 megawatts for 8,760 hours per year available for import). The additional megawatts available from LANL via the TA-3 Co-Generation Complex give the power pool a total electric energy availability of 1,314,000 megawatt-hours.

In 2010, the total peak load was 69.23 megawatts for LANL and 23.3 megawatts for the rest of the power pool users. The system peak for fiscal year (FY) 2010 was 82.72 megawatts. A total of 419,908 megawatt-hours of electricity were used at LANL in 2010. Other Los Alamos County users consumed an additional 150,000 megawatt-hours for a power pool total electric energy consumption of 569,908 megawatt-hours. Peak demand and consumption of electricity are below those projected for the level of operations that NNSA selected in the September 2008 and June 2009 *LANL SWEIS* RODs (73 FR 55833 and 74 FR 33232). LANL usage as projected in the *LANL SWEIS*, adjusted for decisions made since then, was 101 megawatts and 563,000 megawatts, annually.

Historically, year-to-year fluctuations in LANL's total electrical energy use have largely been attributable to Los Alamos Neutron Science Center (LANSCE) operations. Since 2003, an increase in LANL base peak load demand and particularly in base electrical energy use, independent of LANSCE operations, is evident. This is punctuated by the observed spike both in LANL base electrical energy use and in use by other Los Alamos County consumers. Nevertheless, operations at several of the large LANL load centers continue to change, which complicates attempts to forecast future electricity demands.

The need for upgrades and the limitations of the electric transmission lines that deliver electric power to the Los Alamos power pool was documented in the 2008 *LANL SWEIS*. LANL has completed several construction projects to expand and enhance existing power capabilities (LANL 2010a). Additional upgrades are being considered, including construction of a portion of the line from the Norton substation to the Southern Technical Area substation. The existing underground ducts need upgrading to fully realize the capabilities of the Western Technical Area substation and the upgraded Eastern Technical Area substation. Redundant feeders need to be added to critical facilities, and the aging TA-3 substation needs upgrading to complete the 13.8-kilovolt distribution and 115-kilovolt transmission systems. The current CMR Building and RLOUB are served by the TA-3 substation.

3.3.3 Fuel

Natural gas is the primary heating fuel used at LANL and in Los Alamos County. The natural gas system includes a high-pressure main and distribution system to Los Alamos County and pressure-reducing stations at LANL buildings. LANL and Los Alamos County both have delivery points where gas is monitored and measured. In August 1999, DOE sold the 130-mile long (210-kilometer-long) main gas supply line and associated metering stations to the Public Service Company of New Mexico. This gas pipeline traverses the area from Kutz Canyon Processing Plant south of Bloomfield, New Mexico, to Los Alamos County. Approximately 4 miles (6.4 kilometers) of the gas pipeline are within LANL boundaries. Natural gas is distributed to the point of use via some 42 miles (68 kilometers) of distribution piping (DOE 2008a).

Natural gas used by LANL is currently used for heating (both steam and hot air), with the TA-3 Co-Generation Complex being the principal user of natural gas at the site. About 200 other smaller boilers are maintained at LANL, which are primarily natural gas fired (DOE 2008a). Relatively small quantities of fuel oil are stored at LANL as a backup fuel source for emergency generators.

FY 2010 natural gas consumption for LANL and the Los Alamos service area was 1,104 million cubic feet (31 cubic meters) and 1,018 million cubic feet (29 cubic meters), respectively. Total natural gas consumption for LANL remains below that projected for the level of operations that NNSA selected in the September 2008 and June 2009 *LANL SWEIS* RODs (73 FR 55833 and 74 FR 33232). LANL usage projected in the *LANL SWEIS*, adjusted for decisions made since then, was 1,197 million cubic feet (34 cubic meters), annually.

Natural gas usage at TA-55 is limited to boilers used for heating. TA-55 is estimated to use approximately 45 million cubic feet (1.3 million cubic meters) of natural gas annually (DOE 2008a).

3.3.4 Water

The Los Alamos County water production system consists of 14 deep wells, 153 miles (246 kilometers) of main distribution lines, pump stations, and storage tanks. The system supplies potable water to all of Los Alamos County, LANL, and Bandelier National Monument. The deep wells are located in three well fields (Guaje, Otowi, and Pajarito). Water is pumped into production lines, and booster pump stations lift this water to reservoir tanks for distribution. Prior to distribution, the entire water supply is disinfected (DOE 2008a).

The system was originally owned and operated by DOE. On September 8, 1998, DOE transferred operation of the system to Los Alamos County under a lease agreement. Under the agreement, DOE retained responsibility for operating the distribution system within LANL boundaries, whereas Los Alamos County assumed full responsibility for ensuring compliance with Federal and state drinking water regulations. DOE retained the right to withdraw an equivalent of about 5,541 acre-feet or 1,806 million gallons (6,840 million liters) of water per year from the main aquifer and its right to purchase a water allocation of 1,200 acre-feet or 391 million gallons (1,480 million liters) per year from the San Juan-Chama Transmountain Diversion Project (DOE 2008a).

On September 5, 2001, DOE transferred ownership of the water production system to Los Alamos County, along with 70 percent (3,879 acre-feet or 1,264 million gallons [4,780 million liters] annually) of the DOE water rights. DOE leased the remaining 30 percent (1,662 acre-feet or 542 million gallons [2,050 million liters] annually) of the water rights to Los Alamos County for 10 years, with the option to renew the lease for four additional 10-year terms. LANL is now considered a Los Alamos County water customer, and DOE is billed and pays for the water LANL uses. The current 10-year agreement (water service contract) with Los Alamos County, includes an escalating projection of future LANL water consumption (DOE 2008a). While the contract does not specify a supply limit to LANL, the water right owned by DOE and leased to Los Alamos County (that is 1,662 acre-feet or 542 million gallons [2,050 million liters] per year) is a target ceiling quantity under which total water consumption at LANL should remain. The distribution system serving LANL facilities consists of a series of reservoir storage tanks, pipelines, and fire pumps. The LANL distribution system is gravity fed with pumps for high-demand fire situations at limited locations (DOE 2008a).

Los Alamos County has signed a contract with the Bureau of Reclamation for accessing up to 391 million gallons (1,480 million liters) of water per year from the San Juan-Chama Transmountain Diversion Project. The water is currently inaccessible while the project completes engineering studies that will lead directly to the environmental clearance, enabling the county to utilize its entire annual allocation of the San Juan-Chama water supply in the most economical and beneficial way (LACBPU 2010). Use of the San Juan-Chama water along with conservation, are integral to Los Alamos County's Long-Range Water Supply Plan (DOE 2008a).

Water use for LANL and other Los Alamos County users is shown in Table 3–3. In 2010, LANL operations consumed about 412 million gallons (1,560 million liters) of water. This is greater than the 408 million gallons (1.5 billion liters) annual usage projected for the level of operations that NNSA selected in the September 2008 and June 2009 *LANL SWEIS* RODs (73 FR 55833 and 74 FR 33232). In recent years, total and consumptive water use for both LANL and other Los Alamos County users has increased. Water use at LANL has increased by about 10 percent from 2007 to 2010, whereas from 1999 to 2005 water use at the site decreased (LANL 2010e).

NNSA continues to maintain the onsite distribution system by replacing portions of the more-than -50-year old system as problems arise. The LANL contractor is also in the process of installing additional water meters and a Supervisory Control and Data Acquisition and Equipment Surveillance System on the water distribution system to keep track of water usage and to determine the specific water use for various applications. Data are being accumulated to establish a baseline for conserving water. NNSA has instituted a number of conservation and water-reuse projects, including improvements to the Sanitary Effluent Recycling Facility to reduce potable water usage (DOE 2008a).

3.3.5 High Performance and Sustainable Buildings

NNSA's commitment to the principles of sustainable buildings is evident in several requirements specified in various DOE Orders (for example, 413.3B, 430.2B, 450.1). In 2002, the *LANL Sustainable Design Guide* (LANL 2002b) was developed to provide a specific planning and design process for creating and meeting site sustainability goals in buildings through energy reduction, indoor environmental quality, water efficiency and quality, and site preservation (LANL 2002b). The LANL contractor has incorporated sustainable design into its Engineering Standards Manual, with guidance on siting, circulation, and landscape design, and has hosted sustainable design workshops. Following DOE Order 430.2B, *Departmental Energy, Renewable Energy, and Transportation Management*, the LANL contractor incorporates specific requirements into design/build contracts that are designed to achieve the U.S. Green Building Council's Leadership in Energy and Environmental Design™ (LEED) certification for sustainable design proficiency. Further, the LANL and Sandia National Laboratories contractors have convened a High-Performance Group to share knowledge about sustainable design and lessons learned from ongoing projects. In all cases, security and safety must be priorities in achieving energy goals.

Recently, LANL completed the *Fiscal Year 2011 site Sustainability Plan* (LANL 2010e) which sets up specific goals for reduced energy and water use and greenhouse gas reduction. Several strategies and measures are laid out as part of a site-wide, holistic path to achieving sustainability goals.

Of note, LANL recently won the 2010 NNSA Pollution Prevention Award for Best in Class for Sustainable Design/Green Building and the 2010 EStar DOE Environmental Sustainability Award in Recognition of Exemplary Environmental Sustainability Projects and Practices (DOE's highest environmental award). These awards were presented for RLUOB integrated planning, design, procurement, and construction. RLUOB, which is part of the CMRR Project, is expected to be awarded the level of Silver Certified under the LEED for New Construction and Major Renovations (LEED-NC) rating system and will be the first building at LANL to register and participate in the formal process to submit required documentation for review by the USGBC. The CMRR-NF is also registered under the LEED-NC rating system, with many of the same credits anticipated to be achievable. Lessons learned from design and construction of the RLUOB from a LEED perspective are already being incorporated into the CMRR-NF and are shared with other LANL planned construction projects.

3.4 Climate, Air Quality, and Noise

3.4.1 Climate

Climate information for an area does not change drastically over time; thus, the information presented in the *CMRR EIS* (DOE 2003b) and *LANL SWEIS* (DOE 2008a) is still applicable. Los Alamos County is a semiarid, temperate mountain climate characterized by seasonable, variable rainfall. Precipitation ranges from 10 to 20 inches (25 to 51 centimeters) per year and precipitation rates within the county decline toward the Rio Grande Valley. The town of Los Alamos is less arid (dry) than the area near the Rio Grande, which is arid continental. Mean temperatures range from 17.4 degrees Fahrenheit (°F) (-8.1 degrees Centigrade [°C]) in January to 80.6 °F (27 °C) in July, with an extreme low of -18 °F (-28 °C) and high temperature of 95 °F (35 °C). Normal temperatures (30-year mean) in the town of White Rock range from 14.6 °F (-9.7 °C) in January to 85.6 °F (29.8 °C) in July. Temperatures in Los Alamos County vary with altitude, averaging 5 °F (3 °C) higher in and near the Rio Grande Valley, which is 6,500 feet (1,981 meters) above sea level, and 5 to 10 °F (3 to 5.5 °C) lower in the Jemez Mountains, which are 8,500 to 10,000 feet (2,590 to 3,050 meters) above sea level (DOE 2003b).

Precipitation in Los Alamos County during July and August is 36 percent of the annual average value due to thunderstorms. Los Alamos County averages 60 thunderstorms per year, with intense and frequent lightning that has caused fires. Local lightning density is estimated at 15 strikes per square mile (5.6 strikes per square kilometer) per year, commonly observed between May and September (LANL 2009). Flash flooding from heavy thunderstorms in canyons and low-lying areas does occur. Winter precipitation falls as snow, with an average snowfall of 59 inches (150 centimeters). Snowfall levels vary year to year, ranging from 9 inches (23 centimeters) to 153 inches (389 centimeters). Los Alamos County experienced drought conditions from 1998 through 2003, the longest and most severe drought experienced by this area during the last 80 years. Above-average precipitation in 2004 and 2005 helped to restore normal conditions. Precipitation levels were slightly below normal in 2010 (18.8 inches [47.8 centimeters]) (LANL 2010b).

Windspeed averages 7 miles per hour (3 meters per second) in Los Alamos County. Due to storms and cold fronts, windspeeds are lowest in December and January and highest in March through June. Due to the complex terrain surface winds vary dramatically with time of day, location, and elevation. Generally, an upslope airflow occurs in the morning, with winds shifting from the south over the entire plateau by noon. During the night, winds come from the west-southwest to the northwest over the western portion of the plateau due to cold air drainage off the Jemez Mountains and the Pajarito Plateau (DOE 2008a).

3.4.2 Air Quality

Air quality is determined by the type and amount of the pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The baseline standards for pollutant concentrations are the National Ambient Air Quality Standards (NAAQS) and state air quality standards. These standards represent the maximum allowable atmospheric concentration that may occur and still protect public health and welfare. Based on measured ambient air pollutant concentration, EPA designates whether areas of the United States meet NAAQS. Those areas demonstrating compliance with NAAQS are considered "attainment" areas, while those that are not are known as "nonattainment" areas. Those areas that cannot be classified on the basis of available information for a particular pollutant are "unclassifiable" and are treated as attainment areas.

The State of New Mexico has established ambient air quality standards for the criteria pollutants and total suspended particulates, hydrogen sulfide, and total reduced sulfur (**Table 3–4**). The Clean Air Act gives the authority to states to establish air quality rules and regulations. EPA is the regulating authority for the Clean Air Act; however, EPA has granted the New Mexico Environment Department (NMED) primacy for regulating nonradioactive air emissions under an approved State Implementation Plan. New Mexico has adopted all Clean Air Act regulations as part of the State Implementation Plan, except the National Emission Standards for Hazardous Air Pollutants for radionuclides (40 CFR Part 61), provisions of the Stratospheric Ozone Protection section (40 CFR Part 82), and the Risk Management Program (40 CFR Part 68).

Bi-annual public meetings on the status of the CMRR Project are held as a result of a formal negotiated settlement between NNSA and local public citizens groups. A number of public citizens groups raised concerns to the New Mexico Environment Department on the air quality construction permit application submitted in February 2005 for the RLUOB. As a means of settling raised concerns, an agreement was reach to hold public briefings on the CMRR Project as well as including the interested groups in the review of future air quality permit submissions. As of March 10, 2011, eleven public meeting have been held. Transcripts of the meetings can be viewed at http://www.lanl.gov/orgs/cmrr/publicmeetings/index.shtml.

Air quality permits have been obtained from the New Mexico Environment Department Air Quality Bureau for various activities at LANL including beryllium operations; open burning of high-explosives waste; and operation of an air curtain destructor, an asphalt plant, a rock crusher, the TA-3 power plant, and the TA-33 generator. Each of these operations was modified or constructed after August 31, 1972. In accordance with Title V of the Clean Air Act and New Mexico Administrative Code 20.2.70, a site-wide operating permit application was submitted to NMED in December 1995. A modified application was submitted in 2005; a renewal application was submitted in 2008. The current approved operating permit was issued in August 2009. The LANL site-wide operating permit has voluntary facility-wide emission limits to ensure that LANL remains a minor stationary source for the purposes of the Prevention of Significant Deterioration Construction Permit Program and the Clean Air Act Title III requirements for hazardous air pollutants. Prior to construction NMED requires air permits for new buildings depending on the design and operation. An application to modify the LANL Title V permit would be submitted to NMED prior to operation of the new facility.

LANL is located within the Upper Rio Grande Valley Intrastate Air Quality Control Region (#157). The area encompassing LANL and Los Alamos County is classified as an attainment area for all six criteria pollutants (40 CFR 81.332). Baseline emissions for the Upper Rio Grande Valley Intrastate Air Quality Control Region utilized in this *CMRR-NF SEIS* are presented in **Table 3–5**. The county data include emissions data from point sources, area sources, and mobile sources. "Point sources" are stationary sources that can be identified by name and location. "Area sources" are point sources of emissions too small to track individually, such as individual homes, small office buildings, or diffuse stationary sources (e.g., wildfires or agricultural tilling equipment). "Mobile sources" are vehicles or equipment with gasoline or diesel engines, e.g., an airplane or a ship. Two types of mobile sources are considered: on-road and nonroad. On-road mobile sources are vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Nonroad mobile sources are aircraft, locomotives, diesel- and gasoline-powered boats and ships, personal watercraft, landscaping equipment, agricultural and construction equipment, and recreational vehicles (for example, snowmobiles) (EPA 2009b).

Table 3–4 Federal and New Mexico State Ambient Air Quality Standards

Air Pollutant	*Averaging Time*	*New Mexico Standards*	*Federal Standards*	
			Primary	*Secondary*
Carbon Monoxide	8-hour 1-hour	8.7 ppm 13.1 ppm	9 ppm 35 ppm	— —
Nitrogen Dioxide	AAM 24-hour	0.05 ppm 0.10 ppm	0.053 ppm —	0.053 ppm —
Sulfur Dioxide	AAM 24-hour 3-hour	0.02 ppm 0.10 ppm —	0.030 ppm 0.140 ppm —	— — 0.50 ppm
Particulate Matter (PM_{10})	AAM 24-hour	— —	50 μg/m^3 150 μg/m^3	50 μg/m^3 150 μg/m^3
Particulate Matter ($PM_{2.5}$) [a]	AAM 24-hour	— —	15 μg/m^3 65 μg/m^3	15 μg/m^3 65 μg/m^3
Total Suspended Particulates	AGM 30-day 7-day 24-hour	60 μg/m^3 90 μg/m^3 110 μg/m^3 150 μg/m^3	— — — —	— — — —
Hydrogen sulfide	1-hour [c]	0.010 ppm	—	—
Total Reduced Sulfur [b]	½-hour [c]	0.003 ppm	—	—
Ozone	8-hour	—	0.08 ppm	0.08 ppm
Lead	3-month	—	1.5 μg/m^3	1.5 μg/m^3

AAM = annual arithmetic mean; AGM = annual geometric mean; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; ppm = parts per million; μg/m^3 = micrograms per cubic meter.

[a] The $PM_{2.5}$ standard was promulgated in January 2005 and will be implemented over the next few years.

[b] Total reduced sulfur does not include hydrogen sulfide.

[c] Entire state except for the Pecos–Permian Air Basin, which includes De Baca, Chaves, Curry, Quay, and Roosevelt Counties.

Source: EPA 2009a; NMAC 20.2.3. 2006.

Table 3–5 Upper Rio Grande Valley Intrastate Air Quality Control Region Emissions

Source Type	*Emissions (tons per year)*				
	Carbon Monoxide	*Nitrogen Oxides*	*PM_{10}*	*Sulfur Dioxide*	*Volatile Organic Compounds*
Area Source	4,608	631	271,212	259	3,943
Nonroad Mobile	13,807	1,416	166	145	1,628
On-Road Mobile	75,197	8,454	214	269	5,306
Point Source	4,119	2,970	266	35	2,652
Total	97,730	13,472	271,858	707	13,530

PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

Total may not equal the sum of the contributions due to rounding.

Note: To convert tons to metric tons, multiply by 0.90718.

Source: EPA 2002.

Operations at LANL emit criteria pollutants primarily from combustion sources, such as boilers, emergency generators, and motor vehicles. Emissions at LANL are provided in **Table 3–6**.

Table 3–6 Air Emissions at Los Alamos National Laboratory as Reported in the Los Alamos National Laboratory Title V Operating Permit Emissions Reports

Pollutants	*2008 LANL SWEIS (tons per year)*	*Title V Facility-wide Emission Limits (tons per year)*	*2008 Emissions (tons per year)*
Carbon Monoxide	58	225	32.5
Nitrogen Oxides	201	245	45.9
Particulate Matter	11	120	4.5
Sulfur Oxides	0.98	150	0.6

Note: The Title V Operating Permit Emissions Report includes two categories of sources not required in the annual emission inventory: small, exempt boilers and heaters, and exempt standby emergency generators.
To convert tons to metric tons, multiply by 0.90718.
Source: DOE 2003b, 2008a; LANL 2010a.

3.4.3 Radiological Releases

Radiological air emissions in 2009 from all LANL TAs, as well as emissions solely from TA-55, are presented in **Table 3–7**. Uranium releases for the year did not change significantly from releases in 2008. Plutonium releases were higher by a factor of three over previous years. Tritium releases are mainly from TA-16, which accounted for 47.6 curies (62 percent) of the tritium released at LANL over the entire year. Standards for emissions of radionuclides are discussed in Section 3.11.1.

Table 3–7 Radiological Airborne Releases to the Environment at Los Alamos National Laboratory in 2009

Radionuclide	*LANL (curies)*	*TA-3 (curies)*	*TA-55 (curies)*
Tritium	76.7	2.48×10^{-6}	7.45
Americium-241	2.5×10^{-6}	—	5.1×10^{-10}
Plutonium (includes isotopes -238, -239, -240)	1.3×10^{-5}	1.29×10^{-5}	8.6×10^{-10}
Uranium (includes isotopes -234, -235, -238)	1.1×10^{-5}	1.06×10^{-5}	—
Thorium	2.5×10^{-7}	2.50×10^{-7}	—
Strontium-90	1.62×10^{-7}	2.34×10^{-8}	—
Particulates/vapor activation products	1.4×10^{-2}	—	—
Gaseous/mixed activation products	775	—	—
Total	852	2.6×10^{-5}	7.5

LANL = Los Alamos National Laboratory; TA = technical area.
Note: Dashed lines indicate no measurable releases.
Source: LANL 2010b.

A radiological ambient air-sampling network is fielded in Los Alamos, Santa Fe, and Rio Arriba Counties and is designed to measure levels of airborne radionuclides (plutonium, tritium, and uranium) that may be emitted from LANL operations. Radionuclides emitted from stacked and/or diffuse sources may be captured. The network comprises more than 50 ambient air-sampling stations. Each sampler is equipped with a filter to collect a particulate matter sample (for gross alpha/beta and radiochemical determination) and a silica gel cartridge to collect a water sample (for tritium determination). **Table 3–8** presents the average ambient air concentrations calculated from the field and analytical data for the last 5 years by the type of radioactivity and specific radionuclides.

Table 3–8 Average Background Concentration of Radioactivity in the Regional Atmosphere near Los Alamos National Laboratory [a]

Radioactivity (units)	*EPA Concentration Limit [b]*	*2005*	*2006*	*2007*	*2008*	*2009*
Gross Alpha (fCi/m³) [c]	Not applicable	0.9	1.0	1.0	0.9	0.8
Gross Beta (fCi/m³) [c]	Not applicable	16	17	19	17	19
Tritium (pCi/m³)	1,500	0.1	-02	0.2	0.8	0.2
Plutonium-238 (aCi/m³)	2,100	0.1	-0.3	-0.3	0.1	0.4
Plutonium-239, -240 (aCi/m³)	2,000	0.0	0.1	0.6	-0.1	1.0
Americium-241 (aCi/m³)	1,900	0.1	0.2	-0.1	-0.3	-0.6
Uranium-234 (aCi/m³)	7,700	12	17	15	18	17
Uranium-235 (aCi/m³)	7,100	1.2	0.8	0.8	1.3	0.7
Uranium-238 (aCi/m³)	8,300	13	16	15	17	16

EPA = U.S. Environmental Protection Agency; aCi = attocuries (10^{-18} curies); fCi = femtocuries (10^{-15} curies); pCi = picocuries (10^{-12} curies); m^3 = cubic meters.

[a] Data from regional air-sampling stations operated by LANL during the last 5 years. Locations can vary by year.

[b] Each EPA limit is from 10 CFR Part 40 and corresponds to 10 millirem per year.

[c] Alpha and beta values are gross air concentrations; all others are net air concentrations.

Note: Some values in the tables indicate measured negative concentrations, which is physically impossible. However, it is possible for measured concentrations to be negative because the measured concentrations are a sum of the true value and all random errors. As the true value approaches zero, the measured value approaches the total random errors, which can be negative or positive and overwhelm the true value. Arbitrarily discarding negative values when the true value is near zero will result in overestimated ambient concentrations.

Source: LANL 2010b.

3.4.4 Greenhouse Gases and Climate Change

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions are generated by both natural processes and human activities. The accumulation of GHGs in the atmosphere regulates the Earth's temperature. Assessments by the Intergovernmental Panel on Climate Change (IPCC) indicate that the Earth's climate has warmed between 1.08 and 1.62 °F (0.6 and 0.9 °C) over the past century and that it is "very likely" (that is, there is a 90 percent chance) that the effect of human activity on the atmosphere is an important driving factor. In the IPCC Fourth Assessment Report (IPCC 2007), scientists conclude that "most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations." The IPCC goes on to state, "The observed widespread warming of the atmosphere and ocean, together with ice mass loss, support the conclusion that it is extremely unlikely that global climate change of the past 50 years can be explained without external forcing, and very likely that it is not due to known natural causes alone." The U.S. Global Change Research Program report, *Global Climate Change Impacts in the United States,* states that the U.S. average temperature has risen by an amount comparable to global increases, and is very likely to rise more than the global average over this century, with some variation from place to place (Karl et al. 2009).

The six primary GHGs, which are defined in Section 19(i) of Executive Order 13514 and internationally recognized and regulated under the Kyoto Protocol, are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

Each GHG has an estimated global warming potential, which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the Earth's surface. To allow GHGs to be compared to each other, each GHG quantity is translated into a common unit called the "carbon dioxide equivalent." A description of this methodology along with the full list of GHGs and global warming potentials can be found in Appendix B.

NMED prepared the *Inventory of New Mexico's Greenhouse Gas Emissions: 2000-2007* (NMED 2010). The state-wide inventory has been compiled as mandated in Executive Orders 2005-033 and 2006-69 to provide an update regarding trends of GHG emissions in the state. The inventory reported 85,900,000 tons (78,000,000 metric tons) of carbon dioxide equivalent in 2000, and 84,000,000 tons (76,000,000 metric tons) of carbon dioxide equivalent in 2007 for New Mexico. The focus of the report was to provide a top-down inventory; however, some bottom-up data are included. Top-down data (for example, statewide fuel consumption) are used to estimate emissions from a broad cross section of GHG emitting sources, whereas bottom-up data are estimated from specific emitting unit(s) (for example, a facility with an air permit). The year 2008 marked the first year for which NMED received GHG reporting data from the largest sources of air pollutants that it regulates (that is, sources that are subject to the Title V air permitting program). However, they only required reporting of carbon dioxide. A LANL GHG inventory is shown in **Table 3–9**. As noted in the table, the carbon dioxide equivalent inventory at LANL for FY 2008 is 439,673 tons (398,865 metric tons). The inventory focuses on FY 2008 because Executive Order 13514 established greenhouse gas emissions percentage reduction targets for three scoping categories (discussed below) to be reached by FY 2020, using FY 2008 as the baseline.

Table 3–9 Los Alamos National Laboratory Site-Wide Greenhouse Gas Inventory for Fiscal Year 2008

Emissions Scope	*Category*	*Tons Carbon Dioxide Equivalent*
Scope 1	Sulfur Hexafluoride	6,805
	Hydrofluorocarbon-23	3
	Hydrofluorocarbon-134a	674
	Asphalt Plant	162
	Boilers	31,876
	Permitted Generators	52
	Power Plant	29,931
	Combustion Turbine	1,046
	Standby Generators	240
	Fleet Vehicles	6,714
	Other Onsite Vehicles	1,983
Total Scope 1		**79,485**
Scope 2	Purchased electricity	269,597
	Purchased renewable electricity	9,218
Total Scope 2		**278,814**
Total Scope 1 and 2		**358,300**
Scope 3	Transmission and Distribution Losses	18,671
	Employee Commuting	53,608
	Business Air Travel	9,055
	Municipal Solid Waste	31
	Wastewater Treatment	9
Total Scope 3		**81,374**
Total Scope 1, 2, and 3		**439,673**

Note: To convert tons to metric tons, multiply by 0.90718.
Total may not equal the sum of the contributions due to rounding.
Source: LANL 2011.

Scope 1 emissions include direct stationary and mobile sources, as well as direct fugitive emissions from refrigeration or air conditioning equipment owned and controlled by NNSA at LANL, and various other sources of fluorinated gases.

Scope 2 and 3 emissions are defined as indirect greenhouse gas emissions generated outside the boundaries of NNSA's direct control at LANL. Originally, these were defined by the World Resources Institute and the World Business Council for Sustainable Development to avoid double counting emissions. Double counting would occur if two different entities were to report the same emissions. Scope 2 sources account for emissions from the generation of purchased electricity or renewable electricity consumed at LANL. The electricity-generating facility on site, which is currently not operating at full capacity, is owned by LANL, and, therefore, is included under Scope 1 emissions. Scope 3 sources are derived from business travel, employee commutes in vehicles not owned by NNSA at LANL, and municipal solid waste and wastewater treatment.

3.4.5 Noise

Noise is defined as any unwanted sound. Defining characteristics of noise include sound level (amplitude), frequency (pitch), and duration. Each of these characteristics plays a role in determining the intrusiveness and level of impact that noise may have on a receptor, that is, any person, animal, or object that hears or is affected by noise. The standard unit used to report 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.

Existing noise related to LANL facilities that is detectable by the public comes from a variety of sources, including construction, truck and automobile movements to and from the LANL TAs, high-explosives testing, and firearms practice by security guards. Non-LANL noise occurring within Los Alamos County is dominated by traffic movement and, to a much lesser degree, other residential-, commercial-, and industrial-related activities. Measurements of nonspecific background ambient noise in the LANL area have been taken at a couple of locations near LANL boundaries next to public roadways. Background noise levels were found to range from 31 to 35 decibels A-weighted (dBA) at the vicinity of the entrance to Bandelier National Monument and New Mexico State Route (SR) 4. At White Rock, background noise levels range from 38 to 51 dBA (1-hour equivalent sound level); the slight increase compared to Bandelier National Monument is probably due to higher levels of traffic and the presence of a residential neighborhood, as well as the different physical setting (DOE 2003b).

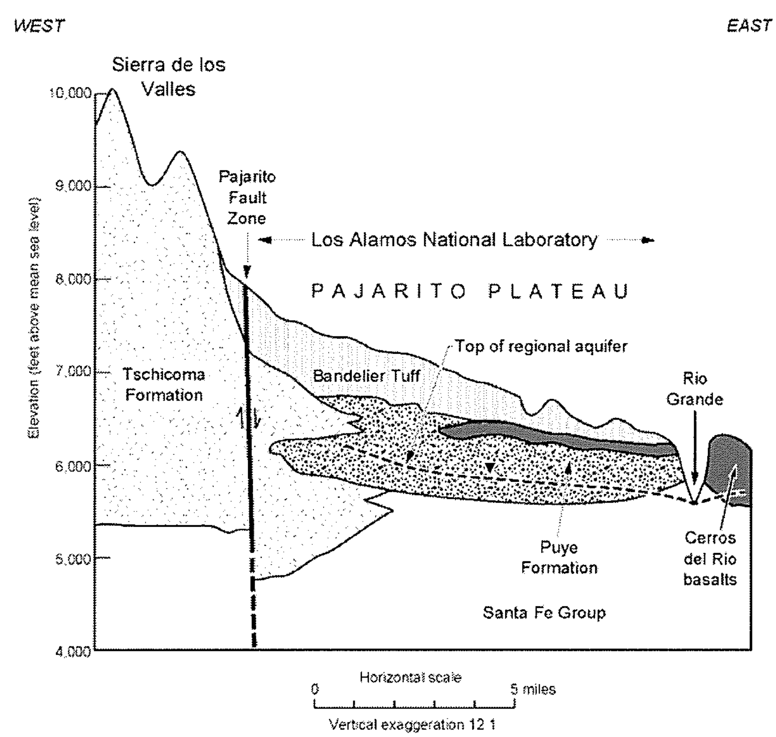
Peak noise levels from LANL operations are represented by the detonation of high explosives. The higher-frequency, audible air pressure waves that accompany detonation of explosives can be heard by both workers and the area public. The lower-frequency air pressure waves are not audible, but may cause secondary and audible noises within a testing structure that may be heard by personnel.

Noise attenuation (reduction) is affected by vegetation, topography and meteorology. Much of LANL is forested, particularly where explosive test sites are located, and varied elevations and rock formations influence and channel noise and vibrations away from receptors. Booming noises from explosives are similar to thunder and startle receptors and LANL workers alike. The Cerro Grande Fire decreased the ability of the surrounding environment to absorb noise by reducing vegetative cover (DOE 2008a).

LANL operational noise (both audible and vibration) is regulated by worker protection standards (29 CFR 1910.95) that are consistent with the Los Alamos County Code. Los Alamos County promulgated a local noise ordinance that establishes noise level limits for residential land uses. Noise levels that affect residential receptors are limited to a maximum of 65 dBA during daytime hours (between 7 a.m. and 9 p.m.) and 53 dBA during nighttime hours (between 9 p.m. and 7 a.m.). During daytime hours, the permissible noise level can be increased to 75 dBA in residential areas, provided the noise is limited to 10 minutes in any 1 hour. Activities that do not meet the noise ordinance limits require a permit. It was determined by the Los Alamos County Community Development Department that LANL does not need a special permit under the Los Alamos County Code, as explosive test noise is not prolonged. Traffic noise is exempted from the Los Alamos County Code. Wildlife and sensitive, federally protected bird populations are vigorous in the LANL area, suggesting that noise generated at LANL is within the acceptable tolerance range for most wildlife species and sensitive nesting birds.

3.5 Geology and Soils

LANL is located on the Pajarito Plateau, within the Southern Rocky Mountains Physiographic Province. The Pajarito Plateau lies between the Sierra de los Valles, located in the Jemez Mountains, to the west, and the Rio Grande to the east (see **Figure 3–2**). The Sierra de los Valles comprise the eastern rim of the Valles Caldera, which is a large collapsed volcano that formed 1.12 million years ago (Gardner et al. 1986). The gently sloping surface of the Pajarito Plateau is divided into multiple narrow east-southeast-trending mesas, dissected by deep parallel canyons that extend from the Jemez Mountains to the Rio Grande. The major tectonic feature in the region is the Rio Grande Rift, which begins in northern Mexico, trends northward across central New Mexico, and terminates in central Colorado. This rift comprises a complex system of north-trending basins, formed from down-faulted blocks of the Earth's crust. In the LANL area, the rift is approximately 35 miles (56 kilometers) wide and contains the Española Basin. The Sangre de Cristo Mountains border the rift on the east. The Jemez Mountains and associated Pajarito Fault system lie west of the rift (DOE 2003b).



Notes:
1. The thickness of geologic units has been exaggerated on this figure to illustrate unit relationships and topography.
2. Offset of the Tschicoma formation on the Pajarito Fault zone is schematic due to the variation along the trace of the fault.
3. To convert feet to meters, multiply by 0.3048; miles to kilometers by 1.6093.

Source: DOE 2008a.

Figure 3–2 Generalized Cross Section of the Los Alamos National Laboratory Area

Rocks in the LANL region are volcanic and sedimentary. Volcanic activity began forming the Jemez Mountains approximately 16.5 million years ago and continued sporadically to the most recent eruptions that produced the El Cajete Fall, about 50,000 to 60,000 years ago (Reneau et al. 1996). Future volcanic activity in the Jemez Mountains is likely, but recurrence intervals have not been firmly established (DOE 2003b). The unusually low amount of seismic activity in the Jemez Mountains has been reinterpreted to indicate that seismic signals of magma movement are partially absorbed deep in the subsurface, due to elevated temperatures and high heat flow (LANL 2004). The significance of this to LANL is that magma movement indicates that the Jemez Mountains continue to be a zone of potential volcanic activity.

3.5.1 Geology

3.5.1.1 Surficial Geologic Units

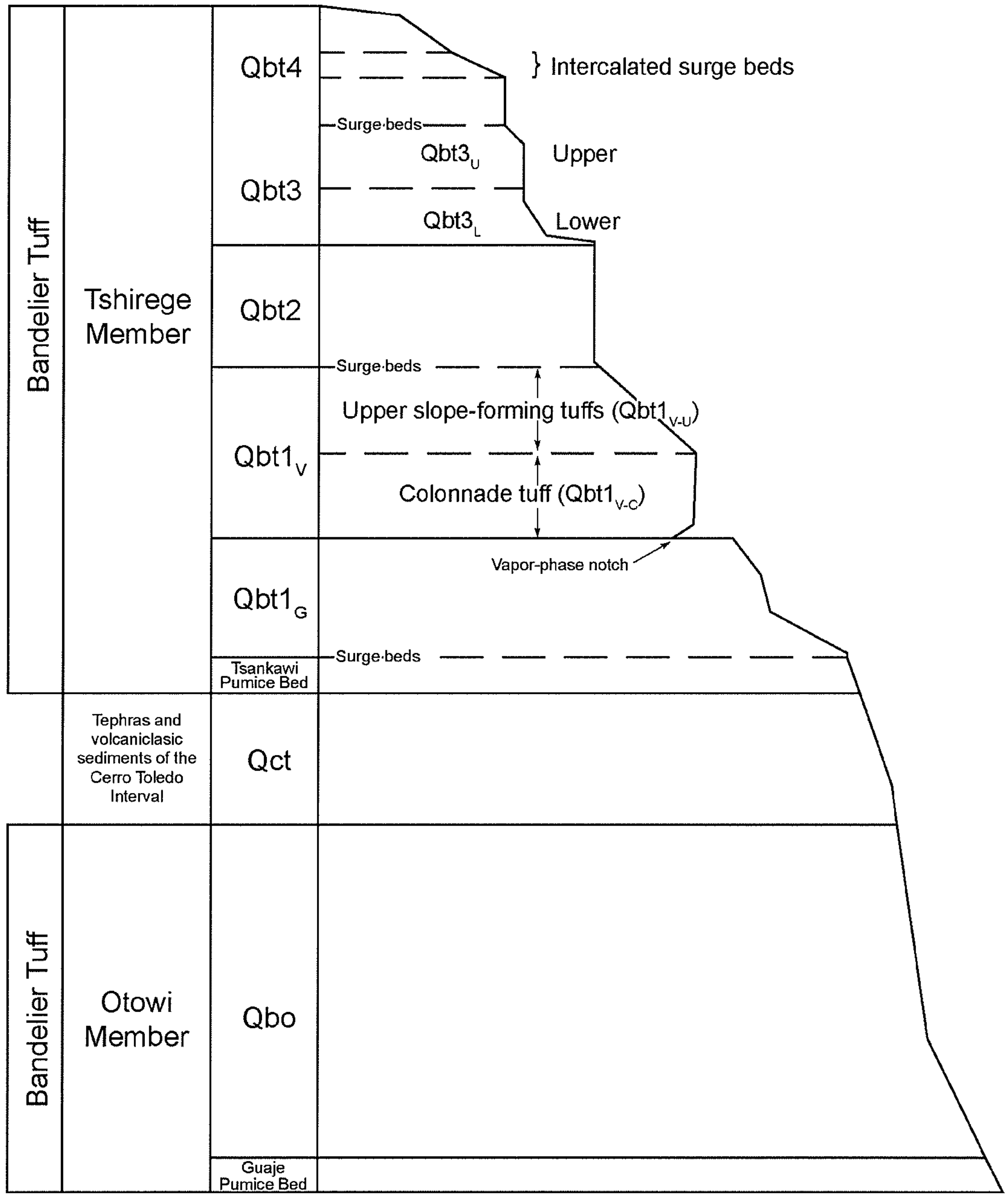
In the LANL area, the youngest surficial geologic units consist of sediment deposited by flowing water (alluvium) and rock debris accumulated at the bases of slopes along stream channels and in canyons (colluvium). Artificial fill is also present as a result of modern development. Extensive areas on the Pajarito Fault escarpment show evidence of mass erosion and landslides. Detailed mapping and trench studies in the Pajarito Fault zone have identified multiple alluvial fan deposits, the youngest of which contains charcoal debris dated at 9,300 to 9,600 years old. El Cajete Pumice, which dates back 50,000 to 60,000 years, is contained within intermediate-aged alluvial fan deposits. Older surficial geologic deposits are remnants from once-extensive alluvial fans, predating the incision of the present canyons. These older alluvial deposits contain pumice beds dated at approximately 1.1 million years old (DOE 2003b).

3.5.1.2 Bedrock Units

Bedrock outcrops occur on more than 50 percent of the surface at LANL. The geologic formations that are most relevant to TA-55 are those that would influence seismic ground response and foundation performance. Seismic ground response is affected by the relatively high seismic wave velocity of the Cerro del Rio basalt and Tschicoma Formation dacite (which is a relatively hard volcanic rock) and the much lower seismic wave velocities of the overlying, softer Bandelier Tuff (Kleinfelder 2007a).

The 1.2- to 1.6-million-year-old Bandelier Tuff is the primary bedrock unit at LANL and is the bedrock on which nearly all LANL facilities are constructed. The upper (Tshirege) member of the Bandelier Tuff, which underlies most facilities, consists of a series of thick, welded tuff sheets, deposited by multiple volcanic flows. These layers dip gently southeastward, representing the paleotopographic surface and thinning of units away from the volcanic source to the west (DOE 2003b, 2008a).

Based on borings drilled at the CMRR Facility site within TA-55, approximately 700 feet (210 meters) of Bandelier Tuff is present beneath the proposed CMRR-NF location (see **Figure 3–3**). The upper portion of this geologic unit comprises Units 3 (Qbt3) and 4 (Qbt4) of the Tshirege member of the Bandelier Tuff. The upper unit, Qbt4, is composed of soft volcanic tuff, with slight to moderate welding (which is a term that refers to depositional heat consolidation and compaction) and substantial random fracturing. Some fractures are deeply weathered and clay-filled. The upper part of underlying Unit 3 ($Qbt3_U$) is similar to Qbt4, but less fractured and weathered (Kleinfelder 2007a, 2010a).



Source: Kleinfelder 2007b.

Figure 3–3 Bandelier Tuff Nomenclature

The lower part of Unit 3 ($Qbt3_L$) is nonwelded to slightly welded, and is weak and friable, does not sustain fractures, and exhibits more soil-like properties. This unit is on average, approximately 56 feet (17 meters) thick across LANL, from a depth of approximately 75 feet (23 meters) to approximately 125 to 131 feet (38 to 40 meters) below ground surface, with upper and lower transition zones composed of slightly stiffer and slightly more dense material. Compared to the units above and below it, $Qbt3_L$ has lower bearing capacity, higher porosity, and less cohesion, and is more compressible. This unit also has a slight to moderate potential for hydro-collapse, due to wetting. $Qbt3_L$ displays properties more typical of slightly cemented, nonplastic, medium to dense silty sand. The apparent cementation is actually weak welding caused by vapor-phase minerals that form fragile connections between the volcanic ash particles that constitute the matrix of this unit. This weak welding is easily broken by even slight disturbance. The properties of $Qbt3_L$ that are most problematic to nuclear facility construction are those that affect the seismic response of the unit, specifically, the estimated seismic wave velocities (the speed at which seismic waves travel) associated with this rock type.

Beneath the Bandelier Tuff is approximately 18 feet (5.5 meters) of fine sand and silt, which may be a fine-grained interval of the older alluvial Puye Formation (see Figure 3–2). Underlying the Puye Formation is approximately several hundred feet (several hundred meters) of the Cerro del Rio basalt and Tschicoma Formation dacitic lava (Kleinfelder 2007a). Overall, the complex interfingering and interlaying of strata beneath LANL results in variable properties that affect canyon wall formation, slope stability, subsurface fluid flow, seismic stability, and the engineering properties of the rock (DOE 2003b, 2008a).

3.5.1.3 Faulting

The Pajarito fault system defines the current active western boundary of the Rio Grande Rift. In Los Alamos County, the Pajarito fault system consists of the Pajarito, Santa Clara, Rendija Canyon, Guaje Mountain, and Sawyer Canyon faults, which are roughly north-south trending, nearly parallel, and interconnected (see **Figure 3–4**). Of these faults, the Pajarito is the longest and delineates the boundary between the Pajarito Plateau and Jemez Mountains. The Pajarito Plateau is structurally separated from the Jemez Mountains by the Pajarito fault. This seismically active fault system is a complex zone of deformation, consisting of many laterally discontinuous faults and associated folds and fractures that interact in ways that have important implications for addressing potential seismic hazards in construction engineering. Early Quaternary deposits have been displaced nearly 590 feet (180 meters) down to the east along this fault zone, which shows compelling evidence for repeated, late Quaternary faulting. However, individual rupture patterns are complex and the timing of some events remains ambiguous. Deformation associated with the Pajarito fault locally extends at least 5,000 feet (1,500 meters) to the east of the Pajarito fault escarpment (DOE 2003b; LANL 2007a; Lewis et al. 2009).

The Pajarito fault system has been mapped in detail in the northern and western portions of LANL property, as well as in the vicinity of LANL (see **Figure 3–5**). This detailed fault data includes fault mapping from a variety of projects that were performed using different methods, that is, conventional geologic mapping, surveying, drilling, and trenching; at different scales, ranging from 1:1,200 to 1:62,500; and at different times, from 1987 to 2004. Portions of the data include currently unpublished mapping performed by the LANL Seismic Hazards Geology Team. The fault mapping includes faults and related structures, such as folds, fissures, and fault zones.

Although project areas TA-3 and TA-55 have been mapped in detail for the presence of faults, areas showing no faulting on Figure 3–5 do not necessarily represent an absence or lack of faulting. Large eastern and southern areas of LANL have not yet been mapped in detail for seismic hazards. Additionally, faults are only shown in areas where such faults are exposed or inferred. The end of a fault line on a map does not necessarily indicate truncation of a fault, but may be indicative of the end of surface exposure or lack of evidence of a fault at that location. This scenario is common in urbanized areas or in areas where faults have been buried by younger sediments. Confirmation of the presence or absence of a fault at a particular site, that is, at the end of mapped fault lines, may require further site-specific detailed geologic investigations, even though mapping may already have occurred at that location.

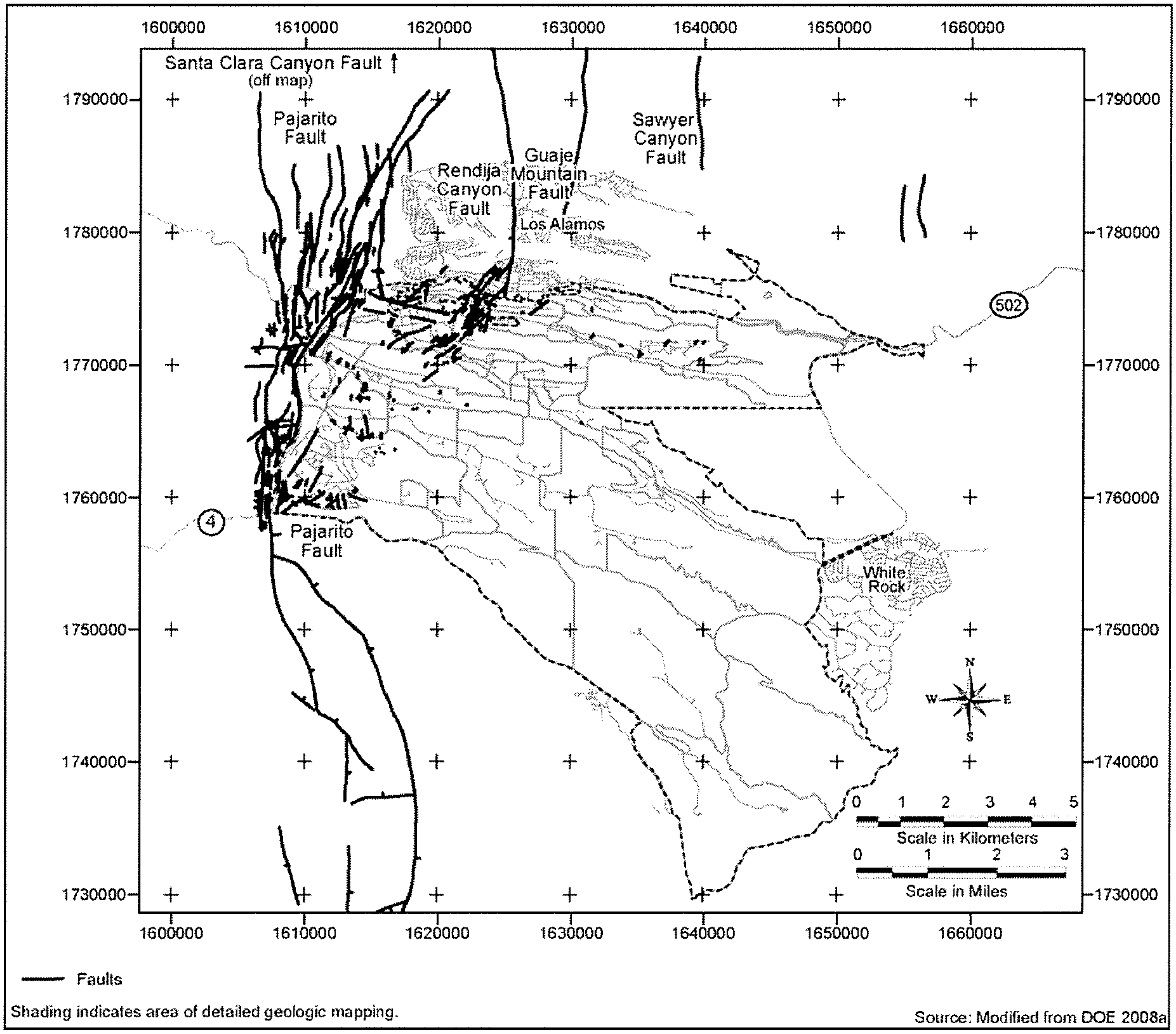


Figure 3–4 Mapped Faults in the Los Alamos National Laboratory Region

Fault traces on Figure 3–5 were digitized from field geologic maps, or incorporated as a two dimensional data point, from locations between surveyed points. The scale and method of mapping that was used to determine the location of faults determines the accuracy in the placement of the fault. Fault traces were locally delineated by three dimensional analyses of surveyed points on geologic contacts, and were determined to lie between two surveyed points. The orientation and lateral extent of such faults is uncertain; therefore, these fault strands are portrayed on the map by point-locations of offset.

The Rendija Canyon fault comprises a broad zone of smaller faults within LANL, approximately 2 miles (3 kilometers) east of the Pajarito fault (see Figures 3–4 and 3–5). Locally, the Pajarito and Rendija Canyon faults define a down-faulted block of the Bandelier Tuff that lies beneath the western part of the Los Alamos townsite and TA-3. Based on geotechnical investigations, a high-angle, reverse fault trace, associated with the Rendija Canyon fault, is located beneath the northern portion of the existing CMR Building within TA-3. Approximately 8 feet (2.4 meters) of fault displacement has occurred at the CMR Building site. The potential for ground deformation from fault rupture is relatively low, with a minimum 4,000-year recurrence interval; however, the Rendija Canyon fault is considered active and capable, per the U.S. Nuclear Regulatory Commission (NRC). A capable fault is one that has demonstrated movement at or near the ground surface within the past 35,000 years (DOE 2003b; LANL 2007a).

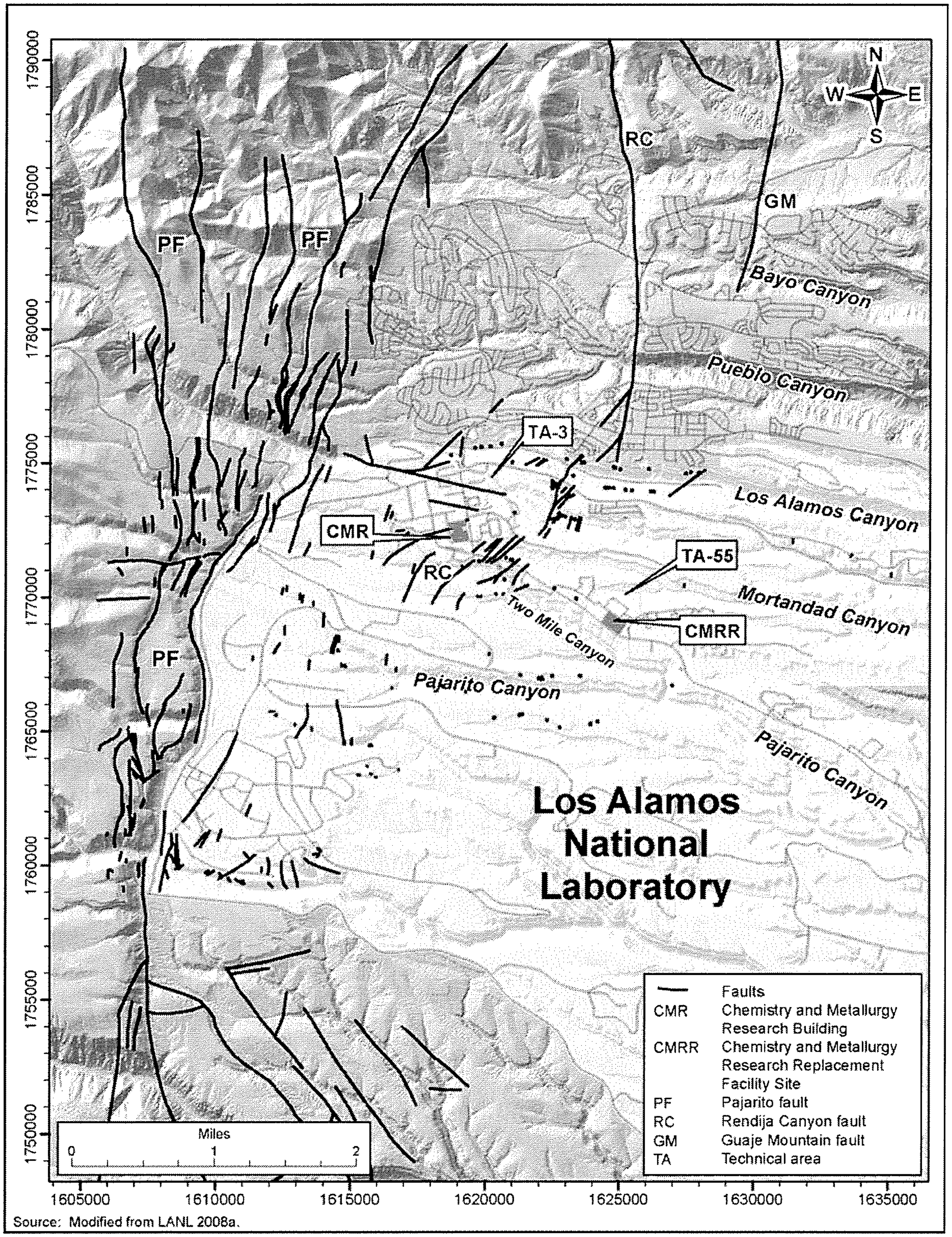


Figure 3–5 Mapped Faults in the Los Alamos National Laboratory Area

In contrast to TA-3, TA-55 is located within an area of relatively simple structure, where no surficial fault deformation has been documented (see Figures 3–4 and 3–5. Detailed geologic mapping in the vicinity of TA-55 indicates that the proposed CMRR-NF site lies approximately 3,000 feet (910 meters) to the east of the Rendija Canyon fault zone and 4,000 feet (1,200 meters) to the east of the Pajarito Fault (see Figure 3–4) and that no large faults exist at the site. Local faults observed in an excavation at the CMRR-NF site originated from fumarolic activity and were created during cooling and compaction of the volcanic tuff, rather than as a result of movement along the Pajarito fault system. These onsite faults have an extremely low probability of surface rupture (LANL 2005, 2008a). However, the Pajarito, Rendija Canyon, and Guaje Mountain fault zones are considered active and capable, per the NRC (DOE 2003b).

3.5.1.4 Seismicity

Although the LANL region is within an intracontinental rift zone, the area demonstrates low seismicity compared to regions bordering on active continental plate boundaries, such as California. For example, since 1973, only 6 earthquakes have been recorded within a 62-mile (100-kilometer) radius of TA-3 at LANL. By comparison, the San Francisco area experienced 1,161 earthquakes during the same time period. The LANL area earthquakes ranged in magnitude from 1.6 to 4.5 on the Richter Scale, while the San Francisco area earthquakes ranged from 1.0 to 7.1 (DOE 2003b). More specific to LANL, 5 small earthquakes, with Richter magnitudes of 2.0 or less, have been recorded along the Pajarito Fault since 1991. These small events, which produced effects felt at the surface, are thought to be associated with ongoing tectonic activity within the Pajarito Fault zone (DOE 2008a).

A comprehensive update to the LANL seismic hazards analysis was completed in June 2007 (LANL 2007a). The updated report used more-recent field study data, most notably from the proposed CMRR-NF site, and the application of the most current seismic analysis methods, in order to update the seismic source model, ground motion attenuation relationships, dynamic properties of the subsurface (primarily the Bandelier Tuff) beneath LANL, as well as the probabilistic seismic hazard, horizontal and vertical hazards, and design-basis earthquake for LANL. The methods used in the updated 2007 analysis follow the Senior Seismic Hazard Advisory Committee's guidelines for a Level 2 analysis in the most recent guidance from NRC, "Recommendations for Probabilistic Seismic Hazard Analysis – Guidance on Uncertainty and Use of Experts" (NRC 1997). Based on this analysis, the dominant contributor to seismic risk at LANL is the Pajarito Fault system, due to its proximity and level of seismic activity. The main element of the fault system is the Pajarito Fault. Secondary elements include the Santa Clara Canyon Fault, the Rendija Canyon Fault, the Guaje Mountain Fault, and the Sawyer Canyon Fault (DOE 2008a; LANL 2007a).

New paleoseismic data argue for three Holocene (past 11,000 years) surface-rupturing earthquakes, including an earthquake on the Pajarito Fault, approximately 1,400 years ago; an earthquake on the Pajarito Fault approximately 5,000 to 6,000 years ago, which is consistent with an event during the same general timeframe on the Guaje Mountain Fault; and a third earthquake on both the Pajarito and the Rendija Canyon Faults, approximately 9,000 years ago. This paleoseismic event chronology demonstrates that the Pajarito Fault often ruptures alone, but sometimes ruptures either with the Rendija Canyon Fault or Guaje Mountain Fault. When this occurs, the resultant seismic moment and, therefore, the earthquake magnitude are larger than when the main Pajarito Fault ruptures alone. Given the evidence for youthful movement on the Pajarito Fault system, future ruptures should be expected. This fault system is capable of producing earthquakes up to Richter magnitude 6.5 to 7.0 (LANL 2007a; Lewis et al. 2009).

Probabilistic seismic hazard was calculated for the ground surface at the existing CMR site within TA-3 and the proposed CMRR-NF project site within TA-55. Anticipated horizontal surface peak ground acceleration values at both sites as a result of a large earthquake on the Pajarito Fault are about

0.52 *g* (percent of acceleration equal to gravity) at a return period of 2,500 years. The vertical peak ground acceleration values are about 0.3 *g*, also at a return period of 2,500 years (LANL 2007a).

During seismic events, facilities near a cliff edge or in a canyon bottom below are potentially susceptible to slope instability, rock falls, and landslides. Slope stability studies have been performed at LANL facilities where a hazard has been identified. As with other geologic hazards due to seismic activity, the potential for land subsidence at LANL is considered low and, for soil liquefaction, negligible (DOE 2003b).

3.5.1.5 Economic Geology

Potential mineral resources at LANL consist of rock and soil for use as backfill or borrow material, or for construction of remedial structures, such as waste unit cover. Rock and mineral resources, including sand, gravel, and volcanic pumice, are mined throughout the surrounding counties. Sand and gravel are primarily used in construction at LANL for road building. Pumice aggregate is used at LANL for landscaping. The major sand and gravel quarry located in the LANL area is situated in the lower member of the Puye Formation. The welded and harder units of the Bandelier Tuff are suitable as foundation rocks, structural and ornamental stone, or insulating material. Volcanic tuff has also been used successfully as aggregate in soil-cement subbase for roads (DOE 2003b, 2008a).

The only borrow pit currently in use at LANL is the East Jemez Road Borrow Pit in TA-61, which is used for soil and rubble storage and retrieval. This borrow pit is cut into the upper Bandelier Tuff, which represents good source material for certain construction purposes. There are numerous commercial offsite borrow pits and quarries in the vicinity of LANL. Eleven pits or quarries are located within 30 miles (48 kilometers) of LANL, which is the distance considered the upper economically viable limit for hauling borrow material to a LANL site. In general, these nearby pits and quarries produce sand and gravel (DOE 2008a). The information regarding the quantity of material produced by individual aggregate or stone mines is not publically available (Lucas-Kamat 2010).

3.5.2 Soils

Soils in Los Alamos County have developed from decomposition of volcanic and sedimentary rocks within a semiarid climate and range in texture from clay and clay loam to gravel. Soils that formed on mesa tops of the Pajarito Plateau include the Carjo, Frijoles, Hackroy, Nyjack, Pogna, Prieta, Seaby, and Tocal soils series. All of these soils are well-drained and range from very shallow (0 to 10 inches [0 to 25 centimeters]) to moderately deep (20 to 40 inches [51 to 102 centimeters]), with the greatest depth to the underlying Bandelier Tuff being 40 inches (102 centimeters) (DOE 1999a). More specifically, TA-55 and TA-3 are underlain by Rock outcrop-Frijoles-Hackroy soils, which consist of barren or nearly barren areas of bedrock, as benches, ledges, and escarpments, with areas of very shallow to deep, well-drained, sandy loam, formed from tuff and pumice on 1 to 8 percent slopes. These soils are characterized by slow to moderate permeability, very low water capacity, high shrink-swell potential, and very high runoff (NRCS 2008).

Soils that develop in canyon settings can be locally much thicker. Soil erosion rates vary considerably at LANL, due to mesa and canyon topography. The highest erosion rates occur in drainage channels and on steep slopes. Roads, structures, and paved parking lots concentrate runoff. High erosion rates are also caused by past area logging practices, livestock grazing, loss of vegetative cover, and decreased precipitation. The lowest erosion rates occur at the gently sloping central portions of the mesas, away from the drainage channels. Soils at LANL are acceptable for standard construction techniques (DOE 2003b). No prime farmland soils have been designated in Los Alamos County. The closest areas of prime farmland are located approximately 7.5 miles (12 kilometers) east and 10 miles (16 kilometers) south of LANL, adjacent to the Rio Grande (NRCS 2011).

3.6 Surface and Groundwater Quality

3.6.1 Surface Water

The LANL area includes all or portions of seven principal watersheds that drain directly into the Rio Grande (the major river in north-central New Mexico), each delineated by a master canyon. Situated from north to south, the master canyons for these seven watersheds are Los Alamos, Sandia, Mortandad, Pajarito, Water, Ancho, and Chaquehui Canyons, each with tributary canyons of various sizes (**Figure 3–6**). Los Alamos, Pajarito, and Water Canyons have their headwaters west of LANL in the western Jemez Mountains (mostly within the Santa Fe National Forest), while the remainder have their upper reaches on the Pajarito Plateau. Ancho Canyon is the only regional watershed located entirely on LANL property. Canyons that drain LANL property are generally dry for most of the year, and no perennial surface water (that is, water that is present all year) extends completely across LANL in any canyon (LANL 2008a; 2010b).

Geographically, TA-55 is located on Pajarito Mesa and along the Pajarito Road corridor, which transverses portions of Pajarito Mesa and Pajarito Canyon. TA-55 is situated on a narrow mesa (Mesita del Buey) approximately 1 mile (1.6 kilometers) southeast of TA-3. TA-55 is bordered by Mortandad Canyon to the north and Twomile Canyon to the south. Twomile Canyon converges with Pajarito Canyon south and east of TA-3 near the border of TA-55 with TA-6, and abuts TA-3 on the south and west (see Figure 3–6). Los Alamos Canyon borders TA-3 to the north. Both TA-55 and TA-3 are heavily developed facility complexes with surface-water drainage primarily occurring as sheet flow runoff from impervious surfaces within each complex (DOE 2003b).

Most surface water on the Pajarito Plateau is designated by the New Mexico Water Quality Control Commission for livestock watering, wildlife habitat, and secondary contact. The New Mexico Environment Department (NMED) has identified several impaired stream reaches (including two in Pajarito Canyon), based on evaluation of surface-water sampling from streams within and downstream of LANL (DOE 2008a). Within LANL boundaries, four stream segments are classified as perennial; three of these stream segments are spring-fed (Pajarito Canyon, Cañon de Valle, and Water Canyon), and the fourth (Sandia Canyon) is fed by treated sanitary effluent (LANL 2010b). Surface water within LANL boundaries is not a source of municipal, industrial, or irrigation water; however, wildlife living within (or migrating through) the region utilize the water (DOE 2003b).

While direct use of the surface water within LANL property is limited, stream flow during storm events can extend beyond the LANL boundary, where there is greater potential for more direct use of the water. Stream flows sometimes extend onto Pueblo of San Ildefonso land, particularly flows in Pueblo Canyon derived from treated sanitary effluent discharged from the Los Alamos County Wastewater Treatment Plant. Spring water may be used traditionally and ceremonially by Pueblo of San Ildefonso members, which may result in exposure through ingestion or direct skin contact (LANL 2010b).

Compliance activities performed through the LANL Water Stewardship Program in 2009 to manage and protect surface water resources focused on monitoring surface-water quality and stream sediment in northern New Mexico. Samples are collected at more than 290 sites when sufficient water is present during stormwater runoff events. LANL workers analyze these samples for radionuclides, high explosives, metals, a wide range of organic compounds, and general chemistry (LANL 2010b).

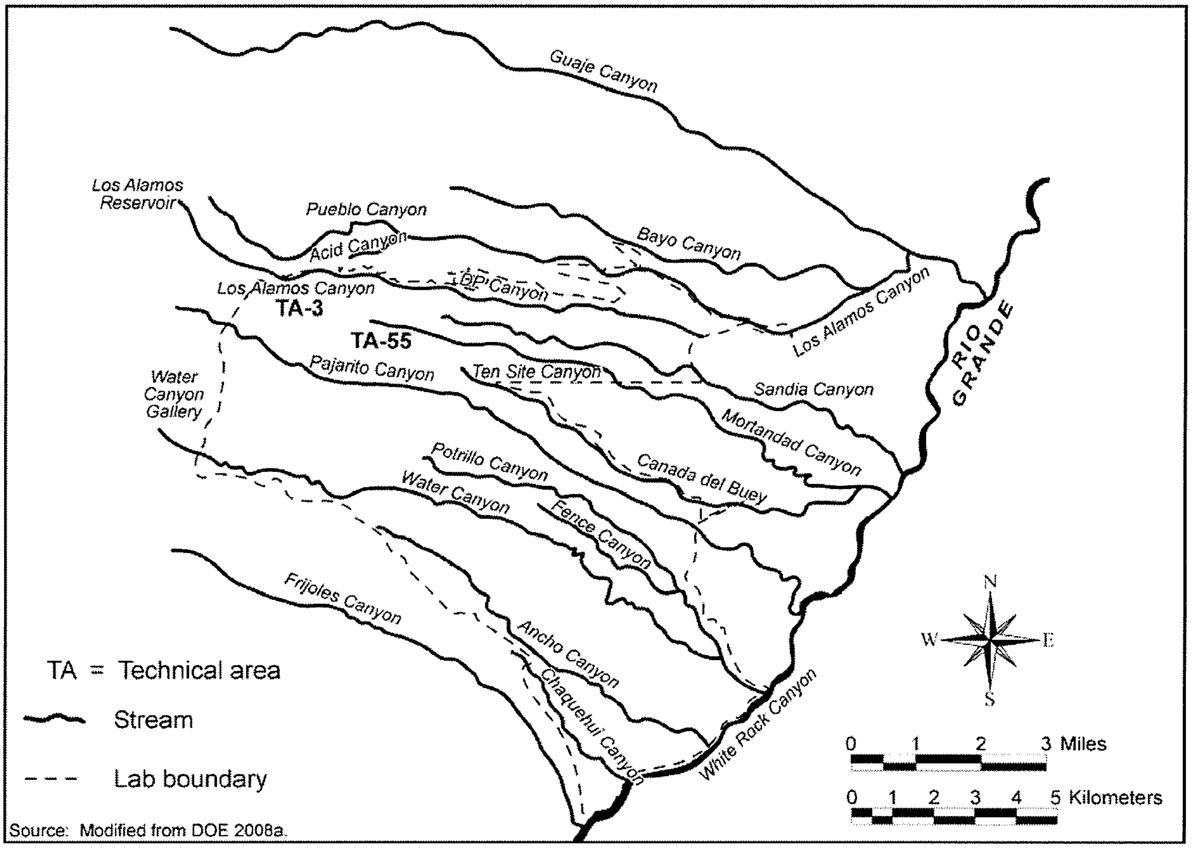


Figure 3–6 Major Watersheds in the Los Alamos National Laboratory Region

In general, the quality of most surface water in the LANL area is good. In more than 100 surface water and sediment samples taken in 2009, most analytes were at concentrations far below regulatory standards and risk-based advisory levels. LANL operations have affected major watersheds in the area, resulting in sediment contamination in several canyons (mainly due to past industrial effluent discharges). However, radionuclide levels are well below applicable regulatory standards and measured sediment contamination levels are well below screening levels for recreational uses (LANL 2010b). Detailed information on surface-water quality monitoring, including analytical results, is presented in the LANL annual site environmental report (LANL 2010b).

NNSA must comply with 10 CFR Part 1022, which identifies DOE requirements for compliance with Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*. Floodplains designated within LANL boundaries are generally associated with watershed canyon drainages and are addressed in the 2008 *LANL SWEIS* (DOE 2008a). There are several facilities and structures located within or partially within 100-year floodplains at LANL, none of these are waste management facilities and most are deemed "low hazard" or "no hazard" (such as small storage buildings, guard stations, well heads, water treatment stations, and some light laboratory[1] buildings) (DOE 2008a). No developed areas of TA-55 or TA-3 are located within a delineated floodplain or a wetland (DOE 2003b). (Wetlands as ecological features are also discussed in Section 3.7.2). The proposed Modified CMRR-NF is located approximately 650 feet (200 meters) from the Twomile Canyon 100-year floodplain, 1,900 feet (580 meters) from the Mortandad Canyon 100-year floodplain, and

[1] *Light laboratory work would involve nonradioactive materials and chemicals as well as very small amounts of radioactive materials. The term is used here to distinguish this work from work requiring Hazard Category 2 and 3 workspace.*

3,000 feet (910 meters) from the Pajarito Canyon 100-year floodplain. In 2009, there were no unusual stormwater runoff events at LANL.

The largest recorded flood in 2009 was measured in Ancho Canyon below SR-4 (stream gauge E275) on July 30, with an estimated peak discharge of 414 cubic feet (12 cubic meters) per second. In 15 years of monitoring at this station, this was the fourth largest recorded event and resulted from a typical short-duration summer thunderstorm. No significant new sediment deposits occurred from this flood. All other runoff events recorded at LANL in 2009 had peak discharges of 60 cubic feet (1.7 cubic meters) per second or less (LANL 2010b).

Section 404 of the Clean Water Act (CWA), which addresses watercourse dredging and fill activities, requires LANL to obtain permits from the U.S. Army Corps of Engineers for any work within perennial, intermittent, or ephemeral watercourses. Section 401 of the CWA requires states to certify that Section 404 permits issued by the Corps of Engineers will not prevent attainment of state-mandated stream standards. During 2009, six Section 404/401 permits were issued to LANL and one Section 404/401 permit was issued to NNSA's Los Alamos Site Office (LANL 2010b).

Since 2008, LANL has operated entirely under the current National Pollutant Discharge Elimination System (NPDES) permit (effective August 1, 2007) for industrial and sanitary wastewater discharges. The NPDES outfall permit establishes specific chemical, physical, and biological criteria that effluent from LANL must meet before it is discharged. During 2009, the NPDES permit for industrial point sources at LANL contained 15 permitted outfalls, covering 1 sanitary outfall and 14 industrial outfalls. The NPDES outfall permit requires weekly, monthly, quarterly, and annual sampling at LANL to validate compliance with effluent quality limits. LANL continues to meet requirements under the CWA. During 2009, none of the 76 samples collected from the Sanitary Wastewater Systems Plant (SWWS) outfall exceeded CWA effluent limits. Only 7 of the 1,361 samples collected from industrial outfalls exceeded effluent limits: 3 chlorine exceedances, 2 pH exceedances, 1 total suspended solids exceedance, and 1 polychlorinated biphenyls exceedance (LANL 2010b). As part of a comprehensive LANL Outfall Reduction Project, the NPDES permitted outfall serving the CMR Building in TA-3 (outfall #03A-021) was closed as of September 2010. All nonradioactive liquid effluent from the CMR Building is now sent to the SWWS Plant. Following field verification by the New Mexico state regulator, a permit modification requesting deletion of the outfall will be made to the EPA.

Stormwater discharges from construction activities disturbing areas 1 or more acres (0.4 or more hectares) in size are regulated under the NPDES Construction General Permit Program. Compliance with the program includes developing and implementing a Storm Water Pollution Prevention Plan (SWPPP) before ground disturbance can begin, as well as conducting site inspections once soil disturbance has commenced. During 2009, LANL maintained and implemented 52 SWPPPs (and addenda) for site construction activities and performed 471 stormwater inspections. The inspection compliance record for Construction General Permit at LANL in 2009 was 99.2 percent for this permit. Furthermore, during the summer, when most high-intensity precipitation events occur, all 467 of the inspections were compliant (LANL 2010b).

The NPDES Industrial Storm Water Permit Program at LANL, covered under the EPA 2008 NPDES Storm Water Multi-Sector General Permit for Industrial Activities (MSGP-2008), regulates stormwater discharges from regulated industrial activities and their associated facilities (such as metal fabrication; hazardous waste treatment, storage, and disposal; landfill operations; vehicle and equipment maintenance; recycling activities; electricity generation; warehousing activities; and asphalt manufacturing). MSGP-2008 requires the development and implementation of site-specific SWPPPs. In 2009, LANL implemented and maintained 15 SWPPPs under MSGP-2008 requirements, covering 19 facilities. Compliance with the permit requirements is mainly achieved by implementing the following activities at these sites:

- Identifying potential contaminants and activities that may impact surface water quality and identifying and providing structural and nonstructural controls to limit the impact of those contaminants;
- Developing and implementing facility-specific SWPPPS; and
- Monitoring stormwater runoff at facility gauging stations and stand-alone samplers for industrial sector-specific benchmark parameters, impaired water constituents, and effluent limitations, and visually inspecting stormwater runoff to assess color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollution (LANL 2010b).

LANL has three principal wastewater treatment facilities—the SWWS Plant in TA-46; the Radioactive Liquid Waste Treatment Facility (RLWTF) in TA-50; and the High Explosives Wastewater Treatment Facility in TA-16. Released treated wastewater from NPDES-permitted outfalls at LANL rarely leaves the site. In 2008, the majority of discharges from LANL came from facilities not tied to operations (such as research, production, or services) and totaled 125.4 million gallons (475 million liters). Two facilities, the TA-46 SWWS Plant and the TA-3 steam plant, accounted for about 73 percent of all water discharged by LANL in 2008 (LANL 2010a). In 2009, 133.3 million gallons (505 million liters) of effluent was discharged to Sandia Canyon from the LANL NPDES-permitted outfalls, with 78 percent of the total discharged attributed almost equally to the TA-46 SWWS Plant and TA-3 steam plant (LANL 2010b).

3.6.2 Groundwater

Three types of groundwater are present in the LANL region: (1) perched alluvial groundwater in watershed canyon bottom sediments, (2) intermediate-depth zones of perched groundwater (that is, location is controlled by recharge availability and changes in rock permeability), and (3) the regional aquifer beneath the watersheds. In wet canyons, surface water runoff from streams percolates downward through the alluvium until less-permeable layers of tuff impede its progress. Shallow bodies of perched groundwater are maintained within the alluvium unless the downward flow is not impeded by impermeable (or less-permeable) layers of tuff. If not impeded by less permeable layers, surface water eventually reaches the regional aquifer (DOE 2008a).

The Los Alamos area regional aquifer occurs at a depth of approximately 1,200 feet (370 meters) along the Pajarito Plateau's western edge and approximately 600 feet (180 meters) along the plateau's eastern edge. In the central portion of the plateau, the regional aquifer occurs at a depth of approximately 1,000 feet (300 meters). Characterization of the regional aquifer (such as directional movement of water flow, main source of recharge, annual deficit in the groundwater table) can be found in the 2008 *LANL SWEIS*. Shallow perched alluvial groundwater and intermediate-depth perched groundwater is not a source of municipal drinking water in the Los Alamos area. The area of saturation deep below the ground surface that forms the regional groundwater aquifer serves as the only regional aquifer in the area that is capable of providing the public water supply for various customers including LANL, Los Alamos County, Bandelier National Monument, and other consumers located in portions of Santa Fe and Rio Arriba Counties (DOE 2008a).

Compliance activities performed through the Water Stewardship Program at LANL in 2009 to manage and protect groundwater monitoring resources included groundwater monitoring (groundwater sampling to monitor water quality beneath the Pajarito Plateau and the surrounding area), groundwater investigations, and groundwater monitoring well construction. Groundwater monitoring and characterization is performed in compliance with the requirements of Federal and State of New Mexico laws and regulations and DOE Orders. Groundwater samples are collected from wells and springs within or adjacent to LANL and from the nearby Pueblo of San Ildefonso. Detailed information on groundwater monitoring, including analytical results, is presented in the LANL annual site environmental report (LANL 2010b).

Groundwater monitoring beyond LANL boundaries is conducted in locations affected by LANL operations in the past, as well as in areas unaffected by LANL for the purpose of providing baseline data. Since the 1940s, liquid effluent discharge at LANL has affected water quality in the shallow perched alluvial groundwater. Liquid effluent discharge is also the primary means by which LANL contaminants have affected the quality of intermediate-depth perched zones and the regional aquifer. However, due to the separation of the regional aquifer (600 feet to 1,200 feet [180 to 370 meters] below dry rock on the Pajarito Plateau) from contaminated alluvial and intermediate-depth perched groundwater bodies, less contamination reaches the regional aquifer than is found in the shallow perched groundwater and impacts on the regional aquifer are either reduced or do not occur (LANL 2010b).

Four canyons (Sandia, Water [and its tributary Cañon de Valle], Mortandad, and Los Alamos) continue to receive LANL effluent discharges, although total effluent discharges to the canyons from LANL decreased by approximately 37 percent over the last 6 years (DOE 2008a). As described in Section 3.6.1, Sandia Canyon receives the largest liquid discharge volumes of any watershed canyon due to releases of power plant cooling water and water from the SWWS Plant. Sandia Canyon has a small drainage area that heads at TA-3. Treated effluents from the TA-46 SWWS Plant have been routed to Sandia Canyon since 1992. Past discharges have included accidental releases from experimental reactors and laboratories at TA-46. In the past, LANL also released wastewater into Water Canyon and Cañon de Valle from several high-explosives processing sites in TA-16 and TA-9 (LANL 2010b).

Mortandad Canyon also has a small drainage area that heads at TA-3, receiving inflow from natural precipitation and several NPDES-permitted outfalls, including one from RLWTF at TA-50. Intermediate-depth groundwater sampling in Mortandad Canyon indicates an impact by LANL effluents, with some contaminant concentrations near or exceeding regulatory standards or screening levels (LANL 2010b). Radionuclide levels in Mortandad Canyon alluvial groundwater are, in general, highest just below the RLWTF outfall in TA-50 and decrease down the canyon. Los Alamos Canyon receives stormwater runoff from LANL as well as discharge of effluent from LANL operations. Alluvial and intermediate-depth groundwater in Los Alamos Canyon indicates effects of past effluent releases from LANL. DOE has removed contaminated sediment in the canyon that was known to contain radionuclides from past LANL operations (DOE 2008a).

Drinking water wells in the Los Alamos area have not been affected by LANL discharges, with one exception. Perchlorate was found in Well O-1 in Pueblo Canyon during 2009 at concentrations up to 58 percent of the 4 micrograms per liter 2005 Consent Order[2] screening level and 16 percent of EPA's interim health advisory for perchlorate in drinking water of 15 micrograms per liter. Although perchlorate levels are below regulatory limits, Los Alamos County does not use the well for public water supply. In 2009, no radioactive analyte concentration values in a water supply well exceeded any regulatory standard, including the 4-millirem per year DOE Derived Concentration Guide applicable to drinking water (LANL 2010b). All drinking water produced by the Los Alamos County water supply system meets Federal and state drinking water standards.

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[2] In March 2005, the New Mexico Environment Department, DOE, and the LANL management and operating contractor entered into a Compliance Order on Consent (Consent Order) (NMED 2005). The purposes of the Consent Order are (1) to define the nature and extent of releases of contaminants at, or from, LANL; (2) to identify and evaluate, where needed, alternatives for corrective measures to clean up contaminants in the environment and prevent or mitigate the migration of contaminants at, or from, LANL; and (3) to implement such corrective measures.

In 2009, alluvial groundwater sampling of several wells along Pajarito Road indicated high chloride and total dissolved solids concentrations. Runoff related to winter road salting (resulting in an increase in chloride, sodium, and total dissolved solids levels) is the apparent cause (LANL 2010b).

3.7 Ecological Resources

3.7.1 Terrestrial Resources

LANL is located in a region of diverse landform, elevation, and climate. The combination of these features, including past and present human use, has given rise to correspondingly diverse, and often unique, biological communities and ecological relationships at LANL and the region as a whole.

LANL contains diverse ecosystems due partly to changes in elevation, temperature, and moisture along the approximately 12-mile- (19-kilometer-) wide, 5,000-foot (1,520-meter) elevational gradient from the peaks of the Jemez Mountains to the Rio Grande. Approximately 20 percent of the site has been developed (LANL 2011). The remaining land has been classified under five vegetation zones, including: Juniper (*Juniperus monosperma* [Engelm.] Sarg.) Savannas; Pinyon (*Pinus edulis* Engelm.)–Juniper Woodlands; Grasslands; Ponderosa Pine (*Pinus ponderosa* P. & C. Lawson) Forests; and Mixed Conifer Forests composed of Douglas fir (*Pseudotsuga menziesii* (Mimel) Franco), ponderosa pine, and white fir (*Abies concolor* (Gord. & Glend.) Lindl. ex Hildebr.) (**Figure 3–7**). This diversity in vegetation communities is reflected by the presence of over 900 species of vascular plants (DOE 2003b, 2008a).

Terrestrial animals associated with vegetation zones in the LANL area include 57 species of mammals, 200 species of birds, 28 species of reptiles, and 9 species of amphibians, and over 1,200 species of arthropods (DOE 2008a). Common animals found on LANL include the black-headed grosbeak (*Pheuclicus melanocephalus*), western bluebird (*Sialia mexicana*), elk (*Cervus elaphus*), and raccoon (*Procyon lotor*). Numerous raptors, such as the red-tailed hawk (*Buteo jamaicensis*) and great-horned owl (*Bubo virginianus*), and carnivores, such as the black bear (*Ursus americanus*) and bobcat (*Lynx rufus*), are also found on LANL. A variety of migratory birds recorded at the site are protected under the Migratory Bird Treaty Act (DOE 2003b).

Impacts on site terrestrial resources have resulted from construction of new facilities, the Cerro Grande Fire, a bark beetle outbreak, and a period of severe drought (DOE 2008a). In 2000, the Cerro Grande Fire burned 43,150 acres (17,460 hectares), including 7,684 acres (3,110 hectares) of forest area within LANL, dramatically altering the habitat of many animals. Starting in 1997, forests around LANL have been thinned to reduce future wildfire potential (DOE 2008a). Between 2008 and 2010, 955 acres (386 hectares) of forest have been thinned under a LANL Wildfire Mitigation Plan; an additional 397 acres (161 hectares) will be thinned in 2011 (LANL 2010f, 2011). Thinning creates a forest that appears more park-like and has increased the diversity of shrubs, herbs, and grasses in the understory (Loftin 2001).

Within 2 years of the Cerro Grande Fire, a bark beetle outbreak occurred that contributed to high mortality of pinyon, ponderosa pine, and Douglas fir trees. While at least partially the result of the fire, the bark beetle outbreak appears to be more a consequence of stress resulting from drought conditions (DOE 2008a).

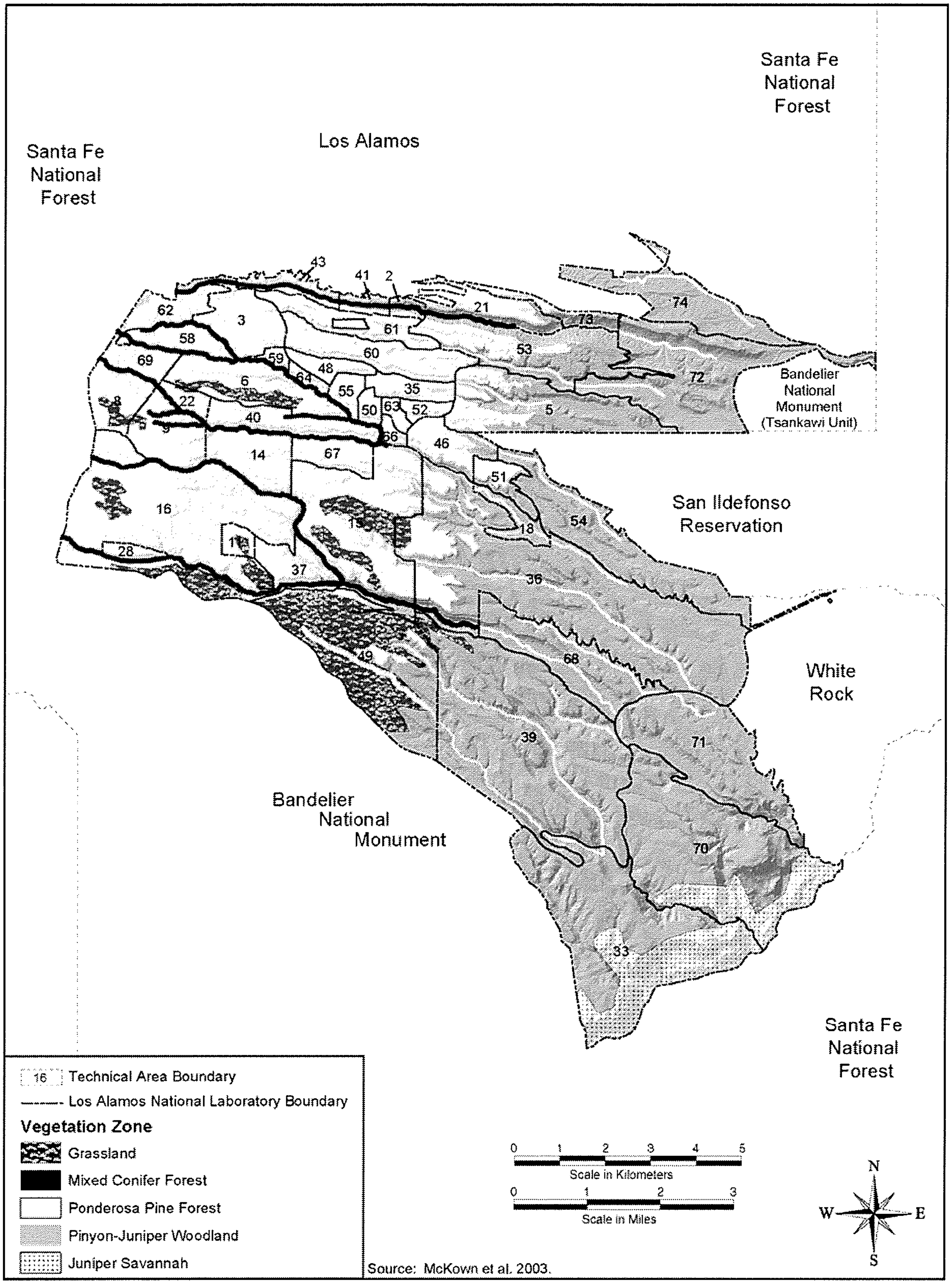


Figure 3–7 Los Alamos National Laboratory Vegetation Zones

Table 3–10 identifies the vegetation zones encompassed by the TAs potentially affected by the proposed action or alternatives. The table also presents the acreage of wetlands occurring within these TAs, discussed in the following section.

Table 3–10 Terrestrial Resources of Technical Areas of Concern

Technical Area	*Vegetation Zone*	*Wetlands (acres)*
3	Ponderosa Pine Forest, Mixed Conifer Forest	0.13
5	Ponderosa Pine Forest, Pinyon–Juniper Woodland	0
36	Pinyon–Juniper Woodland, Ponderosa Pine Forest; Grassland	15.23
46	Ponderosa Pine Forest, Pinyon–Juniper Woodland	0
48	Ponderosa Pine Forest	1.11
50	Ponderosa Pine Forest, Mixed Conifer Forest	0
51	Ponderosa Pine Forest, Pinyon–Juniper Woodland	0
52	Ponderosa Pine Forest	0
54	Pinyon–Juniper Woodland, Ponderosa Pine Forest	0
55	Ponderosa Pine Forest, Mixed Conifer Forest	1.19
63	Ponderosa Pine Forest	0
64	Ponderosa Pine Forest, Mixed Conifer Forest	0
72	Pinyon–Juniper Woodland, Ponderosa Pine Forest	0

Note: To convert acres to hectares, multiply by 0.40469.
Source: ACE 2005; McKown et al. 2003.

3.7.2 Wetlands

Wetlands in the LANL region provide habitat for reptiles, amphibians, and invertebrates (e.g., insects), and potentially contribute to the overall habitat requirements of a number of federally and state-listed species. A majority of the wetlands in the area is associated with canyon stream channels or are present on mountains or mesas as isolated meadows, often in association with springs, seeps, or effluent outfalls. Cochiti Lake and the area near the LANL Fenton Hill site (TA-57) support lake-associated wetlands. There are also some springs within White Rock Canyon that support wetlands (DOE 2008a).

Approximately 34 acres (14 hectares) of wetlands have been identified within LANL boundaries, with 45 percent of these located in Pajarito Canyon. Of these wetlands, 13 acres (5 hectares) were created or enhanced by process effluent wastewater from NPDES-permitted outfalls. This total has most likely been reduced due in part to closure or rerouting of the outfall sources. Dominant wetland plants found in site wetlands include reed canarygrass (*Phalaris arundinacea* L.), narrowleaf cattail (*Typha angustifolia* L.), coyote willow (*Salix exigua* Nutt.), Baltic rush (*Juncus balticus* Willd.), wooly sedge (*Carex pellita* Muhl. ex Willd.), American speedwell (*Veronica americana* Schwein. ex Benth.), common spike rush (*Eleocharis palustris* (L.) Roem. & Schult.), and curly dock (*Rumex crispus* L.) (ACE 2005).

During the Cerro Grande Fire, 16 acres (6 hectares), or 20 percent of the wetlands occurring at LANL, were burned at a low or moderate intensity. Increased sedimentation as a secondary effect from the fire to wetlands also occurred as a result of increased stormwater runoff due to the loss of vegetation (DOE 2008a).

Thirty separate wetlands occupy portions of 14 TAs within LANL. This includes two in TA-3, nine in TA-36, four in TA-48, and one in TA-55 (see Table 3–10). The wetlands in TA-3, which total 0.13 acres (0.05 hectares), lie within Sandia Canyon where three NPDES-permitted outfalls discharge effluent to upper Sandia Canyon (NNSA 2010b). Vegetation associated with these wetlands includes rush

(*Juncus* spp.), willow (*Salix* sp.), and broadleaf cattail (*Typha latifolia* L.). The nine wetlands located in TA-36 total 15.23 acres (6.16 hectares) and are located along Pajarito Canyon. Plants found within these wetlands include coyote willow, Baltic rush, sedges, common spike rush, American speedwell, and cattail. Three of the four wetlands in TA-48 are located between TA-48 and TA-60 in Mortandad Canyon. These wetlands, which total about 1.11 acres (0.45 hectares), are characterized by coyote willow, Baltic rush, cattail, and wooly sedge. The fourth wetland in TA-48, which is smaller than 0.1 acres (0.04 hectares), is located between TA-48 and TA-55 and is dominated by cattail. The wetland within TA-55 is within a branch of Mortandad Canyon between TA-55 and TA-48; it covers 1.19 acres (0.48 hectares). This wetland is also dominated by cattails (ACE 2005; DOE 2003b, 2008a). No wetlands have been identified in other TAs of concern.

3.7.3 Aquatic Resources

The Rito de Los Frijoles in Bandelier National Monument (located to the south of LANL) and the Rio Grande are the only truly perennial streams in the LANL region; however, several of the canyon floors within LANL contain reaches of perennial surface water. Some perennial streams occur in lower Pajarito and Ancho Canyons, which flow to the Rio Grande. Surface water flow occurs in canyon bottoms seasonally or intermittently as a result of spring snowmelt and summer rain. A few short sections of riparian vegetation of cottonwood (*Populus deltoides* Bartr. ex. Marsh, ssp. *wislizeni*, [S. Wats.] Eckenwalder), willow, and other wetland plants are present in scattered locations at LANL, as well as along the Rio Grande in White Rock Canyon. The springs and streams at LANL do not support fish populations; however, many other animal species utilize these waters. For example, terrestrial wildlife use onsite streams for drinking and associated riparian habitat for nesting and feeding (DOE 2003b).

No ponds or permanent streams are identified in any of the TAs of concern; therefore, aquatic habitat is minimal and associated with ponding within wetland areas (LANL 2011). As explained in Section 3.7.2, wetlands are present at TA-3 within Sandia Canyon, TA-36 within Pajarito Canyon, and TA-48 and TA-55 within Mortandad Canyon.

3.7.4 Threatened and Endangered Species

The presence of, and use of LANL by, protected and sensitive species is influenced not only by the actual presence and operation of the facility, but by management of contiguous lands and resources, and by years of human use. A number of federally and state-protected and sensitive (rare or declining) species have been documented in the LANL region. **Table 3–11** provides a list of Federal and state threatened and endangered (and other special status) species occurring or possibly occurring on LANL. LANL contains potential habitat for two federally endangered species (Southwestern willow flycatcher, *Empidonax traillii extimus*, and black-footed ferret, *Mustela nigripes*), one federally threatened species (Mexican spotted owl, *Strix occidentalis lucida*), and three candidate species (Jamez Mountains salamander, *Plethodon neomexicanus*, yellow-billed cuckoo, *Coccyzus americanus*, and New Mexico meadow jumping mouse, *Zapus hudsonius luteus*).

There is no evidence that the Cerro Grande Fire caused a long-term change in the overall number of federally listed threatened or endangered species inhabiting the region within LANL. The species of greatest concern at LANL is the Mexican spotted owl. Individual Mexican spotted owls were seen within weeks of the fire and in all subsequent breeding seasons at LANL; however, there was no recorded Mexican spotted owl breeding after the 2000 Cerro Grande Fire until 2005 when a nested pair was again observed within the LANL boundaries. Some state-listed species, including the Jemez Mountain salamander, have undoubtedly been less fortunate and recovery of the species to pre-fire levels may take a long time (DOE 2008a).

Table 3–11 Threatened and Endangered and Other Sensitive Species of Los Alamos National Laboratory

Common Name	*Scientific Name*	*Federal Status* [a]	*State Status* [b]	*Potential to Occur* [c]
Mammals				
Big Free-tailed Bat	*Nyctinomops macrotis*	SOC	S	High
Black-footed Ferret	*Mustela nigripes*	FE	–	Low
Fringed Bat	*Myotis thysanodes*	–	S	High
Goat Peak Pika	*Ochotona princeps nigrescens*	SOC	S	Low
Long-eared Bat	*Myotis evotis*	–	S	High
Long-legged Bat	*Myotis volans interior*	–	S	High
New Mexico Meadow Jumping Mouse	*Zapus hudsonius luteus*	C	SE	Moderate
Red Fox	*Vulpes vulpes*	–	S	Moderate
Ringtail	*Bassariscus astutus*	–	S	High
Spotted Bat	*Euderma maculatum*	SOC	ST	High
Townsend's Pale Big-eared Bat	*Corynorhinus townsendii pallescens*	SOC	S	High
Western Small-footed Myotis Bat	*Myotis ciliolabrum melanorhinus*	SOC	S	High
Yuma Bat	*Myotis yumanensis*	SOC	S	High
Birds				
American Peregrine Falcon	*Falco peregrinus anatum*	D	ST	High
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	D	ST	Moderate
Bald Eagle	*Haliaeetus leucocephalus*	D	ST	High
Broad-billed Hummingbird	*Cyanthus latirostris magicus*	–	ST	Low
Gray Vireo	*Vireo vicinior*	SOC	ST	Moderate
Loggerhead Shrike	*Lanius ludovicianus*	SOC	S	High
Mexican Spotted Owl	*Strix occidentalis lucida*	FT	ST	High
Northern Goshawk	*Accipiter gentilis*	–	S	High
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	FE	SE	High
White-faced Ibis	*Plegadis chihi*	SOC	–	Moderate
Yellow-billed Cuckoo	*Coccyzus americanus*	C	S	Moderate
Fish				
Rio Grande Chub	*Gila Pandora*	–	S	Moderate
Amphibians				
Jemez Mountains Salamander	*Plethodon neomexicanus*	C	SE	High
Insects				
New Mexico Silverspot Butterfly	*Speyeria nokomis nitocris*	SOC	–	Moderate
Plants				
Greater Yellow Lady's Slipper	*Cypripedium calceolus var. pubescens*	–	SE	Moderate
Wood Lily	*Lilium philadelphicum var. anadinum*	–	SE	High

[a] *Federal Status*

FE = Federally Endangered; in danger of extinction throughout all or a significant portion of its range.

FT = Federally Threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

C = Candidate; substantial information exists in the U.S. Fish and Wildlife Service files on biological vulnerability to support proposals to list as endangered or threatened.

SOC = Species of Concern; conservation standing is of concern, but status information is still needed and the species does not receive recognition under the Endangered Species Act.

D = Federally delisted due to recovery, currently monitored.

[b] *State Status*

SE = State Endangered

Animal: any species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.

Plant: a taxon listed as threatened or endangered under provision of the Federal Endangered Species Act, or is considered proposed under the tenets of the Act, or is a rare plant across its range within the State, and of such limited distribution and population size that unregulated taking could adversely impact it and jeopardize its survival in Mexico.

Table 3–11 Threatened and Endangered and Other Sensitive Species of Los Alamos National Laboratory (continued)

ST = State Threatened
Animal: any species or subspecies that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico.
Plant: New Mexico does not list plants as threatened.
S = Sensitive; those taxa that, in the opinion of a qualified New Mexico Department of Game and Fish biologist, deserve special consideration in management and planning, and are not listed as threatened or endangered by the State of New Mexico.
[c] *Potential Occurrence*
Low = No known habitat exists on LANL.
Moderate = Habitat exists, though the species has not been recorded recently.
High = Habitat exists and the species is recorded to occur at LANL.
Source: DOE 2008a; LANL 2000a, 2011; USFWS 2010.

Habitat that is either occupied by federally protected species or potentially suitable for use by these species in the future has been delineated within LANL and is protected by the *Threatened and Endangered Species Habitat Management Plan* (LANL 2000a). Site plans and monitoring plans for federally listed threatened and endangered species that occur or may occur within LANL are defined in the Habitat Management Plan and designed to provide a balance of current operations and future development needs of LANL with the habitat requirements of the threatened and endangered species. The Habitat Management Plan also facilitates DOE compliance with the Endangered Species Act and related Federal regulations. Each site plan within the Habitat Management Plan identifies areas of environmental interest (AEIs) for various federally listed threatened or endangered species. In general, an AEI consists of a core area that contains potential important breeding or wintering habitat for a specific species and a buffer area around the core area. The buffer protects the core area from disturbances that would degrade its value. The Habitat Management Plan defines the types and levels of activities that may be conducted within these areas. AEIs have been established for the Mexican spotted owl and southwestern willow flycatcher (LANL 2000a, 2011). AEIs have not been established for any other federally protected animal species at LANL, as suitable habitat for these species either does not occur at LANL or the species have never been recorded to be present in the LANL area (DOE 2003b).

Annual surveys of the Mexican spotted owl have been conducted on LANL since 1993. In 1995, a pair of Mexican spotted owls and their nest was observed on LANL property. Since then, the nesting territory has been occupied and young have fledged in multiple years. In 2007, a second pair of Mexican spotted owls and their nest was observed and has also produced young. Annual surveys are done for the Mexican spotted owl, the southwestern willow flycatcher, and the black-footed ferret. Only the Mexican spotted owl has been observed during those surveys. Although willow flycatchers have been observed at one location on LANL during migratory season surveys, it has not been possible to confirm the presence of the southwestern subspecies. Management of AEIs and mitigation measures for proposed projects result in part from these surveys (LANL 2011).

The Sandia–Mortandad Canyon Mexican Spotted Owl AEI, located in Sandia and Mortandad Canyons, encompasses a number of the TAs of concern. This AEI overlaps with both the Pajarito Canyon and Los Alamos Canyon Mexican Spotted Owl AEIs. Specifically, parts of TAs-3, -5, -36, -46, -48, -50, -52, -55, -63, and -64 are within the core and/or buffer zones of the Sandia–Mortandad Canyon, Pajarito Canyon, and/or Los Alamos Canyon Mexican Spotted Owl AEIs. The Three-Mile Canyon Mexican Spotted Owl AEI affects a small section of TA-51 within the buffer zone and a northern part of TA-36 within the core and buffer zones. A southern portion of TA-36 is also within the core and buffer zones of the Cañon de Valle Mexican Spotted Owl AEI (LANL 2000a). Other TAs of concern, such as TA-54 and TA-72, do not fall within any Mexican Spotted Owl AEIs. Also, no portion of any of these TAs is within an AEI for the bald eagle and the southwestern willow flycatcher AEI falls completely within TA-36.

3.8 Cultural and Paleontological Resources

Cultural resources are human imprints on the landscape that are defined and protected by a series of Federal laws, regulations, and guidelines and include archaeological resources, historic buildings and structures, and traditional cultural properties. To fully meet the requirements of these laws, regulations, and guidelines, DOE is implementing *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (LANL 2006a). Implementation of this plan involves a Programmatic Agreement between DOE, the Advisory Council on Historic Preservation, and the New Mexico State Historic Preservation Office (DOE 2006). By carrying out the terms of the agreement, DOE will fulfill its responsibilities under Section 106 of the National Historic Preservation Act. Paleontological resources, the physical remains, impressions, or traces of plants or animals from a former geologic age, are also addressed in this section.

3.8.1 Archaeological Resources

As of 2010, archaeological surveys have been conducted on over 88 percent of the land within LANL boundaries. A total of 1,890 archaeological resource sites currently exist on the site, of these, most are prehistoric sites related to the Archaic and Ancestral Pueblo Cultures (DOE 2008a).

Following the Cerro Grande Fire, surveys identified 333 archaeological resource sites that were affected by that fire. Of these sites, 269 were damaged by the fire, 35 by suppression activities, and 29 by rehabilitation activities. Damage included direct loss, soot staining, spalling, and cracking of stone masonry walls of Ancestral Pueblo field houses and room blocks, and exposure of artifacts from erosion. Additionally, the fire, as well as prior and subsequent tree thinning measures taken to reduce wildfire hazard, resulted in the discovery of 447 new archaeological sites at LANL (DOE 2008a).

The conveyance and transfer of land has resulted in the removal of some archaeological sites from DOE protection. However, in some cases, archaeological protection easements have been used to provide continued protection for many of these sites (DOE 2008a). Sites located on lands to be conveyed to Los Alamos County for economic development were excavated and therefore mitigated under the Programmatic Agreement (DOE 1999c; LANL 2008b).

Table 3–12 provides a summary of the number of prehistoric and historic sites present within the TAs of concern that are eligible or potentially eligible for listing on the National Register of Historic Places (NRHP) and the types of archaeological sites present.

3.8.2 Historic Buildings and Structures

In terms of the historic built environment, there are 440 buildings and structures that date to the Manhattan Project and early Cold War, of which 21 date back to the Manhattan Project. A total of 335 of these 440 buildings and structures have been evaluated for eligibility for inclusion in the NRHP, of which 160 have been determined eligible and 165 ineligible. Among those buildings deemed eligible is the CMR Building in TA-3 which is important due to its association with important events during the Cold War years and its architectural and engineering significance (Garcia, McGehee, and Masse 2009). These figures include a small number of structures younger than 50 years in age that are likely to be deemed of exceptional national significance and are thus eligible for inclusion in the NRHP despite not yet having achieved the 50-year age limit normally required for inclusion (DOE 2008a).

Table 3–12 Archaeological Sites Present within the Technical Areas of Concern

Technical Area	*Eligible and Potentially Archaeological Sites* [a]	*Archaeological Site Types*
3	6	Cultural management unit, historic other, lithic scatter, trail and/or stair
5	60	Lithic and ceramic scatter, game pit, complex pueblo, cavate, 1- to 3-room structure, historic structure, lithic scatter, rock art, wagon road, pueblo roomblock, trail and/or stair, water control
36	402	Lithic and ceramic scatter, game pit, complex pueblo, cavate, 1- to 3-room structure, Garden plot, lithic scatter, prehistoric other, rock art, wagon road, rock/wood enclosure, rock feature, rock ring, rock shelter, pueblo roomblock, trail and/or stair, water control
46	12	Lithic and ceramic scatter, cavate, 1- to 3-room structure, lithic scatter, pueblo roomblock
48	2	1- to 3-room structure, historic structure
50	0	
51	26	Lithic and ceramic scatter, cavate, 1- to 3-room structure, lithic scatter, wagon road, rock feature, rock shelter, pueblo roomblock
52	6	Cavate, rock shelter
54	97	Lithic and ceramic scatter, complex pueblo, cavate, 1- to 3-room structure, garden plot, historic artifact scatter, lithic scatter, prehistoric other, rock art, wagon road, rock feature, rock shelter, pueblo roomblock,
55	2	Historic structure, rock shelter
63	0	
64	0	
72	93	Lithic and ceramic scatter, game pit, cultural management unit, complex pueblo, cavate, 1- to 3-room structure, garden plot, historic other, historic structure, lithic scatter, prehistoric other, pit structure, rock art, rock/wood enclosure, rock feature, rock ring, rock shelter, pueblo roomblock, trail and/or stair

[a] Includes sites that have been determined eligible and potentially eligible and those proposed as eligible and potentially eligible.

A number of factors have served to greatly reduce the number of Manhattan Project buildings still extant. These include (1) the expedient initial construction of the original buildings and structures; (2) post-Manhattan Project infrastructure development, particularly during the late 1950s and early 1960s, and again beginning in the late 1990s through the first decade of the twenty-first century; (3) the development of the Los Alamos townsite during the 1950s and 1960s; (4) the Cerro Grande Fire; and (5) contamination of some buildings by asbestos and radioactive isotopes. As of 2003, only 28 Manhattan Project buildings retained sufficient historical and physical integrity for listing on the NRHP, and only a handful are deemed suitable for long-term preservation and interpretation (LANL 2006a).

3.8.3 Traditional Cultural Properties

Within the boundaries of LANL there are ancestral villages, shrines, petroglyphs (carvings or line drawings on rocks), sacred springs, trails, and traditional use areas that could be identified by Pueblo and Hispanic communities as traditional cultural properties. In addition to physical cultural entities, concern has been expressed that "spiritual," "unseen," "undocumentable," or "beingness" aspects may be present at LANL that are an important part of Native American culture. According to the DOE compliance procedure, Native American tribes may request permission for visits to sacred sites within LANL boundaries for ceremonies or other purposes to insure visitor safety and site security (DOE 1999a, 2008a).

When a project is proposed, NNSA arranges site visits with tribal representatives from the San Ildefonso, Santa Clara, Jemez, and Cochiti Pueblos, as appropriate, to solicit their concerns and to comply with applicable requirements and agreements. Provisions for coordination among these four pueblos and DOE are contained in Accords agreements that were entered into beginning in 1992 for the purpose of improving communication and cooperation among Federal and tribal governments (DOE 1999a, 2008a). In accordance with the Accords and as part of its Government-to-Government interactions, twice yearly executive meetings are held among the Los Alamos Site Office Manager, the LANL Director, and the respective Accord Pueblo Governors (or their representatives) of the four Accord Pueblos (Cochiti, San Ildefonso, Jemez, and Santa Clara). In addition, the Los Alamos Site Office Manager meets monthly with each governor of the two pueblos closest to LANL (San Ildefonso and Santa Clara) and with the other Accord Pueblo Governors on a less frequent basis. In both the executive meetings and the monthly meetings, the Los Alamos Site Office Manager discusses current and planned activities taking place at LANL and seeks comment on these activities from the Governors.

A "Comprehensive Plan for the Consideration of Traditional Cultural Properties and Sacred Sites at Los Alamos National Laboratory, New Mexico" was sent by DOE in 2000 to 24 tribes to help complete the traditional cultural properties identification and evaluation process begun during the 1999 *LANL SWEIS* preparation process. Only the Pueblo of San Ildefonso responded with site information; however, DOE continues to consult with various Pueblos to maintain an open dialog. LANL missions are aware of the needs of the Pueblos and are respectful of times when the Pueblos participate in ceremonies and rituals. Various agreements, MOAs, MOUs, and Programmatic agreements are in place with San Ildefonso, Santa Clara and other Pueblos to allow individuals access to areas across LANL (DOE 2008a).

3.8.4 Paleontological Resources

A single paleontological artifact has been discovered at a site formerly within LANL boundaries that has since been conveyed to Los Alamos County; however, in general, the near-surface stratigraphy is not conducive to preserving plant and animal remains. The near-surface materials at LANL are volcanic ash and pumice that were extremely hot when deposited; most carbon-based materials (such as bones or plant remains) would likely have been vaporized or burned if present (DOE 2008a). No paleontological resources have been identified within any of the TAs of concern for the impact analyses across the three alternatives analyzed in this SEIS.

3.9 Socioeconomics

Statistics for the local economy, population, and housing are presented for the ROI, a four-county area in New Mexico made up of Los Alamos, Santa Fe, Sandoval, and Rio Arriba Counties (see Figure 3–1). In 2010 there were 13,474 people employed at LANL. The majority of all LANL employees reside in this four-county area. It is estimated that approximately half of the LANL workforce resides in Los Alamos County (LANL 2011).

3.9.1 Regional Economic Characteristics

Between 2000 and 2009, the civilian labor force in the four-county area increased 14.5 percent, to 164,588 persons. In 2009, the annual unemployment average in the ROI was 6.8 percent, which was less than the annual unemployment average of 7.2 percent for New Mexico (NMDWS 2010a). By November 2010, the unemployment rates in the ROI and the State of New Mexico increased to 7.7 percent and 8.2 percent, respectively (NMDWS 2010b).

In 2009, the total government employment sector (Federal, state, and local) represented the largest employment sector in the four-county area (26.4 percent). This was followed by professional and business services (16.4 percent) and trade, transportation, and utilities (14.4 percent). For comparison, the totals for these employment sectors in New Mexico were 23.9 percent, 13.0 percent, and 17.0 percent, respectively (BLS 2010b).

3.9.2 Population and Housing

From 2000 to 2009, the total population in the ROI increased approximately 19.2 percent, to 332,272 persons. All of the increased population can be attributed to Sandoval and Santa Fe Counties, which experienced an increase of 40.1 and 14.1 percent, to 125,988 and 147,753, respectively. Over this time, the total population of Los Alamos and Rio Arriba Counties decreased to 18,074 (-1.5 percent) and 40,678 (-1.3 percent), respectively (DOC 2010a).

Table 3–13 displays the number of housing units, vacancy rates, and median value for homes in the ROI. From 2000 to 2009, the total number of housing units in the ROI increased by 19.9 percent, to 142,137. Sandoval County accounted for the largest portion of growth, increasing by approximately 16,000 units (45.3 percent). Santa Fe County accounted for the second largest portion of growth, increasing by approximately 7,000 units (12.0 percent). The total number of housing units in Los Alamos and Rio Arriba Counties increased by approximately 640 units (8.1 percent) and 240 units (1.3 percent), respectively (DOC 2010b).

Table 3–13 Housing Units and Vacancy Rates in the Region of Influence

	Los Alamos County	*Rio Arriba County*	*Sandoval County*	*Santa Fe County*	*Region of Influence*
2000 Housing Units [a]	7,937	18,016	34,866	57,701	118,520
2009 Housing Units [a]	8,578	18,255	50,672	64,632	142,137
Percent Change	8.1	1.3	45.3	12.0	19.9
Vacant Units for Sale	99 [b]	216 [c]	1,002 [d]	675 [d]	1,992
Owner-Occupied Units	6,073 [b]	11,594 [c]	34,691 [d]	38,302 [d]	90,660
Homeowner Vacancy Rate (percent)	1.6	1.8	2.8	1.7	2.1
Vacant Units for Rent	207 [b]	267 [c]	799 [d]	1,769 [d]	3,042
Renter-Occupied Units	1,730 [b]	2,716 [c]	9,685 [d]	16,524 [d]	30,655
Renter Vacancy Rate (percent)	10.7	9.0	7.6	9.7	9.0
Median Value	$287,900 [b]	$151,200 [c]	$ 188,700 [d]	$295,000 [d]	Not Available

[a] DOC 2010b.
[b] DOC 2010c.
[c] DOC 2010d.
[d] DOC 2010e.

Data on vacancy rates and home values for the counties within the ROI are taken from the Census Bureau's American Community Survey (ACS). Availability of data for each county is dependent upon the total population thresholds required for inclusion in the ACS 1-year estimates, 3-year estimates, and 5-year estimates. The latest available data is presented for each county to provide the most up to date representation of conditions in the ROI. According to the Census Bureau's 2005-2009 ACS 5-Year Estimates, Los Alamos County had a homeowner vacancy rate of 1.6 percent and a renter vacancy rate of 10.7 percent. The median value of housing units in the county was $287,900 (DOC 2010c). Los Alamos County is currently working on updating the County Comprehensive Plan, the Downtown Los Alamos Comprehensive Plan, and implementation of the White Rock Master Plan, all of which include additional residential development.

According to the Census Bureau's 2007–2009 ACS 3-Year Estimates, the homeowner vacancy rate of Rio Arriba County was 1.8 percent and the renter vacancy rate was 9.0 percent. During this time, the median value of owner occupied housing units in Rio Arriba County was $151,200 (DOC 2010d).

In 2009 the homeowner vacancy rates of Sandoval and Santa Fe Counties were 2.8 and 1.7 percent, respectively. The renter vacancy rates of the two counties were 7.6 and 9.7 percent. During this time, the median value of owner occupied housing units in Sandoval and Santa Fe Counties was $188,700 and $295,000, respectively (DOC 2010e). Using the most recent data available for all four counties, the homeowner and renter vacancy rates of the ROI are estimated to be 2.1 and 9.0 percent, respectively.

3.10 Environmental Justice

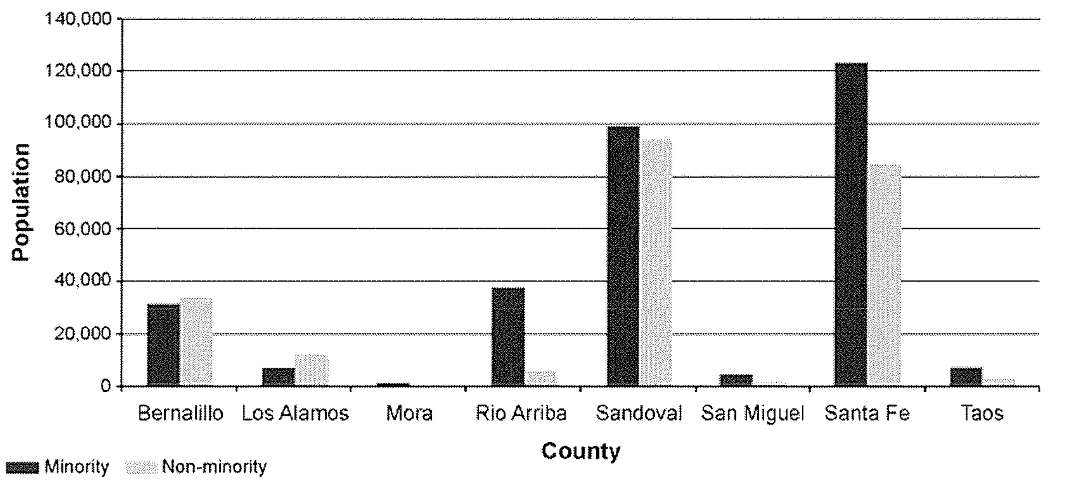
Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. As discussed in Appendix B, minority persons are those who identify themselves as Hispanic or Latino, Asian, Black or African American, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or multi-racial (with at least one race designated as a minority race under CEQ Guidelines (CEQ 1997). Persons whose income is below the Federal poverty threshold are designated as low income.

There are two locations at LANL being considered for operation of CMR activities. These are TA-3, and TA-55 (see Chapter 1, Figure 1–2). The location for the proposed new CMRR-NF Facility at TA-55 is approximately 1.2 miles (1.9 kilometers) southeast of the existing CMR Building.

Populations at risk include persons who live within 50 miles (80 kilometers) of the existing CMR Building or the proposed location for CMRR-NF Facilities at TA-55. There are eight counties included or partially included in the potentially affected areas surrounding these locations: Bernalillo, Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, and Taos. Consistent with the Human Health analysis, populations in the surrounding areas have been projected to the year 2030.

Using data from the 1990 census, 2000 census, and the latest data available for each of the affected counties within a 50-mile (80-kilometer) radius of LANL (Census Bureau 2010), projections of the affected populations were calculated for 2030. **Figure 3–8** shows the minority and non-minority populations by county projected to live within the potentially affected area surrounding the existing CMR Building in 2030. Because the CMRR-NF Facility and CMR Building locations are relatively close to one another, the minority and non-minority populations living in the potentially affected area surrounding the TA-55 site differ from those surrounding the existing CMR Building at TA-3 by approximately 2 percent. Minority populations projected to live within the 50 mile (80 kilometer) radius comprise approximately 57 percent of the total population at risk. This is slightly lower than the projected total minority population for the State of New Mexico of approximately 65 percent. Approximately 74 percent of the total population and 72 percent of the total minority populations at risk reside in Sandoval and Santa Fe Counties.

Figure 3–9 shows cumulative minority populations projected to live within the potentially affected area in 2030 as a function of distance from TA-3, and TA-55. Values along the vertical axis of Figure 3–9 show the minority population residing within a given distance from these technical areas. Moving outward from locations, the cumulative populations increase sharply in the Española, Santa Fe, and Albuquerque areas. Approximately 40 percent of the potentially affected minority population reside in the Santa Fe area. Cumulative minority populations surrounding TA-3 and TA-55 are almost identical as a function of distance from the site.



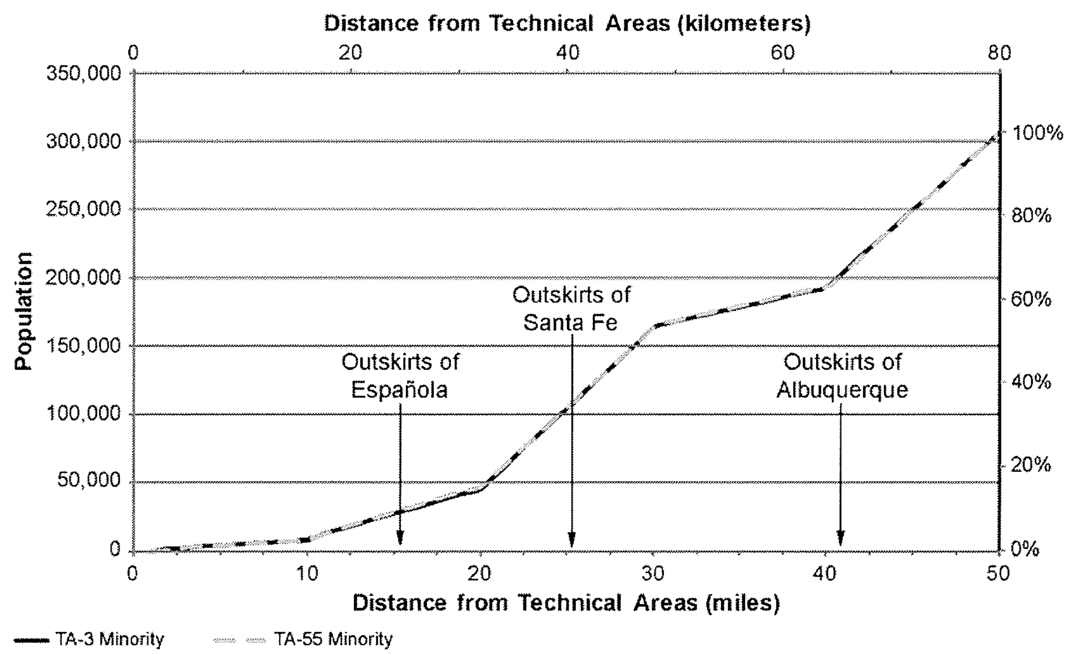
LANL = Los Alamos National Laboratory; TA = technical area.

Notes:

The population residing within 50 miles (80 kilometers) of LANL was projected out to the year 2030 using 1990 Census, 2000 Census, and the latest U.S. Census Bureau data (DOC 1990, 2000, 2010c) for each of the counties included within a 50-mile (80-kilometer) radius of the affected LANL technical areas.

The 2030 projected population residing within 50 miles (80 kilometers) of TA-3 is about 536,000.

Figure 3–8 Minority and Non-minority Populations by County Projected to Live in the Potentially Affected Area in 2030



LANL = Los Alamos National Laboratory; TA = technical area.

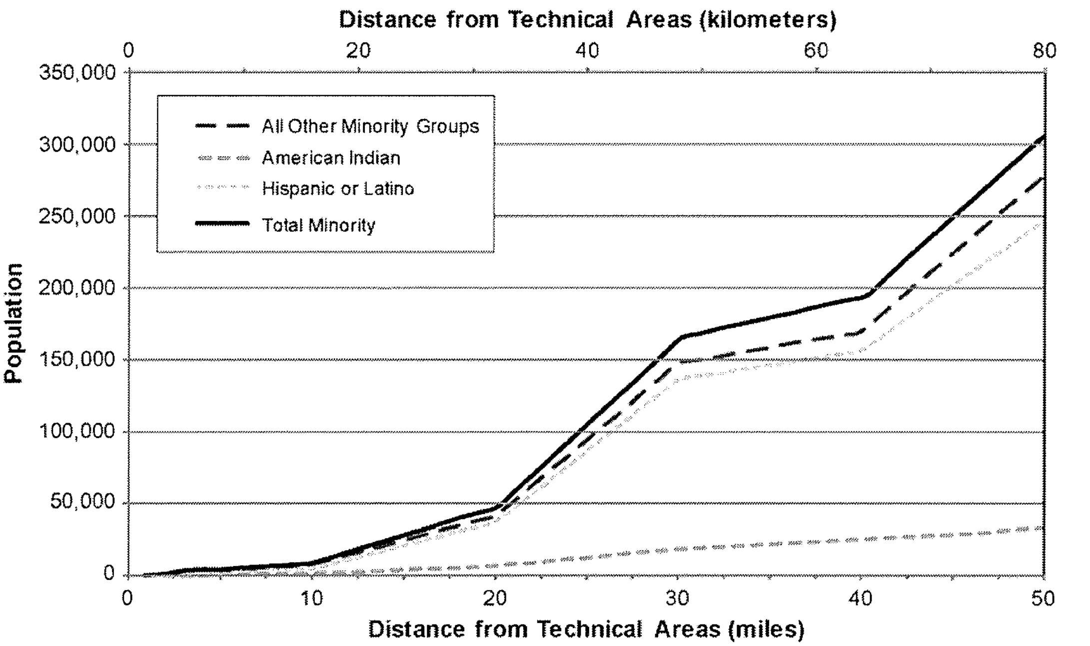
Notes:

The population residing within 50 miles (80 kilometers) of LANL was projected out to the year 2030 using 1990 Census, 2000 Census, and the latest U.S. Census Bureau data (DOC 1990, 2000, 2010c) for each of the counties included within a 50-mile (80-kilometer) radius of the affected LANL technical areas.

The 2030 projected population residing within 50 miles (80 kilometers) of TA-3 is about 536,000 while that residing within 50 miles (80 kilometers) of TA-55 is about 545,000.

Figure 3–9 Minority Populations as a Function of Distance from Technical Area 3 and Technical Area 55 in 2030

Figure 3–10 shows the projected composition in 2030 of the potentially affected minority population surrounding TA-55. Approximately 80 percent of the potentially affected minority population is projected to be Hispanic or Latino. Similarly, the Hispanic population is projected to account for approximately 82 percent of the total minority population of the State of New Mexico. The American Indian population is projected to account for approximately 10 percent of the total minority population of the potentially affected area in 2030. Much lower than the projected American Indian population for the State of New Mexico of approximately 16 percent.



LANL = Los Alamos National Laboratory; TA = technical area.

Notes:

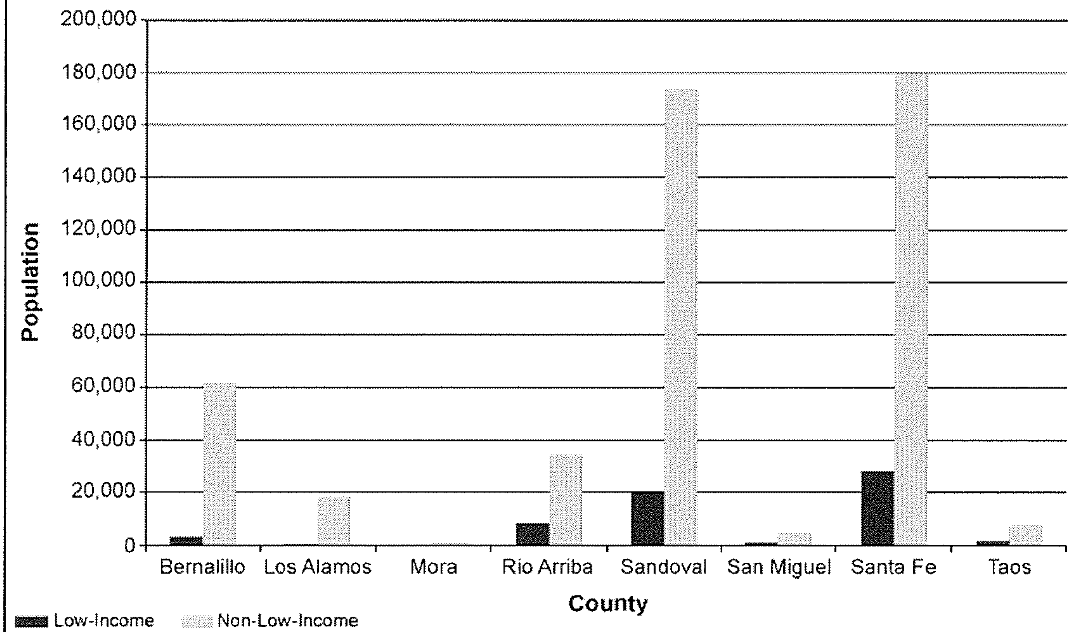
The population residing within 50 miles (80 kilometers) of LANL was projected out to the year 2030 using 1990 Census, 2000 Census, and the latest U.S. Census Bureau data (DOC 1990, 2000, 2010c) for each of the counties included within a 50-mile (80-kilometer) radius of the affected LANL technical areas.

The 2030 projected population residing within 50 miles (80 kilometers) of TA-55 is about 545,000.

Figure 3–10 Minority Populations as a Function of Distance from Technical Area 55 in 2030

Figure 3–11 shows the low-income and non-low-income population by county projected to live within the potentially affected area surrounding the existing CMR Building in 2030. As indicated in the figure, the largest potentially affected low-income populations reside in Sandoval and Santa Fe counties. Approximately 75 percent of the total potentially affected low-income populations reside in these two counties. Low-income persons comprised approximately 11.6 percent of the total potentially affected population.

Figure 3–12 shows the cumulative low-income populations projected to live within the potentially affected area in 2030 as a function of distance from TA-3, and TA-55. The overall shape of these curves is similar to those shown in Figures 3–9 and 3–10 indicating that increases in the cumulative populations occur at the same distances and same rates. Low-income populations surrounding TA-3 and TA-55 are concentrated in the Española, Santa Fe, and Albuquerque areas. Approximately 45 percent of the potentially affected low-income population reside in Santa Fe County.



LANL = Los Alamos National Laboratory; TA = technical area.

Notes:

The population residing within 50 miles (80 kilometers) of LANL was projected out to the year 2030 using 1990 Census, 2000 Census, and the latest U.S. Census Bureau data (DOC 1990, 2000, 2010c) for each of the counties included within a 50-mile (80-kilometer) radius of the affected LANL technical areas.

The 2030 projected population residing within 50 miles (80 kilometers) of TA-3 is about 536,000.

Figure 3–11 Low-Income and Non-Low-Income Populations by County Projected to Live in the Potentially Affected Area in 2030

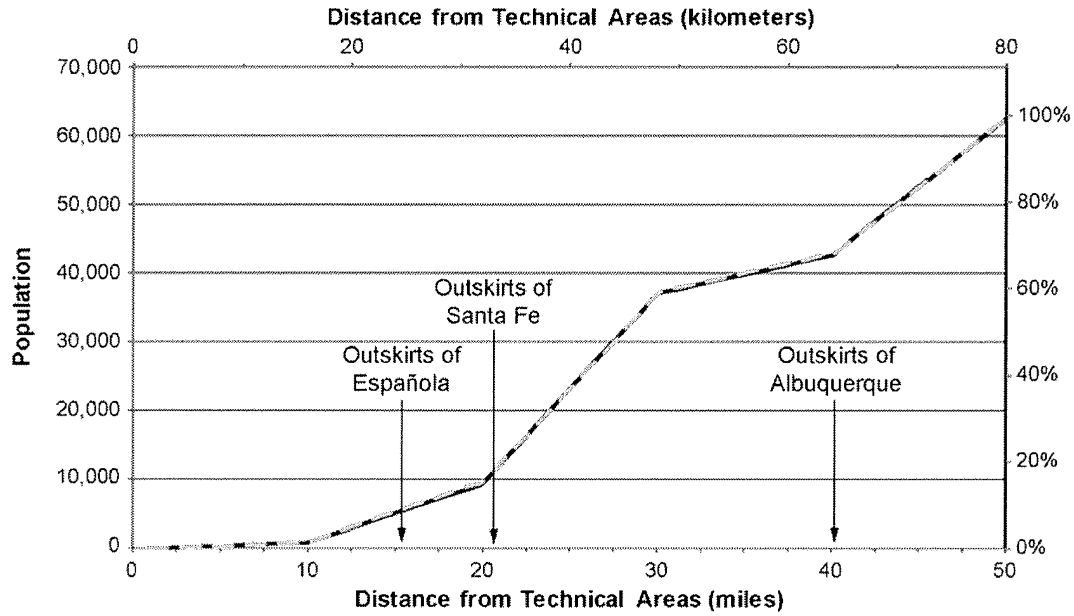
3.11 Human Health

Public and occupational health and safety issues for LANL operations include the determination of potential adverse effects on human health that could result from acute and chronic exposure to ionizing radiation and hazardous chemicals. The following subsections include a discussion of radiation exposure and chemical exposure and the associated human health risks of each.

3.11.1 Radiation Exposure and Risk

Major sources and levels of background radiation exposure to individuals in the vicinity of LANL are shown in **Table 3–14**. Annual background radiation doses to individuals are expected to remain constant over time. Background radiation doses are unrelated to LANL operations.

Normal operational releases of radionuclides to the environment from LANL operations provide another source of radiation exposure to individuals in the vicinity of LANL. Types and quantities of radionuclides released from LANL operations in 2009 are listed in *Environmental Surveillance at Los Alamos During 2009* (LANL 2010b) and are presented in Section 3.4.3.



LANL = Los Alamos National Laboratory; TA = technical area.

Notes:

The population residing within 50 miles (80 kilometers) of LANL was projected out to the year 2030 using 1990 Census, 2000 Census, and the latest U.S. Census Bureau data (DOC 1990, 2000, 2010c) for each of the counties included within a 50-mile (80-kilometer) radius of the affected LANL technical areas.

The 2030 projected population residing within 50 miles (80 kilometers) of TA-3 is about 536,000, while that residing within 50 miles (80 kilometers) of TA-55 is about 545,000.

Figure 3–12 Low-Income Populations as a Function of Distance from Technical Area 3 and Technical Area 55 in 2030

Table 3–14 Sources of Radiation Exposure That Affect Individuals in the Vicinity of Los Alamos National Laboratory But Are Unrelated to Site Operations

Source	*Effective Dose Equivalent (millirem per year) [Los Alamos National Laboratory]*
Natural Background Radiation	
External cosmic [a]	50 to 90 [70]
External terrestrial [b]	50 to 150 [100]
Internal terrestrial and global cosmogenic	40
Radon (in homes)	200-300 [270]
Other Background Radiation	
Diagnostic x-rays and nuclear medicine	300
Weapons test fallout	< 1
Consumer and industrial products	10
Total	650 to 890 [790]

[a] Cosmic radiation doses are lower in the lower elevations and higher in the mountains.

[b] Variation in the external terrestrial dose is a function of the variability in the amount of naturally occurring uranium, thorium, and potassium in the soil.

Source: LANL 2010b.

The annual population dose to the public resulting from these releases is about 0.6 person-rem (LANL 2010b), which corresponds to an average annual individual dose of 0.002 millirem for individuals residing within 50 miles (80 kilometers) of LANL. (The estimated population for this region in 2009 is about 332,272 persons.) This dose to the offsite public is primarily the result of airborne releases from LANSCE operations. Collective annual population doses over the last 16 years from releases at LANL have declined from a high of 4 person-rem in 1999 to less than 1 person-rem in 2009. Future collective annual doses are expected to be less than 1 person-rem. No observable health effects are expected from this dose.

The annual dose from airborne releases to the maximally exposed offsite individual (at East Gate[3]) was calculated to be about 0.6 millirem (LANL 2010b). This dose falls within the radiological limits (individual dose limit of 10 millirem per year from airborne emissions [40 CFR Part 61, Subpart H] and 100 millirem per year from all sources [DOE Order 458.1]) and is much lower than those from background radiation.

Using a risk estimator of 1 latent cancer fatality (LCF) per 1,667 person-rem dose (or 0.0006 LCF per 1 person-rem) (DOE 2003a), the estimated probability of this maximally exposed person developing a latent fatal cancer from radiation exposure associated with 1 year of LANL operations is about 1 in 3 million (3.6×10^{-7}). According to the same risk estimator, 0.00034 excess LCFs are projected in the population living within 50 miles (80 kilometers) of LANL from 1 year of normal LANL operations. To place this number in perspective, it may be compared with the number of fatal cancers expected in the same population from all causes. The mortality rate associated with cancer for the entire U.S. population is 0.2 percent per year. Based on this mortality rate, the number of fatal cancers to be expected during 2009 from *all causes* in the population of about 332,272 living within 50 miles (80 kilometers) of LANL would be 665, much higher than the 0.00034 LCFs resulting from total LANL operations that was estimated in 2009 (LANL 2010b).

LANL workers receive the same dose as the general public from background radiation, but they also receive an additional dose from working in facilities with nuclear materials. The average dose to the individual worker and the cumulative dose to all workers at LANL from operations in 2009 are presented in **Table 3–15**. These doses fall within the radiological limits established by 10 CFR Part 835. Using a risk estimator of 1 LCF per 1,667 person-rem among workers (0.0006 LCF per person-rem) and a total dose to workers of 116 person-rem, the number of estimated LCFs among LANL workers from normal operations in 2009 is 0.070.

In 2009, the average onsite concentrations in air of plutonium-239, gross alpha, and gross beta radiation on the LANL site were measured to be 1×10^{-18} curies per cubic meter, 7×10^{-16} curies per cubic meter, and 1.7×10^{-14} curies per cubic meter, respectively. The concentrations of plutonium-239, gross alpha and gross beta radiation were about the same as those measured regionally (see Table 3–8). No specific measurements were reported for the TAs, but the concentrations are expected to be similar to the average site values.

[3] *The individual at this location would receive the maximum dose from all releases at LANL.*

Table 3–15 Radiation Doses to Workers from Normal Los Alamos National Laboratory Operations in 2009 (total effective dose equivalent)

Occupational Personnel	*Onsite Releases and Direct Radiation*	
	Standard	*Actual*
Average radiation worker (millirem)	(a)	83
Total workers (person-rem) [b]	None	1,116

[a] The radiological limit for an individual worker is 5,000 millirem per year (10 CFR Part 835). However, DOE's goal is to maintain radiological exposure as low as reasonably achievable. Therefore, DOE has recommended an administrative control level of 500 millirem per year (DOE 1999b); the site must make reasonable attempts to maintain individual worker doses below this level.
[b] There were 1,392 workers with measurable doses in 2009.
Source: DOE 2010a.

3.11.2 Chemical Environment

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (such as soil through direct contact or via the food pathway).

Adverse health impacts on the public are minimized through administrative and design controls to decrease hazardous chemical releases to the environment and to achieve compliance with permit requirements. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts on the public could occur during normal operations at LANL via inhalation of air containing hazardous chemicals released to the atmosphere by LANL operations. Other potential pathways that pose risks to public health include ingestion of contaminated drinking water or direct exposure.

Baseline air emission concentrations for air pollutants and their applicable standards are presented in Section 3.4.2. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are compared with applicable guidelines and regulations.

Chemical exposure pathways to LANL workers during normal operations could include inhaling the workplace atmosphere, drinking LANL potable water, and possible other contact with hazardous materials associated with work assignments. Workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. LANL workers are also protected by adherence to the Occupational Safety and Health Administration and EPA occupational standards that limit atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring, which reflects the frequency and amounts of chemicals used in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at LANL are substantially better than required by standards.

3.11.3 Industrial Safety

Work-related accidents in terms of total recordable cases, injuries, and deaths from normal activities (facility operation, construction, disposition) are evaluated using historical accidents databases for LANL. Two categories of industrial safety impacts are represented: (1) total recordable cases and (2) days away, restricted, and transfer cases. Total recordable cases include work-related death, illness, or injury that results in loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment beyond first aid. A fatal occurrence is a work-related injury or illness that causes the death of the employee.

Table 3–16 summarizes occupational injury and illness rates at LANL over the last 3 years and the average rates evaluated in 2008 *LANL SWEIS* for the years 1999 through 2005. These rates correlate to reportable injuries and illnesses during the year for 200,000 hours worked or roughly 100 worker-years. Analysis of NNSA's injury and illness performance at LANL shows significant improvement over the last 3 years. This has been influenced by a decrease in some types of injuries that have been historically high, such as repetitive trauma and push/pull/lift injuries. The LANL contractor continues to strengthen the interface between the LANL worker organizations with respect to timely reporting of injuries and the completion and analysis of injury investigation reports. To derive learning from injury/illness events, the LANL contractor requires that facility managers engage in a systematic indepth analysis of the event causes and consider the efficiency of the remaining lines of defense associated with the events they evaluate.

Accident information for activities at facilities across DOE result in rates of 1.6 total recordable cases and 0.7 days away, restricted, or transferred cases, based on occupational injuries or illnesses from 2004 through 2008 (DOE 2011a). These rates are well below industry average, which in 2006 through 2009 were 4.0 recordable cases and 2.0 days away, restricted, or transferred cases as a result of an occupational injury or illness (BLS 2010b).

There were no work-related fatalities at LANL. The DOE and contractors work-related fatality rate from 2002 to 2009 is about 0.0008 for 100 worker-years or 200,000 labor hours (DOE 2011a).

Table 3–16 Occupational Injury and Illness Rates at Los Alamos National Laboratory

Calendar Year	*2006*	*2007*	*2008*	*LANL SWEIS*
Total recordable cases	2.56	2.0	1.83	2.40
Days away, restricted, transfer	1.15	0.80	0.65	1.18

[a] Total recordable cases, number per 200,000 hours worked.
[b] Days away, restricted, or transfer, number of cases per 200,000 hours worked.
Source: LANL 2007d, 2009, 2010a.

3.11.4 Health Effects Studies

Numerous epidemiological studies have been conducted in the LANL area.

The 2008 *LANL SWEIS* presented a summary of cancer incidence and mortality figures for the Los Alamos region as derived from data made available by the National Cancer Institute (through 2003) (DOE 2008a). **Table 3–17** presents a summary of total cancer mortality, incidence of all cancers, and incidence of selected cancer types for the State of New Mexico, as well as Los Alamos, Santa Fe, Sandoval, and Rio Arriba Counties, for the period 2003 through 2007. During that period, the overall cancer incidence (403.6) and death rates (162.2) for the State of New Mexico were somewhat below the national average (464.5 and 183.8, respectively). Total cancer incidence in Los Alamos (433.4), Santa Fe (417.2), and Sandoval (444.7) Counties exceeded the state average, although the rates in all four counties were below the national averages. As reported in the State Cancer Profiles in the National Cancer Institute web site (see Table 3–17), the cancer incidence rates of melanoma of the skin, prostate cancer, and female breast cancer are elevated in Los Alamos County with respect to the state averages. The rate of thyroid cancer also exceeded the state average for the period. Cancers of the lung, colon, and rectum occurred at rates below the state averages. Due to the small number of reported cases and resulting statistical unreliability of the data, the rates of non-Hodgkin's lymphoma, ovarian cancer, brain cancer, leukemia, and stomach cancer in Los Alamos County were not reported by the National Cancer Institute (NCI 2011).

The U.S. Public Health Service has reported on its review of possible public exposures to radioactive materials and other toxic substances in the environment near LANL (ATSDR 2006). The report determined that there were no data to link environmental factors, other than naturally occurring ultraviolet light from the sun, with the observed incidence of any cancer in Los Alamos County. The Agency for Toxic Substances and Disease Registry concluded that, "Overall, cancer rates in the Los Alamos area are similar to cancer rates found in other communities. In some time periods, some cancers will occur more frequently and others less frequently than seen in reference populations. Often, the elevated rates are not statistically significant."

Table 3–17 Five-Year Profile of Cancer Mortality and Incidence in the United States, New Mexico, and Los Alamos Region, 1999 through 2003 [a]

Statistic	*United States* [b]	*New Mexico*	*Los Alamos County*	*Santa Fe County*	*Sandoval County*	*Rio Arriba County*
Average Deaths Per Year	558,564	3,132	24	213	166	66
Annual Death Rate (per 100,000)	183.8 (183.6 - 184.0)	162.2 (159.6 - 164.8)	127.4 (105.1 - 153.2)	148.3 (139.4 - 157.6)	165.3 (154.2 - 177.1)	163.1 (145.8 - 181.8)
Annual Cancer Mortality Incidence Rate (per 100,000)						
All sites [c]	464.5 (464.1 - 464.8)	403.6 (399.6 - 407.6)	433.4 (393.5 - 476.4)	417.2 (402.5 - 432.3)	444.7 (426.4 - 463.5)	336.9 (312.2 - 363.1)
Brain and Other Nervous System	5.7 (5.7 - 5.8)	4.3 (3.8 - 5.0)	NA [d]	7.2 (4.8 - 10.5)	NA [d]	NA [d]
Lung and Bronchus	84.9 (84.7 - 85.1)	55.5 (53.3 - 57.8)	NA	40.3 (33.4 - 48.1)	49.7 (40.7 - 60.0)	28.6 (18.5 - 42.0)
Colon and rectum	57.0 (56.9 - 57.2)	48.0 (45.9 - 50.1)	37.8 (22.8 - 59.8)	44.9 (37.8 - 53.0)	49.5 (40.6 - 59.6)	61.5 (46.5 - 79.7)
Stomach	4.8 (4.7 - 4.8)	5.2 (4.6 - 5.9)	NA [d]	4.8 (2.9 - 7.6)	NA [d]	NA [d]
Breast Cancer	120.6 (120.4 - 120.9)	108.5 (105.7 - 111.4)	133.5 (104.3 - 169.0)	131.7 (120.8 - 143.4)	131.1 (118.1 - 145.2)	79.6 (63.8 - 98.3)
Leukemia	9.6 (9.6 - 9.7)	10.1 (9.3 - 11.0)	NA [d]	12.1 (8.8 - 16.2)	10.4 (7.0 - 15.0)	NA [d]
Melanoma of Skin	23.1 (23.0 - 23.2)	21.1 (19.7 - 22.5)	38.2 (22.5 - 61.0)	23.0 (18.2 - 28.7)	24.9 (18.9 - 32.2)	NA [d]
Non-Hodgkin's Lymphoma	23.1 (23.0 - 23.3)	18.1 (16.9 - 19.4)	NA [d]	24.0 (19.0 - 30.0)	14.8 (10.1 - 20.8)	NA [d]
Ovary	12.8 (12.8 - 12.9)	12.2 (11.3 - 13.2)	NA [d]	15.5 (11.9 - 19.8)	17.1 (12.5 - 22.8)	NA [d]
Prostate	153.5 (153.2 - 153.8)	143.3 (139.8 - 146.8)	219.3 (181.0 - 264.0)	169.8 (156.2 - 184.2)	158.4 (142.3 - 175.8)	145.2 (121.8 - 171.8)
Thyroid	10.2 (10.2 - 10.3)	12.2 (11.5 - 12.9)	33.6 (22.1 - 48.7)	13.6 (11.1 - 16.6)	14.0 (11.0 - 17.5)	13.5 (8.9 - 19.6)

NA = not available.

[a] Age-adjusted incidence rates. 95 percent confidence interval in parentheses.

[b] The U.S. average number of deaths and annual death rate reported by the National Cancer Institute are for the entire 2003 through 2007 rate period. The U.S. annual incidence rates reported by the National Cancer Institute are for the year 2010.

[c] All cancers, all races, both sexes.

[d] Data not available. When the number of reported cases is small, some data are suppressed in National Cancer Institute reports to ensure confidentiality and stability of rate estimates.

Source: NCI 2011.

3.11.5 Accident History

Unanticipated incidents have occurred at the CMR Building during the course of its 50-plus-years of operation that had the potential for impacts on workers and the public. To provide a perspective on facility hazards, a compendium of major accidents or hazardous situations that have occurred through 2008 was reviewed using historical analyses and CMR Building occurrence reports.

Radiological occurrences categories and the number of incidences are: skin contamination – 107; internal dose received – 12; clothing contamination (personal or personal protective equipment) – 79; area contamination – 73; loss of source or radiological control – 20; high airborne activity in operational area – 11; effluent stack release – 2; radiation exposure – 4; other – 9. The consequences of most of the incidents were minor, and none resulted in fatal worker injuries. Following are examples of the types of incidents that have occurred:

- An incident in Wing 9 involved an uptake of plutonium-238 during work on a heat source in an argon-purged atmosphere. The airborne radioactive material was released through a puncture in a boot around a manipulator in the operating area. Several personnel in the area received intake exposures. Intensive decontamination efforts were required to clean up the wing.

- A radiological incident occurred in Wing 3 of the CMR Building. Plutonium-238 heat source material was accidently spilled. As a result, there was widespread building contamination and 15 laboratory employees were contaminated. Radioactive contamination on workers was transferred to two residential houses in Santa Fe that required decontamination.

- Several incidents occurred that resulted in contamination outside of the CMR Building. One incident was the result of contaminated material being sent to the Los Alamos landfill. Other incidents were the result of stack releases in excess of DOE guidelines. There were two releases at the CMR Building involving 116 microcuries of uranium-235 from Wing 4 and 1.24 microcuries of plutonium-239 from Wing 3. In addition, a hot-cell manipulator seal leak and glove tear in Wing 9 resulted in both a stack release of 55 curies of plutonium-238 to the environment and an individual worker exposure of 15 rem in the lungs.

- There have also been incidents of small fires. One fire was a result of the ignition of a container of isopropyl alcohol and potassium hydroxide. The incident occurred either by spontaneous ignition of the bath or the evolution of vapors that were ignited by an external source. A second fire occurred in Wing 5 involving an unattended electric oven that was being used to dry a potentially contaminated mop head. A third fire occurred in Wing 9 as a result of an explosion.

- Over the history of the CMR Building, there have been a number of spills of radioactive materials during operations within ventilated hoods and operations outside of containment boxes. As an example, a spill occurred when a worker working in a ventilated hood was splashed with a radioactive solution spilled inside the hood. Another spill occurred when a worker dropped a glass vial containing 140 micrograms of dried plutonium-238 residue.

In recent years, the frequency of accidents is lower than in earlier years of CMR Building operations. Investigations of these and other occurrences were conducted to determine root causes, implement corrective actions, evaluate trends, and communicate lessons learned. A review of incidents at the CMR Building verifies that accidents occur both during laboratory processes and during activities to operate and maintain the facility.

On June 13, 2007, two workers were exposed above the Occupational Safety and Health Administration permissible exposure limit, time weighted average limit for silica. Sampling during this period indicated that an overexposure occurred when the two workers were jack hammering concrete. Although the Occupational Safety and Health Administration permissible exposure limit was exceeded, a single overexposure should not result in measurable harm to the workers.

3.11.6 Emergency Preparedness and Security

Each DOE site has established an emergency management program that is activated in the event of an accident. This program has been developed and maintained to ensure adequate response to most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program includes emergency planning, training, preparedness, and response.

NNSA maintains 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 assistance teams (DOE Order 151.1). These programs also provide for notification of local governments whose constituencies may be threatened. Broad ranges of exercises are run to ensure the systems are working properly, from facility-specific exercises to regional responses. In addition, DOE has specified actions to be taken at all DOE sites to implement lessons learned from the emergency response to an accidental explosion at the Hanford Site in Richland, Washington, in May 1997.

Emergency response facilities and equipment, trained staff, and effective interface and integration with offsite emergency response authorities and organizations support NNSA's emergency management system at LANL. LANL personnel maintain the necessary apparatus, equipment, and a state-of-the-art Emergency Operations Center to respond effectively to virtually any type of emergency, not only at LANL, but throughout the local community as well.

The Emergency Operations Center serves as the command center for emergency responders in the event of an emergency and has space and resources to house up to 120 personnel, including representatives from neighboring pueblos, the Federal Bureau of Investigation, the Federal Emergency Management Agency, DOE, U.S. Forest Service, National Park Service, National Guard, New Mexico State Police, Los Alamos County police and firefighters, Emergency Managers, the Red Cross, and others.

NNSA's Emergency Response and Management Program at LANL effectively combines Federal and local emergency response capabilities. A coordinated effort to share emergency information with Los Alamos County is a cornerstone of the Emergency Management Program. LANL emergency management staff and Los Alamos County police, fire, emergency medical, and 911 dispatch personnel operate out of the LANL Emergency Operations Center. It is the United States' first Emergency Operating Center that combines Federal and local operations. A computer-aided dispatch system provides a centralized dispatch capability for the Los Alamos police and fire departments. First responders from different agencies can share real-time information in the same Emergency Operations Center, resulting in a more coordinated emergency response. Additional information on the Emergency Response and Management Program is provided in the 2008 *LANL SWEIS* (DOE 2008a).

3.11.7 Los Alamos National Laboratory Security Program

LANL workers maintain special nuclear material inventories, classified matter, and facilities that are essential to nuclear weapons production. These security interests are protected against a range of threats that include adversarial groups, theft or diversion of special nuclear material, sabotage, espionage, and loss or theft of classified matter or government property.

NNSA's physical security protection strategy at LANL is based on a graded and layered approach supported by an armed guard force trained to detect, deter, and neutralize adversary activities and backed up by local, state, and Federal law enforcement agencies. This strategy employs the concept of defensible concentric layers where each layer provides additional controls and protections. The defense-in-depth approach begins in the airspace above LANL, which is restricted to approximately 5,000 feet (1,500 meters) above the ground surface. On-the-ground protection begins at the site perimeter and facility access control points and builds inwardly to facility exteriors and designated interior zones and control points.

Physical security protection also includes barriers, electronic surveillance systems, and intrusion detection systems that form a comprehensive site-wide network of monitored alarms. Various types of barriers are used to delay or channel personnel, or to deny access to classified matter, special nuclear material, and vital areas. Barriers are used to direct the flow of vehicles through designated entry control portals and to deter and prevent penetration by motorized vehicles where vehicular access could significantly enhance the likelihood of a successful malevolent act.

Barriers may be passive, active, or a combination of the two. Barriers may also have an active component designed to dispense an obscuration agent, viscous barrier, or sensory irritant. Tamper-protected surveillance, intrusion detection, and alarm systems designed to detect an adversary action or anomalous behavior inside and outside LANL facilities are paired with assessment systems to evaluate the nature of the adversary action. Random patrols and visual observation are also used to deter and detect intrusions. Penetration-resistant alarmed vaults and vault-type rooms are used to protect classified materials.

Guards are stationed in mobile and fixed posts around LANL 24 hours a day, 365 days a year. They are trained and equipped to respond to alarms and adversary action, in accordance with well-designed and thoroughly tested plans, using specialized equipment and weapons.

3.12 Waste Management and Pollution Prevention

A wide range of waste types are generated through activities at the CMR Building and LANL that are related to research, production, maintenance, construction, decontamination, decommissioning, demolition, and environmental restoration. These waste types include wastewaters (sanitary liquid waste, high-explosives-contaminated liquid waste, and industrial effluent); solid (sanitary) waste, including routine office-type waste and construction and demolition debris; and radioactive and chemical wastes. Management of these wastes is addressed in detail in the *CMRR EIS* (DOE 2003b) and the 2008 *LANL SWEIS* (DOE 2008a). Sections 3.12.1 through 3.12.4 of this *CMRR-NF SEIS* summarize information and updates information from these and other sources.

Wastes managed at the CMR Building and LANL are regulated in accordance with a variety of Federal and state regulations, applicable to specific waste types and their radiological and nonradiological content. Requirements for waste management activities are determined and documented by Institutional Requirements. These Institutional Requirements provide details on proper management of all process wastes and contaminated environmental media. The waste management operation tracks waste generating processes; waste quantities; chemical and physical characteristics; regulatory status; compliance with applicable treatment and disposal standards; and final disposition (DOE 2008a).

Several capabilities have been established at the CMR Building for managing waste within overall LANL capabilities, including analyzing, packaging, storing, and transporting all wastes generated from CMR Building operations. All liquid wastes generated at the CMR Building are determined to meet appropriate waste acceptance criteria before the wastes are sent to designated LANL waste management facilities. Liquid wastes are treated at LANL at the SWWS Plant and RLWTF. Liquid radioactive and inorganic chemical wastes from the CMR Building are piped to RLWTF for processing, while liquid organic chemical wastes (which are low in volume) are collected in small containers in temporary holding areas, packaged, and trucked to TA-50 for disposition. Wastes from processing operations are solidified and transported to TA-54, Area G, or offsite for disposal. Solid low-level radioactive waste, mixed low-level radioactive waste, transuranic waste, and chemical waste generated at the CMR Building are packaged there and shipped to on- and offsite facilities for disposition (DOE 2003b, 2008a).

The CMR Building conducts operations in accordance with the LANL waste minimization and pollution prevention program. The preferred method for minimizing waste is source reduction, including materials substitution and process improvement. Recycling and reuse practices are also implemented, along with volume reduction and treatment options. Progress in pollution prevention initiatives at LANL is measured annually against metrics approved by DOE.

In 2004 (LANL 2010a), LANL began development and implementation of an environmental management system to comply with DOE Order 450.1. DOE Order 450.1 defines an environmental management system as a continuous cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental missions and goals. The environmental management system at LANL was third-party-certified to the ISO 14001:2004 standard in April 2006 by the National Sciences Foundation's International Strategic Registrations (LANL 2010a).

Research, production, maintenance, and construction activities at LANL, as well as the environmental restoration activities, generate radioactive, chemical, and other wastes. The volumes of all types of waste produced at LANL are projected to be large over the next 5 years because of the need for site remediation pursuant to the 2005 Consent Order and from decontamination, decommissioning, and demolition (DD&D) of facilities, in addition to routine operations. Actual waste volumes from remediation may be smaller than projected, depending on regulatory decisions and because of the employment of possible waste volume reduction and sorting techniques.

Table 3–18 compares annual waste generation rates by waste type for the CMR Building and site-wide for 2008 (LANL 2010b). Note that routine and nonroutine solid wastes are presented for FY 2008, rather than calendar year. Routine and nonroutine solid wastes from operations are not tracked on a facility-specific basis, but only on a LANL site-wide basis.

3.12.1 Wastewater Treatment and Effluent Reduction

LANL has three primary sources of nonradioactive wastewater: sanitary liquid wastes, high-explosives-contaminated liquid wastes, and industrial effluent. Radioactive liquid waste is addressed in Section 3.12.4.2.

3.12.1.1 Sanitary Liquid Waste

The SWWS Plant in TA-46 treats liquid sanitary wastes. In 2008, the plant processed about 101.2 million gallons (383.1 million liters) of wastewater, all of which was pumped to TA-3 to be either recycled at the TA-3 power plant (as makeup water for the cooling towers), or discharged into Sandia Canyon via permitted Outfall Number 001 (LANL 2010a). The Sanitary Effluent Reclamation Facility treats some liquid effluent for reuse in the cooling towers at the Metropolis Center for Modeling and Simulation (DOE 2008a).

Table 3–18 Annual Waste Generation Rates for the Chemistry and Metallurgy Research Building and Los Alamos National Laboratory for 2008 [a]

Waste Type	*Chemistry and Metallurgy Research Building* 2008	*Los Alamos National Laboratory Site-Wide* 2008
Liquid NPDES discharge (millions of gallons) [b]	0.17	158.41
Routine solid waste (tons) [c, d]	(f)	2,907
Nonroutine solid waste (tons) [d, e]	(f)	2,082
Chemical waste (tons) [g]	0.0764	862.8
Low-level radioactive waste (cubic yards)	262	3,669.5
Mixed low-level radioactive waste (cubic yards)	0.86	18.3
Transuranic waste (cubic yards)	2.72	317.2
Mixed transuranic waste (cubic yards)	0.68	217.4

NPDES = National Pollutant Detection and Elimination System.

[a] Waste generation rates reflect the current reduced capacity and limited capabilities of the CMR.

[b] The CMR Building discharged effluent from NPDES-permitted Outfall Number 03A-021, until September 30, 2010, at which time the CMR outfall was discontinued and the effluent piped to the sanitary wastewater system in TA-46. Through December 31, 2008, LANL discharged from 14 industrial outfalls and 1 sanitary outfall.

[c] Routine solid waste consists mostly of food and food-contaminated waste and cardboard, plastic, glass, Styrofoam® packing material, and similar items.

[d] Quantities listed for routine and nonroutine solid wastes are for FY 2008.

[e] Nonroutine solid waste is typically derived from construction and demolition projects and consists of materials such as asphalt, concrete, dirt, or brush.

[f] Routine and nonroutine solid wastes are not reported on a facility-specific basis.

[g] Chemical waste is not a formal LANL waste category, but per the *LANL SWEIS* (DOE 2008a), is used in this SEIS to denote a broad category of materials, including hazardous wastes, toxic wastes, and special wastes so designated under the New Mexico Solid Waste Regulations.

Note: To convert gallons to liters, multiply by 3.7854; tons to metric tons, multiply by 0.90718; cubic yards to cubic meters, multiply by 0.76456.

Source: LANL 2010b.

3.12.1.2 Sanitary Sludge

Sanitary sludge from the SWWS Plant is dried for a minimum of 90 days to reduce pathogens and then disposed of as special waste (as determined by the State of New Mexico) at an authorized, permitted landfill. The volume of sanitary sludge generated and disposed of by DOE is reported in the annual site environmental surveillance report (DOE 2008a).

3.12.1.3 High-Explosives-Contaminated Liquid Wastes

The High Explosives Wastewater Treatment Facility, located in TA-16, treats process waters containing high-explosives compounds using three treatment technologies. Sand filtration is used to remove particulate high explosives; activated carbon is used to remove organic compounds and dissolved high explosives; and ion exchange units are used to remove perchlorate and barium. The High Explosives Wastewater Treatment Facility receives some wastewaters by truck from processing facilities located outside TA-16 (DOE 2008a). The CMR Building does not generate high-explosive-contaminated liquid wastes.

Equipment upgrades have significantly reduced the quantities of high-explosives wastewater treated and effluent discharged to NPDES-permitted outfalls. In 2005, the High Explosives Wastewater Treatment Facility discharged about 30,000 gallons (114,000 liters) to permitted Outfall Number 05A-055

(DOE 2008a). No wastewater discharge occurred in 2008 (LANL 2010a) from this outfall because wastewater evaporation processes have been incorporated into the facility's operation.

3.12.1.4 Industrial Effluent

Industrial effluent is discharged through NPDES-permitted outfalls across LANL. The number of outfalls has been reduced in recent years with an eventual goal of achieving zero liquid discharge from LANL operations. As of December 31, 2008, LANL operated 15 wastewater outfalls (14 industrial and 1 sanitary) regulated under NPDES Permit Number NM0028355. In 2008, combined discharges totaled 158.4 million gallons (600 million liters), approximately 19.8 million gallons (75 million liters) less than the 2007 total of 178.2 million gallons (674.6 million liters) (LANL 2010a), and well below the maximum flow of 279.5 million gallons (1,058 million liters) projected for the No Action Alternative in the 2008 *LANL SWEIS* (DOE 2008a). The outfall from the CMR Building (03A-21) discharged about 170,000 gallons (640,000 liters) in 2008 (LANL 2010a), about 9 percent of the annual 1.9 million gallons (7.2 million liters) projected in the 2008 *LANL SWEIS* for this outfall under all alternatives (DOE 2008a). The CMR outfall was discontinued as of September 30, 2010, and effluent is now piped to the SWWS Plant in TA-46.

3.12.2 Sanitary Solid Waste

Sanitary solid waste is excess material that is not radioactive or hazardous and can be disposed of in a permitted solid waste landfill (LANL 2010a). LANL sanitary solid waste was historically disposed of at the Los Alamos County Landfill, which is located within LANL boundaries, but operated by Los Alamos County. Waste volumes delivered to the landfill varied considerably over the last decade, with a peak of more than 14,000 tons (12,700 metric tons) transferred to the landfill in 2000 due to removal of Cerro Grande fire debris. The Los Alamos County Landfill was replaced in March 2009 by a solid waste transfer station, the Los Alamos County Eco Station, which is located at the landfill site. A landfill closure plan was submitted to NMED in September 2005 (LANL 2010a). Solid waste from the Los Alamos County Eco Station is transported offsite for recycle or disposal, typically to the Rio Rancho and Valencia County solid waste facilities for disposal.

Sanitary solid waste can be classified as routine or nonroutine. Routine sanitary waste consists mostly of food and food-contaminated waste and cardboard, plastic, glass, Styrofoam® packing material, and similar items. Nonroutine sanitary waste is typically derived from construction and demolition projects and includes materials such as concrete, asphalt, dirt, or brush that may be separated and sorted by material for recycle or beneficial reuse. Routine and nonroutine sanitary solid wastes may be recycled or disposed of as summarized in **Table 3–19** for FY 2008 (LANL 2010a). These wastes may be sent to the Los Alamos Eco Station or directly to an offsite facility for recycle or disposal.

Table 3–19 Los Alamos National Laboratory Sanitary Solid Waste Generation for Fiscal Year 2008

Disposition	*Routine Waste (tons)*	*Nonroutine Waste (tons)*	*Total (tons)*
Recycled	810	1,495 [a]	2,305
Landfill disposal	2,097	588 [b]	2,684
Total	2,907	2,082	4,989

[a] Brush, dirt, concrete, and asphalt.
[b] Construction and demolition debris, nonhazardous solid waste from TA-54.
Total may not equal the sum of the contributions due to rounding.
Note: To convert tons to metric tons, multiply by 0.9072.
Source: LANL 2010a, 2011.

DOE/NNSA has instituted a waste minimization and recycling program at LANL that has reduced the amount of waste disposed of in sanitary landfills. Per capita generation of routine sanitary waste at LANL fell from 584 pounds (265 kilograms) per person per year in 1993 to 359 pounds (163 kilograms) per person per year in 2001 to 344 pounds (156 kilograms) per person per year in 2008, equivalent to a 41 percent decrease in routine waste generation over 16 years. This reduction is the result of waste minimization programs that includes recycle of mixed office paper, cardboard, plastic, and metal and source reduction efforts (LANL 2010a). As indicated in Table 3–19, of the routine solid waste that was generated in FY 2008, about 28 percent was recycled rather than being disposed of.

Nonroutine waste from construction and demolition projects is regulated as a separate category of solid waste under the New Mexico Solid Waste Regulations. This waste may be disposed of in a municipal or construction and demolition debris landfill (NMAC 20.9.1), but is frequently separated by material and recycled or beneficially reused. Recycling programs for concrete, asphalt, dirt, and brush were established at LANL in FY 2001 and, as a result, LANL is recycling more construction waste and decreasing landfill disposal (LANL 2010a). As shown in Table 3–19, of the nonroutine solid waste that was generated at LANL in FY 2008, about 72 percent was recycled. During construction of RLUOB, over 81 percent of construction-generated waste materials were recycled (LANL 2011).

Construction of new facilities and demolition of old facilities are expected to continue to generate substantial quantities of this type of waste. The annual average generation of 310,000 cubic yards (240,000 cubic meters) of construction and demolition debris has been projected for LANL activities, including waste from DD&D of structures at TA-18 and TA-21 (LANL 2010a). Additional wastes could be generated from environmental restoration activities, depending on regulatory decisions regarding the restoration of several material disposal areas at LANL (DOE 2008a).

3.12.3 Chemical Waste

"Chemical waste" is not a formal LANL waste category but per the *2008 LANL SWEIS* (DOE 2008a), is used in this CMRR-NF SEIS to denote a broad category of materials, including hazardous wastes, toxic wastes, and special wastes. Hazardous and toxic wastes are those wastes defined as such pursuant to the Resource Conservation and Recovery Act (RCRA) and Toxic Substances Control Act, respectively. Typical hazardous waste streams include solvents, unused chemicals, acids and bases, solids such as barium-containing explosive materials, laboratory trash, and cleanup materials such as rags. Toxic wastes principally include waste materials containing asbestos or polychlorinated biphenyls. Special wastes are designated under the New Mexico Solid Waste Regulations and include industrial waste, infectious waste, and petroleum-contaminated soil (DOE 2008a).

Construction and demolition debris is tracked in *LANL SWEIS* yearbooks as a component of chemical wastes that, in most cases, are sent directly to offsite disposal facilities. Construction and demolition debris consists primarily of asbestos and construction debris from DD&D projects, and may be disposed of in permitted solid waste landfills pursuant to Subtitle D of RCRA (DOE 2008a). This waste typically consists of a mixture of materials that would be difficult to separate and sort for recycle or beneficial reuse.

The 2008 *LANL SWEIS* projected that chemical waste volumes would decline for normal LANL operations but potentially increase for environmental restoration activities. In 2008, chemical waste generation at the CMR Building was 0.0764 tons (0.0693 metric tons) (LANL 2010a), which represents about 0.6 percent of the 12 tons (11 metric tons) of annual chemical waste projected for the continued operation of the CMR Building over the next several years (DOE 2008a).

3.12.4 Radioactive Waste

3.12.4.1 Solid Radioactive Waste Management

Solid radioactive waste consists of low-level radioactive waste, mixed low-level radioactive waste, transuranic waste, and mixed transuranic waste. Waste minimization efforts have reduced waste generation rates for specific waste types as facility processes have been improved and nonhazardous product substitutions implemented (DOE 2008a). In some cases, facility workloads have been less than those projected in the 2008 *LANL SWEIS*, and environmental restoration activities have generated less waste than the estimated bounding levels.

Low-Level Radioactive Waste – low-level radioactive waste is defined as waste that is radioactive and does not fall within any of the following classifications: high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct materials (uranium and thorium mill tailings). These wastes are generated at LANL when materials, equipment, and water are used in radiological control areas as part of work activities; when these contaminated items are no longer useable, they are removed from the area as low-level radioactive waste. Typical waste streams include laboratory equipment, service and utility equipment, plastic bottles, disposable wipes, plastic sheeting and bags, paper, and electronic equipment (DOE 2008a). Environmental restoration and DD&D activities also generate low-level radioactive waste, primarily contaminated soil and debris.

Low-level radioactive waste generated at LANL may be disposed of on site at Area G in TA-54 (a small amount of certain types of low-level radioactive waste) or shipped off site for disposal at the Nevada National Security Site or a commercial disposal facility (beginning in about 2008, most low-level radioactive waste generated by LANL operations is disposed of offsite). In 2008, the CMR Building operating at reduced capacity and with limited capabilities generated about 262 cubic yards (200 cubic meters) of low-level radioactive waste (LANL 2010a), representing about 11 percent of the 2,400 cubic yards (1,800 cubic meters) annually projected for the CMR Building for the next several years of continued operations (DOE 2008a).

Mixed Low-Level Radioactive Waste – mixed low-level radioactive waste is waste that contains both low-level radioactive waste and hazardous waste as defined by RCRA. Most operational mixed low-level radioactive waste is generated by stockpile stewardship and research and development programs. Typical waste streams include contaminated lead bricks and debris, spent chemical solutions, fluorescent light bulbs, copper solder joints, and used oil. Environmental restoration and DD&D activities also produce some mixed low-level radioactive waste. In 2008, the CMR Building generated about 0.86 cubic yards (0.66 cubic meters) of mixed low-level radioactive waste (LANL 2010a), representing about 3.4 percent of the 25 cubic yards (19 cubic meters) projected for the continued operation of the CMR Building over the next several years (DOE 2008a). Mixed low-level radioactive waste may be sent for treatment to a variety of permitted commercial facilities (located, for example, in Florida, Tennessee, Texas, Washington, and Utah) with subsequent disposal at a commercial facility such as the facility in Utah or at NNSS in Nevada.

Transuranic and Mixed Transuranic Waste – transuranic waste is waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes having half-lives greater than 20 years per gram of waste. This type of waste contains radioactive isotopes such as plutonium, neptunium, americium, and curium. Specific categories are excluded from the definition of transuranic waste: (1) high-level radioactive waste; (2) waste that DOE has determined, and EPA has concurred, does not need the same degree of isolation as most transuranic waste; and (3) waste that the NRC has approved, on a case-by-case basis, for disposal at a low-level radioactive waste facility (DOE 2008a). Mixed transuranic waste is transuranic waste that also contains hazardous constituents regulated under RCRA.

Transuranic and mixed transuranic wastes may be generated during research, development, and stockpile manufacturing and management activities. Waste forms include contaminated scrap and residues, plastics, lead gloves, glass, and personnel protective equipment. Transuranic and mixed transuranic wastes may also be generated through environmental restoration, legacy waste retrieval, offsite source recovery, and DD&D activities. Transuranic and mixed transuranic wastes are characterized and certified prior to shipment to the Waste Isolation Pilot Plant (DOE 2008a).

In 2008, the CMR Building operating at reduced capacity and with limited capabilities generated about 3.4 cubic yards (2.6 cubic meters) of combined transuranic and mixed transuranic waste (LANL 2010a) representing about 6.2 percent of the 55 cubic yards (42 cubic meters) of combined transuranic waste annually projected for the continued operation of the CMR Building in the 2008 *LANL SWEIS* (DOE 2008a).

3.12.4.2 Liquid Radioactive Waste

The principal facility for treating radioactive liquid waste at LANL is RLWTF, located in TA-50. RLWTF consists of the treatment facility, support buildings, and liquid and chemical storage tanks and receives liquid waste from various sites across LANL. Several upgrades to RLWTF have been implemented in recent years to upgrade the tank farm, install new ultrafiltration and reverse osmosis equipment, and install new nitrate reduction equipment. RLWTF Outfall Number 051 discharges into Mortandad Canyon. In 2008, discharge volumes were 1.39 million gallons (5.26 million liters) (LANL 2010a), which is less than half of the projected annual discharge volume of 4 million gallons (15 million liters) for RLWTF for the next several years of LANL operations (DOE 2008a). Source reduction and process improvements both contributed to these reduced volumes. For example, process waters are now used instead of tap water for the dissolution of chemicals needed in the treatment process and for filter backwash operations (LANL 2010a). The RLWTF is slated for replacement with a new facility in accordance with the 2008 *LANL SWEIS* ROD; this new facility is being planned with an evaporation unit to eliminate liquid discharge into the environment.

3.13 Transportation

Transportation infrastructure includes the public roadway network, public transportation systems, airports, railroads, and pedestrian/bicycle facilities on and in the immediate vicinity of LANL. Motor vehicles are the primary means of transportation in Los Alamos County and to LANL.

Regional transportation routes to LANL include: from Albuquerque and Santa Fe, Interstate 25 to U.S. Routes 84/285 to State Road (SR)-502; from Española, SR-30 to SR-502; and from Jemez Springs and communities to the west of LANL, SR-4. Only two major roads (SR-502 and SR-4) access Los Alamos County. To the west of LANL SR-501 (also known as West Jemez Road) connects SR-502 and SR-4 via Diamond Drive. SR-501 and SR-502 generally bound the site to the west and north. To the south and east, LANL is bounded by SR-4, which is a two-lane roadway. SR-501 is also a two-lane roadway that is a DOE-owned roadway internal to LANL, although it has a State Road numerical designation. SR-4 connects to SR-502 to the north and east of LANL. SR-502 is a two- to six-lane roadway to the north of the site that becomes a multi-lane divided freeway to the east of the intersection with SR-4. Los Alamos County traffic volume on these two segments of highway is primarily associated with LANL activities. The location of arterial public roadways and LANL Vehicle Access Portals (VAPs) are shown in Figure 3–1.

The public road system feeds into an internal LANL road system. The main townsite access is from Diamond Drive. The major roadways of the internal LANL road system are Pajarito Road, East Jemez Road, and West Jemez Road. Pajarito Road is a two-lane, access-controlled roadway, while East Jemez

Road and West Jemez Road are two-lane roadways that are not access-controlled, although the infrastructure to facilitate access control is present. About 80 miles (129 kilometers) of paved roads exist at LANL. There is no railroad service connection to the site or Los Alamos County.

A public bus service (Atomic City Transit) operates within Los Alamos County 5 days a week. The nearest commercial bus terminal is located in Española. The nearest commercial rail connection is at Santa Fe, New Mexico, 35 miles (56 kilometers) southwest of LANL. The primary commercial international airport in New Mexico is located in Albuquerque. The Santa Fe Municipal Airport currently has four daily commercial flights, three to Dallas/Fort Worth and one to Los Angeles (Santa Fe 2010). The small Los Alamos County Airport is owned by the Federal Government and is operated and maintained by the County.

Workers access LANL using both public transportation and privately owned vehicles. The New Mexico Park and Ride regional bus service delivers 500 riders per day to the site, and Atomic City Transit also serves LANL. Additionally, car/vanpool programs are operated by the State of New Mexico, private companies, and by individuals. The number of workers using privately owned vehicles and car/van pools is 11,750 (LANL 2011).

TA-55 is located along Pajarito Road. Pajarito Road is a two-lane roadway connecting to Diamond Drive on the west end and SR-4 on the east end. Pajarito Road has a VAP approximately 0.75 miles (1.2 kilometers) to the west of TA-55 off of Diamond Drive (West VAP). The West VAP has five lanes for incoming traffic and one lane for outgoing traffic. Pajarito Road also has a VAP approximately 5 miles (8 kilometers) east of TA-55 off of SR-4 near the community of White Rock (East VAP). The East VAP has four lanes for incoming traffic and one lane for outgoing traffic. Approximately 70 percent of existing Pajarito Road traffic uses the West VAP. The capacity of a VAP is directly related to the type of identification processing being used and the number of lanes available. The existing capacity of the current gates is provided in **Table 3–20**.

Table 3–20 Vehicle Access Portal Capacity for Vehicles Entering Los Alamos National Laboratory

Identification Processing	*West Vehicle Control Point (vehicles per hour)*	*East Vehicle Control Point (vehicles per hour)*
Identification check	2,100	1,400
Identification check tandem processing	3,000	2,000

Source: SDDCTEA 2006.

LANL has approximately 13,500 site workers, of which 11,752 use personally owned vehicles and car/van pools to commute to work (LANL 2011). Using the methodology developed by the Institute of Transportation Engineers, traffic generated by 11,750 employees has been estimated to be approximately 20,000 trips per day. A trip is defined as a one-way vehicle movement. **Table 3–21** provides the estimated peak hour traffic at LANL (ITE 2003).

Table 3–21 Expected Peak Hour Traffic at Los Alamos National Laboratory

Time Period	*Peak Hour Trips*	
	Entering	*Exiting*
Weekday a.m.	2,600	400
Weekday p.m.	300	2,700
Saturday	440	50
Sunday	430	40

Approximately 4,600 LANL employees (34 percent) work along Pajarito Road (LANL 2010b). Thus, 34 percent of the trips listed in Table 3–20 are expected to take place along this roadway (see **Table 3–22**). For both LANL as a whole and the Pajarito Road corridor, the expected peak hour traffic would occur during the weekday morning and evening rush hours. Actual traffic counts conducted in 2008 at Diamond Drive and Pajarito Road confirmed a peak hour traffic of approximately 1,000 vehicles per hour in the morning peak hour (the 60-minute period with the highest traffic volume between 7 and 9 a.m.) and 950 vehicles per hour in the afternoon peak hour (the 60-minute period with the highest traffic volume between 3:30 and 7 p.m.) (Wilson 2010).

The existing VAPs have adequate capacity for the existing traffic.

Table 3–22 Expected Peak Hour Traffic on Pajarito Road

	Peak Hour Trips	
Time Period	***Entering***	***Exiting***
Weekday a.m.	880	140
Weekday p.m.	100	920
Saturday	150	17
Sunday	150	14

The ability of roadways to function is measured in terms of level of service (LOS), which is determined based on the peak hour traffic. LOS is a measure of the operational characteristics of a roadway. In general, it reflects the amount of congestion and ease of use of a roadway segment by individual drivers. Significant impacts on traffic LOS are generally considered to occur when the LOS on the studied roadway segment falls below the acceptable LOS for that roadway.

Arterial roadways primarily serve through-traffic and secondarily provide access to adjoining properties. Collector roadways primarily serve to provide access to adjoining properties and are not intended to serve through-traffic. Rural areas are areas with widely scattered development and a low density of housing and employment. Urban areas are typified by high-density development or large concentrations of population. Rural arterials are roadways primarily serving through-traffic in rural areas. Urban arterials are roadways primarily serving through-traffic in urban areas. All roadways primarily serving through-traffic in incorporated area are considered urban arterials.

The desired LOS for roadways depends on the classification of the roadway.

- For rural arterial roadways, LOS C or better is desired.
- For urban arterial roadways, LOS D or better is desired.
- For collector roadways, LOS D or better is desired.

Pajarito Road is a collector roadway within LANL. Diamond Drive and SR-502 are urban arterials within the Los Alamos townsite and rural arterials outside of the developed areas. SR-4 is an urban arterial within the community of White Rock and as a rural arterial outside of the developed areas.

Representative existing average annual daily traffic and LOS classifications of the public roadways in the vicinity of LANL are provided in **Table 3–23**.

Table 3–23 Existing Average Annual Daily Traffic and Levels of Service of Roadways in the Vicinity of Los Alamos National Laboratory

Location	*Road Type and Number of Lanes*	*AADT per Year*	*Percent Trucks*	*Existing LOS*
SR-4 at Los Alamos County Line to SR-501	Minor Arterial/Two Lanes	734/2009	9	A
SR-4 at Bandelier Park Entrance	Minor Arterial/Two Lanes	681/2009	7	A
SR-4 at Junction of Pajarito Road – White Rock	Minor Arterial/Two Lanes	9,302/2009	9	D
SR-4 at Jemez Road	Minor Arterial/Two Lanes	9,358/2009	12	D
SR-501 at Junction of SR-4 and Diamond Drive	Minor Arterial/Two Lanes	11,848/2009	11	D
SR-501 at Junction of Diamond Drive	Primary Arterial/Four Lanes	21,211/2009	8	C
SR-501 at SR-502	Primary Arterial/Four Lanes – Divided	17,807/2009	8	C
SR-502 at Oppenheimer Street	Primary Arterial/Four Lanes – Divided	12,817/2009	6	C
SR-502 at Los Alamos/Santa Fe County Line	Primary Arterial/Four Lanes	12,256/2009	9	A

AADT = average annual daily traffic; LOS = Level of Service; SR = New Mexico State Route.
Source: Valencia 2010.

Traffic on arterial roadway segments is generally described by assigning LOS categories, as defined below:

- **LOS A** describes the highest quality of traffic service, with motorists able to travel at their desired speed. Most drivers find operating a vehicle on a LOS A roadway to be stress free.
- **LOS B** describes a condition where the drivers have some restrictions on their speed of travel. Most drivers find operating a vehicle on a LOS B roadway slightly stressful.
- **LOS C** describes a condition of stable traffic flow that has significant restrictions on the ability of motorists to travel at their desired speed. Most drivers find operating a vehicle on a LOS C roadway somewhat stressful.
- **LOS D** describes unstable traffic flow. Drivers are restricted in slow-moving platoons and disruptions in the traffic flow can cause significant congestion. There is little or no opportunity to pass slower-moving traffic. Most drivers find operating a vehicle on a LOS D roadway stressful.
- **LOS E** represents the highest volume of traffic that can move on the roadway without a complete shutdown. Most drivers find operating a vehicle on a LOS E roadway very stressful.
- **LOS F** represents heavily congested flow, with traffic demand exceeding capacity. Traffic flows are slow and discontinuous. Most drivers find operating a vehicle on a LOS F roadway extremely stressful.

A review of information contained in the *Pajarito Road Closure Study* indicates that the LOS of Pajarito Road is LOS C or better for all intersection legs except for Pajarito Road and Diamond Drive in the AM peak hour, which has an unacceptable LOS of E (Wilson 2010). Traffic count information provided for each intersection in the *Pajarito Road Closure Study* has been used to estimate the current LOS for road segments between each intersection (**Table 3–24**). All segments were found to be LOS C or D for both the AM and PM peak hours.

Table 3–24 Estimated 2011 Existing Conditions Los Pajarito Road

Pajarito Road Segment	*2008 AM Peak Hour Vehicles per Hour per Year*	*2008 AM Peak Hour Vehicles per Hour per Year*	*2011 AM Level of Service*	*2011 PM Level of Service*
Diamond Drive to TA 48/64	770	694	C	C
TA 48/64 to Pecos Drive	699	692	C	C
Pecos Drive to Lubbock	807	807	D	D
Lubbock to SR 4	794	770	D	C

SR = New Mexico state route; TA = technical area.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4 ENVIRONMENTAL CONSEQUENCES

Chapter 4 describes the environmental consequences of the alternatives to replace the Chemistry and Metallurgy Research (CMR) Building at Los Alamos National Laboratory. The impact on each resource area is evaluated for the three proposed alternatives: the No Action Alternative (2004 Chemistry and Metallurgy Research Building Replacement Nuclear Facility [CMRR-NF]); the Modified CMRR-NF Alternative; and the Continued Use of CMR Building Alternative. In addition, the analysis evaluates the impacts of two options under the Modified CMRR-NF Alternative: the Deep Excavation Option and the Shallow Excavation Option. Chapter 4 also describes the cumulative impacts of these alternatives when combined with other past, present, and future actions that could affect the region; mitigation measures; and resource commitments.

4.1 Introduction

The environmental impacts analysis evaluates potentially affected resource areas in a manner commensurate with the importance of the potential effects on each area. The methodologies used to prepare the assessments for the following resource areas are discussed in Appendix B of this supplemental environmental impact statement (SEIS): land use and visual resources; site infrastructure; air quality and noise, including greenhouse gas emissions; geology and soils; surface-water and groundwater quality; ecological resources; cultural and paleontological resources; socioeconomics; human health; environmental justice; waste management and pollution prevention; and transportation and traffic. With the exception of the Continued Use of Chemistry and Metallurgy Research (CMR) Building Alternative, all alternatives would involve a significant amount of construction activity. All construction would take place on land already owned by the Federal Government and administered by the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) and, for the most part, on land that has already been disturbed by other DOE activities. This *Draft Supplemental Environmental Impact Statement for the Nuclear Facility Portion of the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico (CMRR-NF SEIS)* addresses the potential effects associated with land disturbance that construction activities would have on air and water resources, as well as the effects on ecological, cultural, and paleontological resources and on socioeconomic conditions within the environment influenced by DOE's potential actions at Los Alamos National Laboratory (LANL). The potential effects on the health and safety of workers, the public, and the environment from postulated accident conditions are analyzed. In addition, this SEIS addresses the impacts of transportation of materials both on site and off site, as well as the impacts of construction-related traffic on the roads in and around LANL.

Activities expected to occur during normal operations under the alternatives would not be characterized by any significant release of effluent, radiological or nonradiological, hazardous or nonhazardous. Therefore, the effects on the health and safety of workers, the public, and the environment from normal facility operations are presented in detail in deference to public interest rather than as an indication of their significance. This is also true of the assessments presented for environmental justice and waste generation.

Chapter 4 is organized by environmental resource areas under each alternative. These sections include discussions of potential impacts on all environmental resources due to construction (except for the Continued Use of CMR Building Alternative) and operations for the proposed alternatives at LANL. Section 4.2 discusses the environmental consequences of the No Action Alternative, building and operating the 2004 Chemistry and Metallurgy Research Building Replacement Nuclear Facility (CMRR-NF) at Technical Area 55 (TA-55), in accordance with the preferred alternative described in the 2003 *Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building*

Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico (CMRR EIS) and selected in the 2004 Record of Decision (ROD).

Section 4.3 discusses the environmental consequences of the Modified CMRR-NF Alternative under both the Deep Excavation and Shallow Excavation Options. Section 4.4 discusses the environmental consequences of the Continued Use of CMR Building Alternative.

Other sections of this chapter present additional information as follows:

- *Section 4.5, Facility Disposition:* This section discusses disposition of the existing CMR Building and the CMRR-NF.
- *Section 4.6, Cumulative Impacts:* This section discusses cumulative impacts at LANL and the surrounding region, as appropriate.
- *Section 4.7, Mitigation:* This section discusses mitigation measures that could reduce, minimize, or eliminate unavoidable environmental impacts.
- *Section 4.8, Resource Commitments:* This section discusses the resource commitments required for the proposed action, including unavoidable, adverse impacts; the relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity; and irreversible or irretrievable commitments of resources.

4.2 Environmental Impacts of the No Action Alternative

4.2.1 No Action Alternative

This section discusses the potential environmental impacts associated with the No Action Alternative. Under the No Action Alternative, NNSA would have constructed and operated a new CMRR-NF at TA-55, adjacent to the Radiological Laboratory/Utility/Office Building (RLUOB), as analyzed in the 2003 *CMRR EIS* and selected in the associated 2004 ROD. The 2004 CMRR-NF would have been linked to RLUOB by a tunnel and to the TA-55 Plutonium Facility by another tunnel. Based on information learned since 2004, the 2004 CMRR-NF would not meet the standards for a Performance Category 3[1] (PC-3) structure as required to safely conduct the full suite of NNSA analytical chemistry and materials characterization mission work. Therefore, the 2004 CMRR-NF would not be constructed. Chapter 2, Section 2.6.1, provides a description of the No Action Alternative.

Because the 2004 CMRR-NF would not be constructed, the potential impacts of constructing and operating the 2004 CMRR-NF have not been fully re-evaluated in this *CMRR-NF SEIS*. Instead, with the exceptions discussed below, the potential impacts as presented in the 2003 *CMRR EIS* for the alternative selected in the 2004 ROD are presented for comparison to the impacts of the action alternatives. Many of the analyses in the 2003 *CMRR EIS* did not distinguish between the potential impacts of the CMRR-NF and RLUOB; therefore, the impacts of constructing and operating both buildings are included in this section.

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[1] Each structure, system, and component in a DOE facility is assigned to one of five performance categories depending upon its safety importance. Performance Category 3 (PC-3) structures, systems, and components are those for which failure to perform their safety function could pose a potential hazard to public health, safety, and the environment from release of radioactive or toxic materials. Design considerations for this category are to limit facility damage as a result of design-basis natural phenomena events (for example, an earthquake) so that hazardous materials can be controlled and confined, occupants are protected, and the functioning of the facility is not interrupted.

Analyses have been updated in three areas. A comprehensive update to the LANL seismic hazards analysis was completed in June 2007 (LANL 2007a), after completion of the 2003 *CMRR EIS*. The updated report used more-recent field study data, most notably from the proposed CMRR-NF site, to update the seismic characterization of LANL, including the probabilistic seismic hazard and horizontal and vertical ground accelerations that would constitute what is considered a design-basis earthquake for the proposed CMRR-NF site. Based on the updated probabilistic seismic hazards analysis, it was concluded that a design-basis earthquake with a return interval of about 2,500 years would have an estimated horizontal peak ground acceleration of 0.52 *g*. The previous estimated horizontal peak ground acceleration for an earthquake with a return interval of about 2,500 years was about 0.3 *g*. As a result of this updated understanding of the seismic hazard, it was concluded that the 2004 CMRR-NF design, as originally conceived, would not survive the updated design-basis earthquake. Therefore, the accident analysis of the 2004 CMRR-NF was updated in this *CMRR-NF SEIS* to reflect the potential consequences and risks associated with such an earthquake. Additionally, analyses of greenhouse gas emissions and the potential impacts of construction transportation on traffic, both of which were not included in the 2003 *CMRR EIS*, have been added to the No Action Alternative analysis.

4.2.2 Land Use and Visual Resources

4.2.2.1 Land Use

Construction and Operations Impacts—Under the No Action Alternative, a total of 26.75 acres (10.8 hectares) would be disturbed during construction of the CMRR Facility (that is, the CMRR-NF and RLUOB) at TA-55. A total of 13.75 acres (5.6 hectares), consisting of land used for buildings (2004 CMRR-NF and RLUOB) and parking lots, would be permanently disturbed. The remaining 13 acres (5.26 hectares) would consist of a construction laydown area (2 acres [0.8 hectares]), an area for a concrete batch plant (5 acres [2 hectares]), and land affected by a road realignment (6 acres [2.4 hectares]). Potential development sites at TA-55 include some areas that have already been disturbed, as well as others that are currently covered with native vegetation, including some mature trees that would have to be cleared prior to construction. Construction and operation of the CMRR Facility at TA-55 would be consistent with the designation of the area for Research and Development and Nuclear Materials Research and Development.

4.2.2.2 Visual Resources

Construction and Operations Impacts—Impacts on visual resources resulting from the construction of the 2004 CMRR-NF at TA-55 under the No Action Alternative would be temporary in nature and could include increased levels of dust and human activity. Once completed, the 2004 CMRR-NF would be one story above ground, and its general appearance would be consistent with current development at LANL. The facility would be readily visible from Pajarito Road and from the upper reaches of the Pajarito Plateau rim. Although the 2004 CMRR-NF would add to the overall development at TA-55, it would not alter the industrial nature of the area. Thus, the current Visual Resource Contrast Class IV rating for TA-55 would not change.

4.2.3 Site Infrastructure

Construction Impacts—Projected annual demands on key site infrastructure resources associated with construction under the No Action Alternative are presented in **Table 4–1**. Existing LANL infrastructure would easily be capable of supporting the construction requirements for the CMRR Facility proposed under this alternative without exceeding site capacities. Although gasoline and diesel fuel would be required to operate construction vehicles, generators, and other construction equipment, fuel would be procured from offsite sources and, therefore, would not be a limited resource. Construction impacts on the local transportation network would be minimal.

Table 4–1 No Action Alternative — Annual Site Infrastructure Requirements for 2004 CMRR-NF and RLUOB Construction

Resource	*Available Site Capacity* [a]	*Total Requirement* [b]	*Percentage of Available Site Capacity*
Electricity			
Energy (megawatt-hours per year)	601,000	63	0.01
Peak load demand (megawatts)	26	0.3	1.2
Fuel			
Natural gas (million cubic feet per year)	5,860	0	0
Water (million gallons per year)	130	0.75	0.6

CMRR-NF= Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Capacity minus the current site requirements, a calculation based on the data provided in Chapter 3, Table 3–3, of this SEIS.

[b] Total estimated infrastructure requirements for the CMRR-NF and RLUOB are presented annually, assuming a 5-year construction period for both facilities.

Source: Table 3–3; DOE 2003b.

Operations Impacts—Resources needed annually to support operations under the No Action Alternative are presented in **Table 4–2**. All of the requirements associated with CMRR Facility operations would be well within the available site capacity.

Table 4–2 No Action Alternative — Annual Site Infrastructure Requirements for 2004 CMRR-NF and RLUOB Operations

Resource	*Available Site Capacity* [a]	*Total Requirement*	*Percentage of Available Site Capacity*
Electricity			
Energy (megawatt-hours per year)	601,000	19,300	3.2
Peak load demand (megawatts)	26	2.6	10
Fuel			
Natural gas (million cubic feet per year)	5,860	Not available	Not available
Water (million gallons per year)	130	10.4	8.0

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Capacity minus the current site requirements, a calculation based on the data provided in Chapter 3, Table 3–3, of this SEIS.

Source: Table 3–3; DOE 2003b.

4.2.4 Air Quality and Noise

NNSA determined that the Clean Air Act "General Conformity Rule" would not apply, and no conformity analysis would be required because LANL is located in an attainment area for all criteria pollutants and ambient air quality standards would not be exceeded (DOE 2003b).

4.2.4.1 Air Quality

Construction Impacts—Construction of a CMRR Facility (2004 CMRR-NF and RLUOB) at TA-55 would result in temporary emissions from construction equipment, trucks, and employee vehicles. Criteria pollutant concentrations were modeled for the construction of the CMRR Facility at TA-55 and compared to the most stringent standards (see **Table 4–3** and Chapter 3, Section 3.4.2). The maximum ground-level concentrations off site or along the perimeter road to which the public has regular access would be below the ambient air quality standards. Concentrations along Pajarito Road adjacent to the construction site would be higher and could exceed the 24-hour ambient standards for nitrogen dioxide, particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}), and total suspended particulates. However, the public would not be allowed access to this section of road. Actual criteria pollutant concentrations are expected to be less because conservative emission factors and other assumptions, which tend to overestimate the impacts, were used in the modeling of construction activities. The maximum short-term concentrations during construction would occur at the eastern site boundary at points accessible to the public on a regular basis. The maximum annual criteria pollutant concentrations would occur at a receptor located to the north at the Royal Crest Trailer Park.

Table 4–3 No Action Alternative — Nonradiological Air Quality Concentrations at Technical Area 55 Site Boundary – Construction

Criteria Pollutant	*Averaging Time*	*NMAAQS (parts per million)* [a]	*Calculated Concentration (parts per million)* [b]
Carbon monoxide	1 hour	13	0.20
	8 hours	8.7	0.026
Nitrogen dioxide	Annual	0.05	0.00059
Sulfur dioxide	3 hours	0.5 [c]	0.0089
	24 hours	0.1	0.0011
	Annual	0.02	3.9×10^{-5}
PM_{10}	24 hours	150 μg/m³	34 μg/m³
Total suspended particulates	24 hours	150 μg/m³	67 μg/m³
	Annual	60 μg/m³	4.0 μg/m³

μg/m³ = micrograms per cubic meter; NMAAQS = New Mexico Ambient Air Quality Standards; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

[a] NMAAQS are more stringent than the Federal standards; thus, emissions are compared to the latest NMAAQS consistent with other air quality analyses in this SEIS. All emissions were converted from micrograms per cubic meter, as shown in Table 4–9 of the *CMRR EIS*, to parts per million using the appropriate corrections for temperature (70 degrees Fahrenheit) and a site elevation of 7,229 feet, in accordance with New Mexico dispersion modeling guidelines (NMAQB 2010).

[b] The annual concentrations were analyzed at locations to which the public has access: the site boundary and nearby sensitive areas. Short-term concentrations were analyzed at the site boundary and at the fence line of the technical area to which the public has short-term access.

[c] NMAAQS does not have a 3-hour standard; thus, the current Federal standard (from the National Ambient Air Quality Standards [NAAQS]) is used here.

Source: DOE 2003a.

Radiological releases from construction activities are not expected. As described in Section 2.5, the RLUOB has been constructed and the CMRR-NF site has been excavated down to about 30 feet (9.1 meters) already and no contamination was encountered. Any suspected or known contaminated areas from prior LANL activities would be evaluated to identify procedures for working within those areas and to determine the need to remove site contamination. Contaminated soils would be removed as necessary to protect worker health or the environment before construction was initiated. Any contaminated soil removed would characterized and disposed of appropriately at LANL or an offsite waste management facility.

Operations Impacts—Under the No Action Alternative, criteria and toxic air pollutants would be generated from operation and testing of an emergency generator at TA-55. **Table 4–4** summarizes the concentrations of criteria pollutants from CMRR Facility operations at TA-55. The concentrations are compared to their corresponding ambient air quality standards (see Chapter 3, Section 3.4.2). The maximum ground-level concentrations that would result from CMRR Facility operations at TA-55 would be below the ambient air quality standards. Actual criteria pollutant concentrations are expected to be less because conservative stack parameters were assumed in the modeling of the diesel emergency generator. The maximum annual criteria pollutant concentrations would occur at the Royal Crest Trailer Park. The maximum short-term concentrations would also occur at the Royal Crest Trailer Park north of TA-55 at the LANL site boundary. No major changes in emissions or air pollutant concentrations at LANL would be expected under this alternative.

Approximately 0.00076 curies per year of actinides and 2,645 curies of fission products and hydrogen-3 (tritium) would be released to the environment from relocated CMR Building operations at TA-55 (DOE 2003b). Impacts of radiological air pollutants are discussed in Section 4.2.10.

Table 4–4 No Action Alternative — Nonradiological Air Quality Concentrations at Technical Area 55 Site Boundary – Operations

Criteria Pollutant	*Averaging Time*	*NMAAQS (parts per million)* [a]	*Calculated Concentration (parts per million)* [b]
Carbon monoxide	1 hour	13	0.027
	8 hours	8.7	0.060
Nitrogen dioxide	Annual	0.05	1.2×10^{-5}
Sulfur dioxide	3 hours	0.5 [c]	0.10
	24 hours	0.1	0.014
	Annual	0.02	5.5×10^{-6}
PM_{10}	24 hours	150 μg/m³	1.4 μg/m³
Total suspended particulates	24 hours	150 μg/m³	2.4 μg/m³
	Annual	60 μg/m³	0.001 μg/m³

μg/m³ = micrograms per cubic meter; NMAAQS = New Mexico Ambient Air Quality Standards; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

[a] NMAAQS are more stringent than the Federal standards; thus, emissions are compared to the latest NMAAQS consistent with other air quality analyses in this SEIS. All emissions were converted from micrograms per cubic meter, as shown in Table 4–10 of the *CMRR EIS*, to parts per million using the appropriate corrections for temperature (70 degrees Fahrenheit) and a site elevation of 7,229 feet, in accordance with New Mexico dispersion modeling guidelines (NMAQB 2010).

[b] The annual concentrations were analyzed at locations to which the public has access: the site boundary and nearby sensitive areas. Short-term concentrations were analyzed at the site boundary and at the fence line of the technical area to which the public has short-term access.

[c] NMAAQS does not have a 3-hour standard; thus, the Federal standard (from the NAAQS) is used here.

Source: DOE 2003a.

4.2.4.2 Greenhouse Gas Emissions

Greenhouse gas emissions were not analyzed in the 2003 *CMRR EIS*. The impacts on greenhouse gas emissions due to construction and operation of the 2004 CMRR-NF under the No Action Alternative are discussed below.

Construction Impacts—Under the No Action Alternative, construction of the 2004 CMRR-NF at TA-55 would result in temporary greenhouse gas emissions from construction equipment, material transport trucks, personnel commutes, and electricity consumption.

Emissions of greenhouse gases from these construction activities, excluding electricity consumption, were estimated to be more than 4,000 tons carbon-dioxide equivalent per year (3,700 metric tons per year) (see **Table 4–5**). Compared to the 2008 site-wide greenhouse gas baseline emissions, 440,000 tons

(400,000 metric tons) of carbon-dioxide equivalent per year (LANL 2011)[2], there would be a minimal and temporary increase (about 1 percent) in greenhouse gases from the construction of the 2004 CMRR-NF under the No Action Alternative.

Table 4–5 No Action Alternative — 2004 CMRR-NF Construction Emissions of Greenhouse Gases

Emissions Scope	*Activity*	*Emissions (tons per year)*			
		CO_2	*CH_4 CO_2e*	*N_2O CO_2e*	*Total CO_2e*
Scope 3 [a]	Sitework/grading	1,300	1	10	1,310
	Construction	1,900	3	40	1,940
	Materials transport	100	0	0	100
	Personnel Commutes	850	1	20	871
	Subtotal	4,150	5	70	4,220
Scope 2 [b]	Electricity Use	66	0	0	66
	Total	4,220	5	71	4,290

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; CO_2 = carbon dioxide; CH_4 CO_2e = methane in carbon-dioxide equivalent; N_2O CO_2e = nitrous oxide in carbon-dioxide equivalent; CO_2e = carbon-dioxide equivalent.

[a] Scope 3 sources include indirect emissions of construction equipment not owned or controlled by LANL.

[b] Scope 2 sources include indirect emissions from the generation of purchased electricity, where the emissions actually occur at sources off site and not at sources owned or controlled by LANL.

[c] The electrical requirement estimated in the 2003 *CMRR EIS* was based on preconceptual design information and is now known to be greatly underestimated.

Note: Totals may not equal the sum of the contributions due to rounding.

Direct greenhouse gas emissions at LANL are those described as Scope 1. There are no established thresholds for greenhouse gases, but in draft guidance issued February 18, 2010, the Council on Environmental Quality (CEQ) suggested that proposed actions that are reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon-dioxide equivalent should be evaluated by quantitative and qualitative assessments. This is not a threshold of significance, but a minimum level that would require consideration in National Environmental Policy Act (NEPA) documentation (see Chapter 3, Section 3.4.4, and Chapter 5, Section 5.4). There would be no direct or Scope 1 greenhouse gas emissions during construction under the No Action Alternative.

Operations Impacts—Operations of the 2004 CMRR-NF and RLUOB would release greenhouse gases into the atmosphere annually as a result of emissions associated with personnel commutes, refrigerants used to cool the building, a backup diesel generator, and electricity consumption (see **Table 4–6**). Since no new hires would be needed, emissions from personnel commutes are already included in the baseline inventory and are not included here. Total greenhouse gases emitted during normal operations of the 2004 CMRR-NF and RLUOB under the No Action Alternative, excluding the offsite emissions from electricity consumption, would be approximately 1,100 tons (1,000 metric tons) of carbon-dioxide equivalent per year. Compared to site-wide greenhouse gas emissions, 440,000 tons (400,000 metric tons) of carbon-dioxide equivalent per year (LANL 2011), there would be a minimal increase in greenhouse gases from normal operations of the 2004 CMRR-NF and RLUOB under the No Action Alternative.

[2] *The projected LANL site-wide greenhouse gas emissions associated with the electrical usage corresponding to the operations selected in the 2008* Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico *(LANL SWEIS) RODs would be 543,000 tons per year.*

Emissions from the generation of purchased electricity occur at offsite power plants that are not owned or controlled by LANL. Emissions from electricity use during the operation of the 2004 CMRR-NF are approximately 12,700 tons per year (11,500 metric tons per year); however, the electrical requirement estimated in the 2003 *CMRR EIS* was based on preconceptual design information and is now known to be greatly underestimated. The total greenhouse gas emissions from the operation of the 2004 CMRR-NF and RLUOB, including electricity use, would be approximately 13,800 tons (12,900 metric tons) per year.

Table 4–6 No Action Alternative — 2004 CMRR-NF and RLUOB Operations Emissions of Greenhouse Gases

Emissions Scope	*Activity*	*Emissions (tons per year)*				
		CO_2	*CH_4 CO_2e*	*N_2O CO_2e*	*HFC CO_2e*	*Total CO_2e*
Scope 1 [a]	Refrigerants Used	N/A	N/A	N/A	1,100	1,100
	Backup Generator	2	0	0	N/A	1.6
	Subtotal	2	0	0	1,100	1,100
Scope 2 [b]	Electricity Use [c]	12,600	5	55	N/A	12,700
	Total	12,600	5	55	1,100	13,800

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; CO_2 = carbon dioxide; CH_4 CO_2e = methane in carbon-dioxide equivalent; N_2O CO_2e = nitrous oxide in carbon-dioxide equivalent; CO_2e = carbon-dioxide equivalent; HFC CO_2e = hydrofluorocarbons in carbon-dioxide equivalent; N/A = not applicable; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Scope 1 sources include emissions of direct stationary sources owned or controlled by LANL.

[b] Scope 2 sources include indirect emissions from the generation of purchased electricity, where the emissions actually occur at sources off site and not owned or controlled by LANL.

[c] The electrical requirement estimated in the 2003 *Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico* was based on preconceptual design information and is now known to be greatly underestimated.

Note: Totals may not equal the sum of the contributions due to rounding.

Direct greenhouse gas emissions at LANL are those described as Scope 1. There are no established thresholds for greenhouse gases, but in draft guidance issued February 18, 2010, the CEQ suggested that proposed actions that are reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon-dioxide equivalent should be evaluated by quantitative and qualitative assessments. This is not a threshold of significance, but a minimum level that would require consideration in NEPA documentation. The direct (Scope 1) greenhouse gas emissions during operations of the 2004 CMRR-NF under the No Action Alternative are from the backup generator and refrigerants used for cooling. Together, the Scope 1 emissions during operation of the 2004 CMRR-NF and RLUOB under the No Action Alternative (1,100 tons or 1,000 metric tons of carbon-dioxide equivalent per year) would be below the CEQ suggested level of 25,000 metric tons per year.

4.2.4.3 Noise

Construction Impacts—Construction of the 2004 CMRR-NF at TA-55 would result in some temporary increase in noise levels near the area from construction equipment and activities. Some disturbance to wildlife near the area could occur as a result of the operation of construction equipment. There would be no change in noise impacts on the public outside of LANL as a result of construction activities, except for a small increase in traffic noise levels from construction employees' vehicles and materials shipment. Noise sources associated with construction at TA-55 are not expected to include loud, impulsive sources such as from blasting.

Operations Impacts—Noise impacts resulting from CMRR Facility operations at TA-55 would be similar to those resulting from existing operations at TA-55. Although there would be a small increase in traffic and equipment noise (such as heating and cooling systems) near the area, there would be little change in noise impacts on wildlife and no change in noise impacts on the public outside of LANL as a result of moving CMR Building activities to TA-55.

4.2.5 Geology and Soils

Construction Impacts—Construction of the CMRR Facility under this alternative would require aggregate and other geologic resources to support construction activities at TA-55, but these resources are abundant within a 500-mile (800-kilometer) radius. Relatively deep subsurface excavation would be required to construct belowground portions of the CMRR Facility.

A site survey and foundation study would be conducted as necessary to confirm site geologic characteristics for facility engineering purposes.

Operations Impacts— CMRR Facility operations under this alternative would not impact geologic or soil resources at LANL. Seismic accident analysis is discussed in Section 4.2.10.2.

4.2.6 Surface-Water and Groundwater Quality

4.2.6.1 Surface Water

Construction Impacts—There are no natural surface-water drainages in the vicinity of the proposed 2004 CMRR-NF site in TA-55 or Mesita del Buey, and no surface water would be used to support facility construction. It is expected that portable toilets would be used for construction personnel, resulting in no onsite direct discharge of sanitary wastewater and no impact on surface waters. Waste generation and management activities are detailed in Section 4.2.12.

Stormwater runoff from construction areas could potentially impact downstream surface-water quality. Appropriate soil erosion and sediment control measures (such as sediment fences and mulching disturbed areas) and spill prevention practices would be employed during construction to minimize suspended sediment and material transport and potential water quality impacts. TA-55 is not in an area that is prone to flooding, and the nearest 100-year floodplains are located at a distance of approximately 650 feet (200 meters) in Twomile Canyon, 1,900 feet (580 meters) in Mortandad Canyon, and 3,000 feet (910 meters) in Pajarito Canyon.

Operations Impacts—No impacts on surface-water quality are expected as a result of CMR operations at TA-55 under this alternative. No surface water would be used to support facility activities, and there would be no direct discharge of sanitary or industrial effluent to surface waters. Sanitary wastewater would be generated by facility staff use of lavatory, shower, and break room facilities and from miscellaneous potable and sanitary uses. As planned, this wastewater would be collected by an expanded TA-55 sanitary sewer system and conveyed to appropriate wastewater treatment facilities for ultimate disposal. Radioactive liquid waste would be transported via a radioactive liquid waste pipeline to the existing Radioactive Liquid Waste Treatment Facility (RLWTF). The design and operation of new buildings would incorporate appropriate stormwater management controls to safely collect and convey stormwater from facilities while minimizing washout and soil erosion. Overall, operational impacts on site surface waters and downstream water quality would be expected to be minimal.

4.2.6.2 Groundwater

Construction Impacts—Groundwater would be required to support construction activities at TA-55. The volume of groundwater required for construction would be small compared to site availability and historic usage, and there would be no onsite discharge of wastewater to the surface or subsurface. No impact on groundwater availability or quality is anticipated from construction activities in TA-55.

Operations Impacts—Relocated CMR operations and activities at TA-55 under the No Action Alternative would use groundwater primarily to meet the potable and sanitary needs of facility support personnel, as well as for miscellaneous building mechanical uses. It is estimated that new building operations under this alternative would require about 10.4 million gallons (39.4 million liters) per year of groundwater. This demand is a small fraction of total LANL usage and would not exceed site availability. Therefore, no additional impact on regional groundwater availability is anticipated.

Waste generation and management activities are detailed in Section 4.2.12. No sanitary or industrial effluent would be discharged directly to the surface or subsurface. Thus, no operational impacts on groundwater quality are expected.

4.2.7 Ecological Resources

4.2.7.1 Terrestrial Resources

Construction Impacts—Although TA-55 is located within the ponderosa pine forest vegetation zone, few trees exist in developed portions of the area. Where construction would occur on previously disturbed land, there would be little or no impact on terrestrial resources. However, construction would remove some previously undisturbed ponderosa pine forest, resulting in the loss of less-mobile wildlife, such as reptiles and small mammals, and causing more-mobile species, such as birds or large mammals, to be displaced. The success of displaced animals would depend on the carrying capacity[3] of the area into which they move. If the area were at or near its carrying capacity, displaced animals would not likely survive. (Since the issuance of the 2004 ROD associated with the *CMRR EIS*, activities at the proposed TA-55 site related to RLUOB construction and geological studies have resulted in the elimination of this forestland.) Indirect impacts of construction, such as noise or human disturbance, could also impact wildlife living adjacent to the construction zone. Although temporary, such disturbance would span the construction period and the time required for the habitat to naturally regenerate. The work area would be clearly marked to prevent construction equipment and workers from disturbing adjacent natural habitat.

Operations Impacts—CMRR Facility operations would have a minimal impact on terrestrial resources within or adjacent to TA-55. As wildlife residing in the area has already adjusted to current levels of noise and human activity associated with current TA-55 operations, it is unlikely to be adversely affected by similar activities associated with CMRR Facility operations. Areas not permanently disturbed by the new CMRR Facility (for example, construction laydown areas) would be landscaped. While these areas would provide some habitat for wildlife, it is likely that species composition and density would differ from preconstruction conditions.

4.2.7.2 Wetlands

Construction and Operations Impacts—Although there are three areas of wetlands located within TA-55, none is present in the proposed 2004 CMRR-NF construction area. Thus, there would be no direct impacts on wetlands. Further, indirect impacts on these wetlands due to erosion should not occur because water from the site drains into the Pajarito watershed and not the Mortandad watershed, in which these wetlands are located. In addition, a sediment and erosion control plan would be implemented to control stormwater

[3] *Carrying capacity in the ecological context is defined as the threshold of stress below which populations and ecosystem functions can be sustained.*

runoff during construction and operation, thus preventing impacts on wetlands located further down Pajarito Canyon.

4.2.7.3 Aquatic Resources

Construction and Operations Impacts—The only aquatic resources present at TA-55 are small pools associated with wetlands. There would be no impact on these resources from the construction of the 2004 CMRR-NF or operation of the CMRR Facility.

4.2.7.4 Threatened and Endangered Species

Construction Impacts—Areas of environmental interest have been established for the Mexican spotted owl and southwestern willow flycatcher. (Since the issuance of the 2004 ROD associated with the *CMRR EIS*, the bald eagle has been federally delisted due to recovery.) Portions of TA-55 include both core and buffer zones for the Mexican spotted owl, federally classified as a threatened species; however, annual surveys have not identified the spotted owl within these zones. Construction of the 2004 CMRR-NF is not expected to directly affect individuals of this species, but could remove a small portion of the Mexican spotted owl's habitat buffer area; this potential effect on Mexican spotted owl habitat would not likely be adverse. In 2003, the U.S. Fish and Wildlife Service concurred with NNSA's determination that the construction and operation of the CMRR Facility at TA-55 would not be likely to adversely affect either individuals of threatened or endangered species currently listed or their critical habitat at LANL. Core and buffer zones for the southwestern willow flycatcher do not overlap TA-55. No impacts that violate the provisions of the Bald and Golden Eagle Protection Act or the Migratory Bird Treaty Act have been identified.

Operations Impacts—CMRR Facility operations at TA-55 would not directly affect any endangered, threatened, or special status species. Noise levels associated with the CMRR Facility would be low, and human disturbance would be similar to that already occurring within TA-55; however, parking activities at the CMRR Facility could be in close proximity to the Mexican spotted owl's potential habitat area and may indirectly affect that potential habitat. In addition, nighttime lighting at the parking lot could indirectly affect prey species activities; therefore it would not be directed toward canyon areas to reduce such impacts. These are not likely to be adverse effects on the Mexican spotted owl's potential habitat areas.

4.2.8 Cultural and Paleontological Resources

Construction and Operations Impacts—Adverse impacts on historic resources at TA-55 resulting from construction and operation of the CMRR Facility are not expected. There are no prehistoric sites located within TA-55. There is one prehistoric site located near the boundary of TA-55 within TA-48 that is eligible for listing in the National Register of Historic Places (NRHP). This site would be avoided during construction of the 2004 CMRR-NF and operation of the CMRR Facility. Some of the 10 historic sites located within TA-55 could be disturbed by the construction of the 2004 CMRR-NF. As appropriate, NNSA would consult with the State Historic Preservation Officer and, if necessary, data and artifact recovery would be conducted. There are no known paleontological resources present at TA-55 at LANL.

The area at TA-55 proposed to house the 2004 CMRR-NF has not been surveyed for traditional cultural properties. If any traditional cultural properties are found during construction, work would stop while appropriate actions are undertaken. Thus, it is expected that there would be no impacts on these resources.

4.2.9 Socioeconomics

Construction Impacts—Construction of new buildings at TA-55 to house CMR activities would require a peak construction employment level of 300 workers. This level of employment would generate about 852 indirect jobs in the region around LANL. The potential total employment increase of 1,152 direct and indirect jobs represents an approximate 1.3 percent increase in the workforce and would occur over the proposed construction period. This small increase would have little or no noticeable impact on the socioeconomic conditions of the region of influence (ROI).

Operations Impacts—CMRR Facility operations would require a workforce of approximately 550 workers. As evaluated in the *CMRR EIS*, this would be an increase of about 340 workers over currently restricted CMR Building operational requirements. Nevertheless, the increase in the number of workers in support of expanded CMRR Facility operations would have little or no noticeable impact on socioeconomic conditions in the LANL ROI. New LANL employees hired to support the CMRR Facility would compose a small fraction of the LANL workforce and an even smaller fraction of the regional workforce.

4.2.10 Human Health

4.2.10.1 Normal Operations

Radiological Impacts

Construction Impacts—No radiological risks would be incurred by members of the public from construction activities. Construction workers would be at a small risk for construction-related accidents and radiological exposures. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, these workers would be protected through appropriate training, monitoring, and management controls. Their exposure would be limited to ensure that doses are kept as low as is reasonably achievable.

Operations Impacts—Normal operations of the CMRR Facility at TA-55, as evaluated in the 2003 *CMRR EIS*, are not expected to result in an increase in latent cancer fatalities (LCFs) in the general public. Under this alternative, the radiological releases to the atmosphere from the 2004 CMRR-NF and RLUOB at TA-55 would be those shown in **Table 4–7**. The actinide emissions listed in this table are in the form of plutonium, uranium, thorium, and americium isotopes. In estimating the human health impacts, all emissions were considered to be plutonium-239. This is conservative because the human health impacts on a per-curie basis are greater for plutonium-239 than for the other actinides associated with CMR activities.

Doses from radiological emissions under the No Action Alternative are presented as they were reported in the 2003 *CMRR EIS*. They were based on internal dose conversion factors from Federal Guidance Report No. 11 (EPA 1988). For the same exposure, doses would be slightly lower using the more recent Federal Guidance Report No. 13 (EPA 1993b) factors. **Table 4–8** shows the annual collective dose to the population living within a 50-mile (80-kilometer) radius of the CMRR Facility at TA-55 was estimated to be 1.9 person-rem under the No Action Alternative. This population dose increases the annual risk of a single latent fatal cancer in the population by 0.0011. Another way of stating this is that the likelihood that one fatal cancer would occur in the population as a result of radiological releases associated with this alternative is about 1 chance in 1,000 per year. Statistically, LCFs are not expected to occur in the population as a result of CMRR Facility operations at TA-55.

Table 4–7 No Action Alternative — 2004 CMRR-NF and RLUOB Radiological Emissions During Normal Operations

Nuclide	*Emissions (curies per year)*
Actinides	0.00076
Krypton-85	100
Xenon-131m	45
Xenon-133	1,500
Hydrogen-3 (tritium) [a]	1,000

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] The tritium release is in the form of both tritium oxide (750 curies) and elemental tritium (250 curies). Tritium oxide is more readily absorbed by the body; therefore, the health impact of tritium oxide on a receptor is greater than that for elemental tritium. For this reason, all of the tritium release has been conservatively modeled as if it were tritium oxide.

Source: DOE 2003b.

Table 4–8 No Action Alternative — Annual Radiological Impacts of CMRR-NF and RLUOB Operations on the Public

	Population Within 50 Miles [a] *(80 kilometers)*	*Average Individual Within 50 Miles (80 kilometers)*	*Maximally Exposed Individual*
Dose	1.9 person-rem	0.0063 millirem	0.33 millirem
Cancer fatality risk [b]	0.0011	4×10^{-9}	2×10^{-7}
Regulatory dose limit [c]	Not applicable	10 millirem	10 millirem
Dose as a percentage of the regulatory limit	Not applicable	0.06	3.3
Dose from background radiation [d]	139,000 person-rem	450 millirem	450 millirem
Dose as a percentage of background dose	0.0014	0.0014	0.07

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] The population dose for this table was based on the 2000 population estimate of about 309,000 surrounding TA-55, as shown in Table 4–12 of the *Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico.*

[b] Based on a risk estimate of 0.0006 latent cancer fatalities per person-rem (DOE 2003a).

[c] 40 *Code of Federal Regulations* Part 61, Subpart H, establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations. There is no standard for a population dose.

[d] The annual individual dose from background radiation at LANL is 480 millirem (see source of ubiquitous background radiation in Chapter 3, Section 3.11.1).

Source: DOE 2003b.

The average annual dose to an individual in the population would be 0.0063 millirem. The corresponding increased risk of an individual developing a fatal cancer from receiving the average dose would be 4×10^{-9}, or about 1 chance in 250 million per year. The maximally exposed individual (MEI) member of the public would receive an estimated annual dose of 0.33 millirem. This dose corresponds to an increased annual risk of developing a fatal cancer of 2×10^{-7}. In other words, the likelihood that the MEI would develop a fatal cancer is about 1 chance in 5 million for each year of operation.

Estimated annual doses to workers involved with CMRR Facility operations (involved workers) under the No Action Alternative are provided in **Table 4–9**. The estimated worker doses are based on historical exposure data for LANL workers (DOE 2003b). Based on the reported data, the average annual dose to a LANL worker who received a measurable dose was 104 millirem. A value of 110 millirem has been used as the estimate of the average annual worker dose per year of operations at the 2004 CMRR-NF and RLUOB at TA-55.

Table 4–9 No Action Alternative —Annual Radiological Impacts of 2004 CMRR-NF and RLUOB Operations on Workers

	Individual Worker	*Worker Population* [a]
Dose	110 millirem	61 person-rem
Fatal cancer risk [b]	0.000066	0.04
Dose limit [c]	5,000 millirem	Not available
Administrative control level [d]	500 millirem	Not available

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Based on a worker population of 550 for the 2004 CMRR-NF at Technical Area 55. Dose limits and administrative control levels do not exist for worker populations.

[b] Based on a worker risk estimate of 0.0006 latent cancer fatalities per person-rem (DOE 2003a).

[c] 10 CFR 835.202.

[d] DOE 1999b (DOE Standard 1098-99).

Source: DOE 2003b.

This 110-millirem dose is well below the DOE worker dose limit of 5 rem (5,000 millirem) (10 *Code of Federal Regulations* [CFR] Part 835) and is significantly less than the recommended Administrative Control Level of 500 millirem (DOE 1999b). This average annual dose corresponds to an increased risk of a fatal cancer of 0.000066 for each year of operations. In other words, the likelihood that a worker would develop a fatal cancer from annual work-related exposure is about 1 chance in 14,000.

Based on a worker population of 550, the estimated annual worker population dose would be 61 person-rem. This would increase the likelihood of a fatal cancer within the worker population by 0.04 per year. In other words, on an annual basis, there is less than 1 chance in 25 of one fatal cancer developing in the entire worker population (550 workers) as a result of exposures associated with activities under this alternative.

Hazardous Chemical Impacts

No chemical-related health impacts on the public would be associated with this alternative. The laboratory quantities of chemicals that could be released to the atmosphere during normal operations are minor quantities and would be below the screening levels used to determine the need for additional analysis. Workers would be protected from adverse effects from the use of hazardous chemicals by adherence to Occupational Safety and Health Administration (OSHA) and U.S. Environmental Protection Agency (EPA) occupational standards that limit concentrations of potentially hazardous chemicals.

4.2.10.2 Facility Accidents

Radiological Impacts

Radiological impacts of facility accidents at the 2004 CMRR-NF were evaluated in the *CMRR EIS*. Appendix C of the *CMRR EIS* provides the methodology and assumptions used to develop facility accident scenarios and estimate doses to the general public within 50 miles (80 kilometers), to an MEI, and to an onsite worker near the facility. The doses included in the *CMRR EIS* were calculated using MACCS2 [MELCOR Accident Consequence Code Systems], Version 1.12. The accident scenarios in the *CMRR EIS* were reviewed and compared with accidents from more-recent safety analyses for the CMR Building and preliminary analyses for the 2004 CMRR-NF (LANS 2011a, 2011b). Based on this review, four accidents are included in this *CMRR-NF SEIS*, representing a wide range of possible accidents and risks (see Appendix C). The four accident scenarios are common to all three alternatives analyzed in this *CMRR-NF SEIS*. They are a facility-wide fire, a seismically induced spill, a seismically induced fire, and a loading dock spill/fire.

In this SEIS, doses were estimated using MACCS2, Version 1.13.1. Using the scenarios discussed above, the only other changes in parameters used from those presented in Appendix C of the *CMRR EIS* are a new 2030 projected population distribution within 50 miles (80 kilometers) of the 2004 CMRR-NF (projected to be about 545,000 persons surrounding TA-55) and a revised distance to the nearest offsite individual (0.75 miles [1.2 kilometers]) from the 2004 CMRR-NF. All other assumptions are consistent with those presented in Appendix C of the *CMRR EIS*. Because of these changes, the calculated consequences and risks presented in this SEIS are different from those estimated in the 2003 *CMRR EIS*.

As indicated in Appendix C of this *CMRR-NF SEIS*, two sets of accident source terms are presented. First, the conservative source terms developed in the safety-basis process at LANL are presented. In general, these conservative source term estimates take little or no credit for the integrity of containers or building confinement under severe accidents and assume a damage ratio of 1, meaning that all material at risk would be subjected to the similar, near worst-case conditions. Furthermore, these safety evaluations assume that all of the material at risk that is made airborne and respirable is released to the environment (leak path factor of 1).

For purposes of this *CMRR-NF SEIS*, a second set of source terms was developed that presents reasonable, but still conservative, estimates of source terms. These source terms take into account a range of responses of facility features and materials containers and typical operating practices at plutonium facilities at LANL and elsewhere. Therefore, for design-basis-type accidents, a damage ratio of 1 normally would not be realistic if the containers, process enclosures, limits on combustibles, and similar types of safety systems functioned during the accident. Similarly, the building confinement, including high-efficiency particulate air (HEPA) filters, would be expected to remain functioning, although at perhaps a degraded level, during and after the accident.

Tables 4–10 and **4–11** provide the revised accident consequences and risks, respectively. These tables provide accident consequences and risks to the offsite MEI, a member of the public at the nearest public location (0.75 miles [1.2 kilometers] north-northeast from TA-55); the offsite population living within 50 miles (80 kilometers) of the CMRR-NF at TA-55; and a noninvolved worker assumed to be at the TA-55 boundary, about 240 yards (220 meters) from the CMRR-NF.

Table 4–10 presents the frequencies and consequences of the postulated set of accidents for these three receptors, and Table 4–11 presents the accident risks obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur.

As shown in Table 4–11, the accident with the highest potential risk would be a seismically induced spill (safety-basis scenario) that would severely damage the 2004 CMRR-NF. The annual risk of an LCF for the MEI would be 7×10^{-3}. In other words, the MEI's likelihood of developing a fatal cancer from this event would be about 1 chance in 143 per year. The dose to the offsite population would increase the risk of fatal cancers in the entire population. The risk of developing one fatal cancer in the entire population from this event would be 8×10^{-1} per year. LCFs are expected to occur in the population if this accident occurs in the 2004 CMRR-NF. The risk of an LCF to a noninvolved worker would be 1×10^{-2}, or about 1 chance in 100 per year.

Table 4–10 No Action Alternative — Accident Frequency and Consequences

		Maximally Exposed Individual		*Offsite Population* [a]		*Noninvolved Worker at TA Boundary*	
Accident	*Frequency (per year)*	*Dose (rem)*	*Latent Cancer Fatality* [b]	*Dose (person-rem)*	*Latent Cancer Fatalities* [c]	*Dose (rem)*	*Latent Cancer Fatality* [b]
Safety-Basis Scenarios							
Facility-wide fire	0.0001	1.1	0.0007	710	0 (0.4)	5.9	0.004
Seismically induced spill	0.01	600	0.7	140,000	80	20,000	1
Seismically induced fire	0.0001	5,000	1	3,800,000	2,000	27,000	1
Loading dock spill/fire	0.01	0.028	0.00002	6.4	0 (0.004)	1.0	0.0006
SEIS Scenarios							
Facility-wide fire	0.000001	0.011	0.000007	7.2	0 (0.004)	0.059	0.00004
Seismically induced spill	0.001	6.0	0.004	1,400	1 (0.8)	200	0.2
Seismically induced fire	0.0001	2.4	0.001	1,800	1	13	0.008
Loading dock spill/fire	0.0001	0.028	0.00002	6.4	0 (0.004)	1.0	0.0006

SEIS = supplemental environmental impact statement, TA = technical area.
[a] Based on a projected 2030 population estimate of 545,000 persons residing within 50 miles (80 kilometers) of TA-55.
[b] Increased likelihood of an LCF for an individual if the accident occurs.
[c] Increased number of LCFs in the offsite population if the accident occurs (results rounded to one significant figure). When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses.

Table 4–11 No Action Alternative — Annual Accident Risks

	Risk of Latent Cancer Fatality		
Accident	*Maximally Exposed Individual* [a]	*Offsite Population* [b, c]	*Noninvolved Worker at TA Boundary* [a]
Safety-Basis Scenarios			
Facility-wide fire	7×10^{-8}	4×10^{-5}	4×10^{-7}
Seismically induced spill	7×10^{-3}	8×10^{-1}	1×10^{-2}
Seismically induced fire	1×10^{-4}	2×10^{-1}	1×10^{-4}
Loading dock spill/fire	2×10^{-7}	4×10^{-5}	6×10^{-6}
SEIS Scenarios			
Facility-wide fire	7×10^{-12}	4×10^{-9}	4×10^{-11}
Seismically induced spill	4×10^{-6}	8×10^{-4}	2×10^{-4}
Seismically induced fire	1×10^{-7}	1×10^{-4}	8×10^{-7}
Loading dock spill/fire	2×10^{-9}	4×10^{-7}	6×10^{-8}

SEIS = supplemental environmental impact statement, TA = technical area.
[a] Increased risk of an LCF to the individual.
[b] Increased risk of an LCF in the offsite population.
[c] Based on a projected 2030 population estimate of 545,000 persons residing within 50 miles (80 kilometers) of TA-55.

The risks associated with seismically induced accidents at the 2004 CMRR-NF, if they were to occur, would exceed DOE guidelines (see Appendix C) and would present unacceptable risks to the public and the LANL workforce. This is because the building is predicted to fail in the event of a design-basis earthquake (see Appendix C). The results presented in Tables 4–10 and 4–11 indicate that the 2004 CMRR-NF presents a very high risk to the offsite population. To reduce the doses to the offsite MEI and offsite population from these accidents to acceptable levels, the material at risk in the 2004 CMRR-NF would have to be reduced from 6.6 tons (6.0 metric tons) to about 11 pounds (5 kilograms) or less, severely limiting the usefulness of the building and rendering it unable to fulfill its mission.

Involved Worker Impacts

Approximately 550 workers would be at the 2004 CMRR-NF and RLUOB during operations. Workers near an accident could be at risk of serious injury or death. Following initiation of accident and site emergency alarms, workers in adjacent areas of the facility would evacuate the area in accordance with the technical area and facility emergency operating procedures and training in place.

Hazardous Chemicals and Explosives Impacts

Some of the chemicals used in CMRR Facility operations are toxic and carcinogenic. The quantities of the regulated hazardous chemicals and explosive materials stored and used in the 2004 CMRR-NF would be well below the threshold quantities set by the EPA (40 CFR Part 68) and would pose minimal potential hazards to the public health and the environment in an accident condition. These chemicals would be stored and handled in laboratory quantities and would only be a hazard to involved workers under accident conditions.

4.2.10.3 Intentional Destructive Acts

NNSA has prepared a classified appendix to this *CMRR-NF SEIS* that evaluates the potential impacts of malevolent, terrorist, or intentional destructive acts. Substantive details of terrorist attack scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. NNSA's strategy for mitigation of environmental impacts resulting from extreme events, including intentional destructive acts, has three distinct components: (1) prevention or deterrence of successful attacks; (2) planning and timely and adequate response to emergency situations; and (3) progressive recovery through long-term response in the form of monitoring, remediation, and support for affected communities and the environment.

Depending on the intentional destructive acts, the impacts could be similar to the impacts of the accidents analyzed in this SEIS. However, there may be intentional destructive act scenarios for which the impacts exceed those of the accidents analyzed. Analysis of these intentional destructive act impacts provides NNSA with information upon which to base, in part, decisions regarding the construction and operation of the 2004 CMRR-NF. The classified appendix evaluates the similarity of scenarios involving intentional destructive acts with those evaluated in the *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico (LANL SWEIS)* and *Complex Transformation Supplemental Programmatic Environmental Impact Statement* and presents the potential consequences to a noninvolved worker, an MEI, and the population in terms of physical injuries, radiation doses, and LCFs. Although the results of the analyses cannot be disclosed, the following general conclusion can be drawn: the potential consequences of intentional destructive acts are highly dependent on the distance to the site boundary and the size and proximity of the surrounding population; the closer and denser the surrounding population, the higher the consequences. In addition, it is generally easier and more cost-effective to protect new facilities because new security features can be incorporated into their design. In other words, the protective forces needed to defend new facilities may be smaller due to the inherent security features of a new facility. New facilities can, as a result of design features, better prevent security attacks and reduce the impacts of such attacks.

4.2.11 Environmental Justice

Construction Impacts—As discussed throughout the other subsections of Section 4.2, environmental impacts due to construction would be temporary and would not extend beyond the boundary of LANL. For these reasons, under the No Action Alternative, construction at TA-55 would not result in disproportionately high and adverse environmental impacts on the public living within the potentially affected area surrounding TA-55, including low-income and minority populations.

Operations Impacts—Radiological and hazardous chemical risks to the public resulting from normal operations would be small. Table 4–8 shows the health risks associated with these releases also would be small. Normal operations at the CMRR Facility at TA-55 are not expected to cause fatalities or illness among the general population surrounding TA-55, including minority and low-income populations living within the potentially affected area.

Residents of the Pueblo of San Ildefonso have expressed concern that pollution from CMRR Facility operations could contaminate Mortandad Canyon, which drains onto pueblo land and sacred areas. CMRR Facility operations under this alternative are not expected to adversely affect air quality. There would be no direct liquid discharges and stormwater management controls would be in place to collect stormwater and prevent washout and soil erosion. Thus, there would be no contamination of tribal lands adjacent to the LANL boundary (DOE 2003b). In summary, implementation of the No Action Alternative would not pose disproportionately high and adverse environmental risks to low-income or minority populations living in the potentially affected area around the CMRR Facility at TA-55.

4.2.12 Waste Management and Pollution Prevention

Construction Impacts—Only nonhazardous waste would be generated from construction activities to relocate CMR Building operations and materials to the 2004 CMRR-NF at TA-55. No radioactive or hazardous waste would be generated during construction activities.

Solid, nonhazardous waste generated from construction activities associated with the 2004 CMRR-NF at TA-55 would be processed at the Los Alamos County Eco Station, where it would be separated into materials suitable for recycle or disposal, then disposed of at an offsite solid waste facility permitted to accept the waste. Approximately 578 tons (524 metric tons) of solid, nonhazardous waste, consisting primarily of gypsum board, wood scraps, nonrecyclable scrap metals, concrete, steel, and other construction waste, would be generated from the construction activities. Over the construction period, this would represent about 20 percent of the annual solid nonhazardous waste generated at LANL. Management of this additional waste at LANL would be within the capabilities of the LANL waste management program, but additional waste management personnel may be required.

Construction debris would be collected in appropriate waste containers and transported to the receiving landfill on a regular basis. Sanitary wastewater generated as a result of construction activities would be managed using portable toilet systems. No other nonhazardous liquid wastes are expected.

Operations Impacts—The impacts on the LANL waste management systems, in terms of managing the waste, are discussed in this section. Waste generation rates, by waste type, are summarized in **Table 4–12** for CMRR Facility operations and overall LANL activities. Radioactive solid and liquid wastes from CMRR Facility operations would constitute only a portion of the total amounts of these wastes generated, treated, and/or disposed of at LANL. The radiological and chemical impacts of managing CMRR Facility radioactive waste on workers and the public have been evaluated along with the other LANL site wastes in other environmental documentation (at the time of the 2003 *CMRR SEIS*, the 1999 *LANL SWEIS* (DOE 1999b) included evaluation of these wastes).

Table 4–12 No Action Alternative — Operational Waste Generation Rates Projected for CMRR Facility and Los Alamos National Laboratory Activities

Waste Type	*Units*	*CMRR Facility Generation Rate* [a]	*Site-Wide LANL Projections* [b]
Transuranic and mixed transuranic	Cubic yards per year	88 [c]	440 to 870
Low-level radioactive	Cubic yards per year	2,640 [d]	21,000 to 115,000
Liquid low-level radioactive	Gallons per year	2,700,000	4,000,000
Mixed low-level radioactive	Cubic yards per year	26	320 to 18,100
Chemical [e]	Tons per year	12.4	3,200 to 5,750
Sanitary	Gallons per year	7,200,000 [f]	156,000,000 [g]

CMRR = Chemistry and Metallurgy Research Replacement; LANL = Los Alamos National Laboratory.
[a] DOE 2003b.
[b] Estimated site-wide LANL projections based on estimates included in the 2008 *LANL SWEIS* (DOE 2008a).
[c] Includes both transuranic and mixed transuranic waste.
[d] Volumes of low-level radioactive waste include solid wastes generated by the treatment of low-level radioactive liquid wastes generated by CMRR Facility operations.
[e] Chemical waste is not a formal LANL waste category; however, as was done in the 2008 *LANL SWEIS* (DOE 2008a), the term is used in this supplemental EIS to denote a variety of materials including hazardous waste regulated under the Resource Conservation and Recovery Act; toxic waste regulated under the Toxic Substances Control Act; and special waste designated under the New Mexico Solid Waste Regulations, including industrial waste, infectious waste, and petroleum-contaminated soil.
[f] Calculated assuming 550 CMRR Facility workers, each generating 50 gallons per day for 260 workdays per year.
[g] The value shown is the annual volume of wastewater processed at the Sanitary Wastewater Systems Plant in TA-46, assuming operation at its 600,000-gallon-per-day (2.27-million-liter-per-day) design capacity for 260 working days per year (DOE 2003b). Sanitary wastewater and nonradioactive liquid waste are both projected to be routed to the Sanitary Wastewater Systems Plant for treatment.
Note: The generation rates are attributed to facility operations and do not include the waste generated from environmental restoration actions.

Transuranic and Mixed Transuranic Wastes

Analytical, processing, fabrication, and research and development activities at the CMRR Facility would generate transuranic waste. Approximately 88 cubic yards (67 cubic meters) of transuranic and mixed transuranic waste would be generated each year. This transuranic and mixed transuranic waste represents about 10 to 20 percent of the total transuranic waste generated annually at LANL. Any transuranic waste generated by CMRR Facility operations would be transported to the Waste Isolation Pilot Plant (WIPP) or a similar facility for disposition. Transuranic waste volumes generated through CMRR Facility operations over the life of the facility are estimated to be less than 2 percent of the WIPP capacity. Offsite disposal capacities for transuranic waste are expected to be adequate for the disposal needs of LANL, including CMRR Facility operations.

Low-Level Radioactive Waste

About 2,640 cubic yards (2,020 cubic meters) of solid low-level radioactive waste would be generated each year from CMRR Facility operations. This represents about 3 to 13 percent of the total low-level radioactive waste generated annually at LANL. Volumes of low-level radioactive waste from CMRR Facility operations include the solid low-level radioactive component of liquid wastes treated through the RLWTF or a similar facility. The impacts of managing this waste at LANL would be minimal.

CMRR Facility operations would also generate liquid low-level radioactive waste. Because the exact amount of liquid low-level radioactive waste that would be generated by the CMRR Facility at TA-55 is not known, the 10,400 gallons (39,400 liters) per day (2.7 million gallons [10 million liters] per year) associated with operations in the CMR Building were estimated to be generated by operations at the CMRR Facility as well. Therefore, the amount of solid low-level radioactive waste that would result from RLWTF treatment of liquid low-level radioactive waste generated by CMRR Facility operations was estimated to be 200 cubic yards (150 cubic meters) annually and is included as low-level radioactive waste in Table 4–12. RLWTF capacity is expected to be sufficient to manage the liquid low-level radioactive waste generated by CMRR Facility operations.

Mixed Low-Level Radioactive Waste

Mixed low-level radioactive waste generated from CMRR Facility operations at TA-55 would be surveyed and decontaminated on site, if possible. Those wastes would be treated on site or stored and processed at TA-54, Area G, or Area L and transported to a commercial or DOE offsite treatment and disposal facility. About 26 cubic yards (20 cubic meters) of mixed low-level radioactive waste would be generated each year. This represents less than 1 to 8 percent of the current mixed low-level radioactive waste generated at LANL. The impacts of managing this waste at LANL would be minimal.

Sanitary Wastewater

Sanitary wastewater generated from CMRR Facility operations at TA-55 would be sent to the Sanitary Wastewater Systems Plant. Approximately 27,500 gallons per day (104,000 liters per day) of sanitary wastewater would be generated for 260 working days per year. This would represent about 4.6 percent of the 600,000-gallon-per-day (2.27-million-liter-per-day) design capacity of the Sanitary Wastewater Systems Plant.

Chemical Waste

Chemical waste generated from CMRR Facility operations at TA-55 would be decontaminated or recycled, if possible. Typically, chemical waste is not held in long-term storage at LANL. Approximately 12.4 tons (11.2 metric tons) of chemical waste would be generated each year. This represents less than 1 percent of the annual chemical waste generation rate for the entire LANL site. The impacts of managing this waste at LANL would be minimal.

4.2.13 Transportation and Traffic

4.2.13.1 Transportation

A transportation impact assessment was conducted for (1) the one-time movement of special nuclear material (SNM), equipment, and other materials during the transition from the existing CMR Building to the 2004 CMRR-NF and (2) the routine onsite shipment of analytical chemistry and materials characterization samples between the Plutonium Facility at TA-55 and the CMRR Facility at TA-55. The results of this impact assessment are presented below for incident-free and transportation accident impacts to the public and workers.

Routine (Incident-Free) Transportation

One-Time Movement of SNM, Equipment, and Other Materials—Transport of SNM, equipment, and other materials currently located at the CMR Building to the 2004 CMRR-NF at TA-55 would occur on open or closed roads. The public is not expected to receive any measurable exposure from the one-time movement of radiological materials associated with this action.

CMR Building workers could receive a minimal dose from shipping and handling of SNM during the transition from the existing CMR Building to the 2004 CMRR-NF. Based on a review of radiological exposure information, the average dose to CMR Building workers (including material handlers) is about 110 millirem per year. The material handler worker dose from shipping and handling of SNM would be similar to those for normal operations currently performed at the CMR Building.

Routine Onsite Shipment of Analytical Chemistry and Materials Characterization Samples—The public is not expected to receive any additional measurable exposure from the movement of small quantities of radioactive materials and SNM samples between the Plutonium Facility at TA-55 and the CMRR Facility at TA-55. These include metal, liquid, or powder samples of weapons-grade plutonium, plutonium-238, uranium-235, uranium-233, and other actinide isotopes.

Transportation Accidents

One-Time Movement of SNM, Equipment, and Other Materials—Potential handling and transport accidents during the one-time movement of SNM, equipment, and other materials during the transition from the existing CMR Building to the 2004 CMRR-NF at TA-55 would be bounded in frequency and consequence by other facility accidents under each of the alternatives presented in this chapter. Once a shipment is prepared for low-speed movement, the likelihood and consequences of any foreseeable accident are considered to be very small.

4.2.13.2 Traffic

Construction Impacts – Truck Traffic—Under the No Action Alternative, construction of the 2004 CMRR-NF would take approximately 3 years. Construction impacts would occur in the time period from 2012 to 2015. This alternative would require excavation of a 68,000-square-foot (6,300-square-meter) area to a depth of 50 feet (15 meters), of which approximately 30 feet (9.1 meters) have already been excavated as part of the geologic analysis of the site, leaving approximately 20 feet (6.1 meters) to be excavated. The excavated soil and rock material would be stored in temporary storage piles assumed to be located approximately 3 miles (4.8 kilometers) from the 2004 CMRR-NF construction site in appropriate storage areas. Excavation of the additional 20 feet and the tunnels to be constructed between RLUOB and the TA-55 Plutonium Facility to the 2004 CMRR-NF would require the removal of approximately 77,000 cubic yards (59,000 cubic meters) of material. This would take approximately 5,000 20-ton truck round trips or 3,300 30-ton truck round trips to move. This material would be staged at a LANL materials staging area for future reuse in other LANL projects.

The number of truck trips per hour would depend on the method used for excavation of the 2004 CMRR-NF. Assuming a 20-minute round trip to the LANL materials staging area, it would take approximately 54 days with one loader and 20-ton trucks or approximately 36 days with one loader and 30-ton trucks to remove the excavated soils and rock. This time period could be shortened by using two loaders, which would be preferable because it would keep trucks operating more efficiently. On a per-hour basis, these trips would be insignificant to the level of service on Pajarito Road. The acceleration of the loaded earthwork trucks would be slow and would result in lower speeds and some reduction in the level of service in the road segment where the trucks accelerate. Pajarito Road is not accessible by the public.

Bulk materials would be delivered to the 2004 CMRR-NF by either standard three-axle dump trucks (20-ton trucks) or five-axle bottom dump trucks (30-ton trucks). This material would be required over the period when the foundation and shell of the 2004 CMRR-NF are being constructed. Approximately 3,200 cubic yards (2,400 cubic meters) of structural concrete and 5,000 cubic yards (3,800 cubic meters) of other concrete would be required (DOE 2003b). To support the concrete batch plant operation for all concrete operations, the following materials would be required (DOE 2003b):

- Approximately 3,700 tons (3,400 metric tons) of coarse aggregate (180 20-ton trucks or 120 30-ton trucks)
- Approximately 3,700 tons (3,400 metric tons) of fine aggregate (sand) (180 20-ton trucks or 120 30-ton trucks)
- Approximately 1,500 tons (1,400 metric tons) of cement (75 20-ton trucks or 50 30-ton trucks)
- Approximately 800 tons (730 metric tons) of fly ash (40 20-ton trucks or 27 30-ton trucks)

The No Action Alternative would also require approximately 270 tons (240 metric tons) of structural steel (14 20-ton trucks or 9 30-ton trucks) (DOE 2003b).

Most of the length of Pajarito Road from TA-63 to White Rock was repaved in October 2010 (LANL 2011). It now consists of an average of 4 inches of asphaltic concrete over 8 inches of aggregate base course. Consideration of the methods contained in the *AASHTO Guide for Design of Pavement Structures* (AASHTO 1993) indicates that this pavement would withstand the expected truck traffic only if the relative quality of the roadbed soil is "very good" according to American Association of State Highway and Transportation Officials standards. If the relative quality of the roadbed soil is less strong, it is possible that the pavement would fail structurally. A second method of failure would be at the edge of the pavement if that edge is not adequately supported laterally. Pajarito Road has 8-foot, paved shoulders, which would provide the necessary lateral support. The roadway shoulders and especially the edges of the shoulders might be subject to damage if trucks were to use the shoulders on a regular basis.

Construction Impacts – Worker Traffic—Under all alternatives, the workers going to the 2004 CMRR-NF are expected to use the public roadways. A peak of 300 workers is anticipated to commute to parking areas. For this analysis, the peak commuting time of these workers would align with the peak-hour traffic on the adjoining public roadways. Three hundred construction workers are anticipated to add an estimated 200 peak-hour trips. These 200 additional commuter vehicles (300 workers) were added to the existing traffic to determine the anticipated level of service. As shown in **Table 4–13**, the impacts on traffic were compared for the year 2012, the year that construction would start, and 2015, the year that construction would be completed. No change in the level of service of roadways in the vicinity of LANL is anticipated during the construction period.

Operations Impacts—The employees currently working at the existing CMR Building and other facilities at LANL are expected to relocate to the CMRR Facility. There would be no impact from traffic or transportation on the internal LANL road system, the vehicle access portals, or the public roadways external to LANL over the existing conditions.

Table 4–13 No Action Alternative — Expected Levels of Service of Roadways in the Vicinity of Los Alamos National Laboratory

Location / Year	Road Type and Number of Lanes	AADT/Year/ Percentage Trucks	Existing Traffic: AADT/ Peak Hour/ LOS 2012	Existing Traffic: AADT/ Peak Hour/ LOS 2015	No Action Alternative: Peak Hour/ LOS 2012	No Action Alternative: Peak Hour/ LOS 2015	Comments (assumed percentage of construction traffic assigned to road segment) (200 VPH)
SR 4 at Los Alamos County Line to SR 501	Minor arterial/ two lanes	734/ 2009/9	760/ 80/A	780/80/A	100/A	100/A	(10) No change in level of service
SR 4 at Junction Bandelier Park Entrance	Minor arterial/ two lanes	681/ 2009/7	700/ 70/A	710/70/A	90/A	90/A	(10) No change in level of service
SR 4 at Junction of Pajarito Road – White Rock	Minor arterial/ two lanes	9,302/ 2009/9	9,580/ 960/D	9,770/ 980/D	1,140/D	1,160/D	(90) No change in level of service
SR 4 at Junction of Jemez Road	Minor arterial/ two lanes	9,358/ 2009/12	9,640/ 960/D	9,830/ 980/D	1,140/D	1,160/D	(90) No change in level of service
SR 501 at Junction of SR 4 to Diamond Drive	Minor arterial/ two lanes	11,848/ 2009/11	12,210/ 1,220/D	12,460/ 1,250/D	1,260/D	1,290/D	(90) No change in level of service
SR 501 at Junction of Diamond Drive and Onward	Primary arterial/ four lanes	21,211/ 2009/8	21,850/ 2,190/C	22,290/ 2,230/C	2,230/C	2,270/C	(90) No change in level of service
SR 501 at Junction 502	Primary arterial/ four lanes – divided	17,807/ 2009/8	18,350/ 1,840/C	18,720/ 1,870/ C	1,940/C	1,970/C	(20) No change in level of service
SR 502 at Junction Openheimer Street	Primary arterial/ four lanes – divided	12,817/ 2009/6	13,210/ 1,320/C	13,480/ 1,350/C	1,420/C	1,450/C	(20) No change in level of service
SR 502 East of Junction with SR 4	Primary arterial/ four-lane freeway	6,341/ 2009/12	6,530/ 650/A	6,660/ 670/A	670/A	690/A	(10) No change in level of service

AADT = average annual daily traffic; LOS = level of service; SR = State Road; VPH = vehicles per hour.

4.3 Environmental Impacts of the Modified CMRR-NF Alternative

4.3.1 Modified CMRR-NF Alternative

This section presents the environmental impacts associated with the Modified CMRR-NF Alternative. This alternative addresses seismic safety and security concerns associated with the No Action Alternative. Among the concerns identified in the seismic and geologic studies is the presence of a subsurface layer of poorly welded volcanic tuff. The layer would need to be removed or modified to provide a stable medium on which to build the Modified CMRR-NF or the facility would be constructed at a sufficient height above this layer. As a result, two construction options are being considered under the Modified CMRR-NF Alternative.

The Deep Excavation Option would involve excavating the identified footprint another 100 feet (30 meters) to a nominal depth of 130 feet (40 meters), thus removing the poorly welded tuff layer. The excavation would then be backfilled with concrete up to 60 feet (18 meters) to provide a stable surface on which to build. The Shallow Excavation Option would involve constructing the Modified CMRR-NF in the stable geologic layer overlying the poorly welded tuff layer, 17 feet (5.2 meters) above the interface between the two layers.

Additional CMRR Project activities analyzed under this alternative include the following (see Chapter 2, Section 2.6):

- TA-50 electrical substation
- TA-72 parking lot
- Pajarito Road realignment and buried utilities relocation activities
- Construction laydown areas and warehouse (TA-46/63 and TA-48/55)
- Construction laydown and support areas (including spoils storage areas) (TA-5/52)
- Concrete batch plants (TA-46/63 and TA-48/55)
- Temporary power upgrades (TA-5 to TA-55)
- Spoils storage areas (TA-36, TA-51, TA-54)
- Stormwater detention ponds (TA-50, TA-63, TA-64)

As under the No Action Alternative, the Modified CMRR-NF would be linked to the newly constructed RLUOB via an underground tunnel, and another underground tunnel would be constructed to connect the TA-55 Plutonium Facility with the Modified CMRR-NF. The vault for long-term storage of SNM would be within the footprint of the Modified CMRR-NF. Chapter 2, Section 2.6.2, provides a complete description of the Modified CMRR-NF Alternative. The impacts of construction and operation of this proposed facility are described in the following sections for both the Deep Excavation Option and the Shallow Excavation Option. Regardless of the construction option, the impacts from operations would not affect the performance of the building once it was constructed. Under either construction option, the resulting building would meet the current standards required for a PC-3 facility so it would perform the same in the event of a seismic accident. The operations impacts discussed below include those from the operation of RLUOB. The impacts of operating the existing CMR Building would continue during the construction of the Modified CMRR-NF at TA-55. In addition, under the Modified CMRR-NF Alternative, there would be a transition period of 3 years, during which operations impacts could exist in whole or in part from both the existing CMR Building and the Modified CMRR-NF. Disposition of this Modified CMRR-NF is discussed in Section 4.5.

4.3.2 Land Use and Visual Resources

4.3.2.1 Land Use

Construction Impacts – Deep Excavation Option—Construction of the Modified CMRR-NF under the Deep Excavation Option of the Modified CMRR-NF Alternative encompasses numerous project elements that would involve both temporary and permanent facilities. These project elements would have the potential to impact land use within TA-5, TA-36, TA-46, TA-48, TA-50, TA-51, TA-52, TA-54, TA-55, TA-63, TA-64, and TA-72. **Table 4–14** lists the various project elements and the technical areas in which they would occur. Also presented in the table are the total acreages involved and the acreage of land that is presently undeveloped, whether the action would be temporary or permanent, the present land use designation of the area in which each project element would occur, and whether there would be a change in land use. Impacts on land use under the Deep Excavation Option for the various project elements are addressed below.

Table 4–14 Modified CMRR-NF Alternative, Deep Excavation Option — Land Use Impacts

Project Element	*Technical Area*	*Acreage (total/undeveloped)*	*Status*	*Present Land Use*	*Change in Land Use*
Pajarito Road realignment	55	3.4/2	P	Reserve	Yes
Electrical substation	50	1.4/1.4	P	Reserve	Yes
Stormwater detention ponds	50	0.5/0.5	P	Reserve	Yes
	64	1/1	T	Reserve	Yes
Spoils storage areas	36	39.1/39.1	T	High Explosives Testing	Yes
	51	9.1/9.1	T	Reserve	Yes
	54	18.6/18.6	T	Reserve	Yes
Parking lot and associated road improvements	72	13–15/13–15	T	Reserve	Yes
Temporary power upgrades	55 through 50, 63, and 52 to 5	9.1/2	T	Along or adjacent to existing rights-of-way within developed areas; however, within TA-52 and -5, the right-of-way is within an area designated Reserve.	No change along portions of the route that are developed; however, land use would change along the portion of the route designated Reserve.
Construction laydown/concrete batch plant	46/63	40/33.5	T	Administrative, Service, and Support (TA-46); Reserve (TA-63)	No (TA-46); Yes (TA-63)
	48/55	20/16	T	Reserve and Experimental Science (TA-48); Theoretical and Computational Science (TA-55)	No (Experimental Science portion of TA-48 and TA-55); Yes (Reserve portion of TA-48)
Construction laydown and support area	5/52	19.1/19.1	T	Reserve	Yes

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; P = permanent; T = temporary.
Note: To convert acres to hectares, multiply by 0.40469.
Source: LANL 2011.

Pajarito Road Realignment—The realignment of a 0.5-mile (0.8-kilometer) section of Pajarito Road south of the Modified CMRR-NF would disturb 3.4 acres (1.4 hectares) of land on the south side of the road, 2 acres (0.8 hectares) of which have not been previously developed, in addition to requiring movement of the buried utilities. The road shift would ensure proper placement of the Modified CMRR-NF perimeter intrusion security fence in proximity to Pajarito Road (LANL 2010d). The undeveloped portion of the affected area is presently designated as Reserve, indicating that it is vacant land not otherwise included in one of the other land use categories (see Chapter 3, Figure 3–14). Thus, this area would be dedicated to transportation and would fall under the Physical and Technical Support land use category and no longer be classified as Reserve. The realignment would not impact operations at any other facilities along Pajarito Road.

Electrical Substation—If needed, the CMRR Project would install a new substation, as analyzed in the 2008 *LANL SWEIS*, on the existing 115-kilovolt power distribution loop in TA-50, just south of the existing RLUOB construction office trailers. The new substation would be a permanent installation that would provide an independent power feed (about 40 megawatts) to the existing TA-55 complex and the Modified CMRR-NF and RLUOB. The substation would require 1.4 acres (0.57 hectares) (LANL 2010d).

This project would result in a permanent change in the land use designation of the area from Reserve to Physical and Technical Support. Instead of installing this substation, another action being evaluated is the installation of a new electrical feed from the TA-3 substation along an existing utilities right-of-way.

Stormwater Detention Ponds—Approximately 1.5 acres (0.6 hectares) would be required for stormwater detention ponds to be located south of Pajarito Road in TA-64 and adjacent to the electrical substation in TA-50. Each of these areas is presently designated as Reserve; however, once the detention ponds are in place, the land use designation would change to Physical and Technical Support. Additional stormwater detention ponds, one temporary and one permanent, would be located within TA-63; however, because they fall within the TA-46/63 laydown areas, their acreage is accounted for in that discussion and is not included here. The existing detention pond at TA-63 that would be enlarged would not experience a change in land use designation.

Spoils Storage Areas—Spoils storage would require a total of 30 acres (12.1 hectares) of land. The space needed for excavated materials storage would not have to be collocated; that is, it could be broken up across available acreage. Thus, a number of areas, not all of which would be needed, have been identified that could be used to stage excavated spoils. The determination of which areas would be used would be made at a later date once the exact construction schedule is developed (LANL 2010d). As indicated in Table 4–14, spoils storage could take place within TA-36, TA-51, and TA-54. Land use within the potential spoils areas in TA-51 and TA-54 is designated Reserve, while land use in TA-36 is designated High Explosives Testing. Thus, the use of any of these areas for spoils storage would change the present land use. Temporary spoils storage areas would be restored to a more-natural state after they are no longer needed, which could lead to a re-establishment of the current land use designation.

Parking Lot—A parking lot and associated road improvements would be constructed in TA-72 along the south side of East Jemez Road, east of the TA-72 firing range. This lot would have 600 to 800 parking spaces and a truck loop area and would require from 13 to 15 acres (5.3 to 6.1 hectares) (LANL 2010d). This area is designated Reserve; thus, its use as a parking lot would result in a change in its land use designation to Physical and Technical Support. This temporary area would be restored to a more-natural state after it is no longer required for Modified CMRR-NF construction. This could lead to a re-establishment of the Reserve land use designation.

Power Upgrades—It would be necessary to upgrade temporary power services for the Modified CMRR-NF construction site and support activities. The power upgrades project would bring in temporary power along a route from the TA-5 eastern technical area substation along Puye Road through TA-5, TA-52, and TA-63, then through TA-50, along Pecos Drive and through a new underground duct to the Modified CMRR-NF site in TA-55. In general, the project would use existing electric utility easements and overhead power poles (LANL 2010d). However, some new overhead poles may be needed, which would disturb an estimated 2 acres (0.8 hectares) of the 9.1 acres (3.7 hectares) total for this activity. The land that would be newly disturbed is primarily in TA-52 adjacent to Puye Road and is presently designated Reserve. Temporary use of this area would change the land use designation to Physical and Technical Support. However, following completion of the Modified CMRR-NF, the power line and poles would be removed and the area would revert to its previous land use designation.

Construction Laydown and Concrete Batch Plants—The Modified CMRR-NF Project would utilize two areas for construction laydown and support services: one would be located in portions of TA-46 and TA-63 and a second would be located in TA-48 and TA-55. Both areas would provide space for construction office trailers, temporary parking, a concrete batch plant, and construction laydown and storage. Both would also be temporary and would include some areas that were formerly used as material storage and laydown sites. The TA-46/63 site covers 40 acres (16.2 hectares) and is designated Administrative, Service, and Support (TA-46) and Reserve (TA-63). The TA-48/55 site covers 20 acres

(8.1 hectares) and is designated Reserve and Experimental Science (TA-48) and Theoretical and Computational Science (TA-55) (LANL 2010d). The use of both construction laydown sites would require some clearing of vegetation and would alter the current land use designation for the duration of the project. However, following construction, the portions of each area currently designated as Reserve would be restored and revert to that designation.

Construction Laydown and Support Area—Construction support would require an area of 19.1 acres (7.7 hectares) within TA-5/52. This area could be used for a variety of construction-related needs, including storage of equipment and spoils. The use of this area during construction of the Modified CMRR would result in a change in its present Reserve land use designation. However, upon completion of construction, the area could be restored to its present condition, thus leading to the re-establishment of its current land use designation.

Construction Impacts – Shallow Excavation Option—Construction of the Modified CMRR-NF under the Shallow Excavation Option would entail the same project elements noted above under the Deep Excavation Option. However, only 10 acres (4 hectares) would be required for spoils storage. Further, the potential spoils storage areas being considered for this option would only include the 19.1-acre (7.7-hectare) site in TA-5/52 and the 9.1-acre (3.7-hectare) site in TA-51. A determination of which areas would be used would be made at a later date after the exact construction schedule is developed (LANL 2010d).

Operations Impacts—Under both of the Modified CMRR-NF Alternative construction options, there would be a land commitment associated with facility operations of 28.1 acres (11.4 hectares), including 4.8 acres (1.9 hectares) for the Modified CMRR-NF, 4 acres (1.6 hectares) for RLUOB, 13 acres (5.3 hectares) for the TA-50 parking lot, 3.4 acres (1.4 hectares) for the Pajarito Road realignment, 1.4 acres (0.6 hectares) for the electrical substation, and 1.5 acres (0.6 hectares) for stormwater detention ponds. There would be no additional change in land use as a result of operations of the Modified CMRR-NF and RLUOB because any changes that would take place would have already occurred during construction.

4.3.2.2 Visual Resources

Construction Impacts – Deep Excavation Option—A general description of the appearance of each technical area affected by the proposed action and alternatives is presented in Chapter 3, Table 3–2. Project elements undertaken under the Deep Excavation Option of the Modified CMRR-NF Alternative would affect the appearance of the individual technical areas in which they would take place. More importantly, when taken together, they have the potential to affect the overall visual environment of LANL. Most development under this option would occur along the central portion of the Pajarito Road corridor; however, spoils storage could occur to the east in TA-36, TA-51, and TA-54. Additionally, a parking lot would be located in TA-72.

As much of the proposed development associated with the various project elements that would take place under the Deep Excavation Option for the Modified CMRR-NF Alternative would occur within or adjacent to developed areas along the central Pajarito Road corridor, there would be little overall change in the industrial appearance of the area. New construction in these areas would generally take place within or adjacent to previously developed areas; thus, it would not represent a significant change in the visual environment. Because Pajarito Road is closed to the public, near views of CMRR-related development along the roadway would be restricted to site workers. As viewed from higher elevations to the west, new development along the central portion of Pajarito Road would result in little change to the area's present appearance. Further, new required lighting would not noticeably change the present nighttime appearance of the site. Overall, there would be no change in the current U.S. Bureau of Land Management (BLM) Visual Resource Contrast Class IV rating along the central portion of Pajarito Road. Visual impacts to the east along Pajarito Road in the vicinity of TA-36, TA-51, and TA-54 could be more noticeable because this portion of the roadway has little adjacent development. Because many project elements are temporary in nature, visual impacts would decrease once the construction phase of the Modified CMRR-NF project is complete and temporarily disturbed areas are restored to a more-natural appearance.

One project element that would be located some distance from the Pajarito Road corridor under this alternative is the TA-72 parking lot, which would be built approximately 0.75 miles (1.2 kilometers) west of the intersection of East Jemez Road and New Mexico State Road 4. Construction of the 13- to 15-acre (5.3- to 6.1-hectare) parking lot would require removal of all vegetation, as well as leveling the site, which would change its natural appearance. The parking lot would be readily seen by both site workers and the general public because traffic along the road is not restricted, as it is along Pajarito Road. In addition, because it would be lit at night, it would be readily seen from East Jemez Road, and the nighttime sky glow would be visible from New Mexico State Road 4 and the Tsankawi Unit of Bandelier National Monument. It would also be readily seen from nearby higher elevations. Installed lighting would comply with the New Mexico Night Sky Protection Act to the extent that it would not compromise security. Development of this part of TA-72 would result in a change in the BLM visual resource contrast rating from Class III to a Class IV. Following completion of the Modified CMRR-NF, the parking lot would be restored to a more-natural state. However, it would take years before the area would return to its predisturbance appearance.

Construction Impacts – Shallow Excavation Option—Impacts on visual resources resulting from implementation of the Shallow Excavation Option would be similar to those described under the Deep Excavation Option. However, only 10 acres (4 hectares) within TA-5/52 and TA-51 would be needed for spoils storage. Thus, overall visual impact of the project during the period when spoils would be stored would be less than under this option compared with the Deep Excavation Option.

Operations Impacts—Once the Modified CMRR-NF becomes operational and the spoils storage area(s) is closed and restored to a more-natural state, the appearance of the involved technical areas under both options for the Modified CMRR-NF Alternative would approximate preconstruction conditions. The Modified CMRR-NF itself, excluding the cupola roofs, would range from about 20 feet (6 meters) to 55 feet (17 meters) above ground, which would primarily be viewed by LANL employees because Pajarito Road is closed to the public. When viewed from higher elevations to the west, the Modified CMRR-NF and RLUOB would blend in with existing development along the central portion of Pajarito Road. Their presence would not change the BLM Visual Resource Contrast Class IV rating.

4.3.3 Site Infrastructure

Construction Impacts – Deep Excavation Option—Planned and proposed construction activities (see **Table 4–15**) are expected to have a temporary effect on the electrical power requirements at LANL. During the construction phase (about 9 years), the temporary increase in power would be approximately 5 percent of the available (surplus) energy capacity at LANL and would not impact the available energy supply to any current or projected uses. The temporary increase in the peak load demand would be approximately 46 percent of the available (surplus) capacity. With planned upgrades and modifications (see Chapter 2, Section 2.6.2), existing infrastructure would be capable of supporting the construction requirements for the Modified CMRR-NF proposed under this alternative without exceeding site capacities.

No natural gas would be needed for construction of the Modified CMRR-NF. Although gasoline and diesel fuel would be required to operate construction vehicles, generators, and other construction equipment, fuel would be procured from offsite sources and, therefore, would not be a limited resource for the purposes of this SEIS.

Primary construction water use would be for concrete, site preparation, and earthwork (for example, grading, compaction, dust control). There would be a temporary effect on the water supply at LANL. During the construction phase, it was estimated that approximately 5 million gallons (19 million liters) of water per year (42 million gallons total [159 million liters]) would be needed. This would be approximately 4 percent of the available (surplus) capacity at LANL. The volume of groundwater that would be used is within the retained water right quantity at LANL, which is figured on an annual use ceiling of 542 million gallons (2,000 million liters). However, the site is currently at a baseline of 76 percent of the available capacity due to other site requirements. With the proposed construction included, the site would be at 76.9 percent of capacity. The ROI, which includes water used by LANL and Los Alamos County, is over 91 percent; with the proposed construction included, the total ROI would be at 91.8 percent of capacity.

Table 4–15 Modified CMRR-NF Alternative, Deep Excavation Option — Site Infrastructure Requirements for Facility Construction

Resource	*Available Site/System Capacity* [a]	*CMRR-NF Project Requirement*	*Percentage of Available Site Capacity*
Electricity			
Energy (megawatt-hours per year)	601,000	31,000	5
Peak load demand (megawatts)	26	12	46
Fuel			
Natural gas (million cubic feet per year)	5,860	Not applicable	Not applicable
Water (million gallons per year)	130	5	4

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility.
[a] A calculation based on the system-wide (site-wide for water) capacity from data provided in Chapter 3, Table 3–3, of this SEIS.
Source: LANL 2011.

Construction Impacts – Shallow Excavation Option—Planned and proposed construction activities (see **Table 4–16**) are expected to have a temporary effect on the electrical power requirements. During the construction phase (about 9 years),[4] the temporary increase in power would be approximately 5 percent of the available (surplus) energy capacity and would not impact the available energy supply to any current or projected uses. The temporary increase in the peak load demand would be approximately 46 percent of the available (surplus) capacity. With planned upgrades and modifications, existing infrastructure would be capable of supporting the construction requirements of the Modified CMRR-NF proposed under this alternative without exceeding site capacities.

No natural gas would be needed for construction of the Modified CMRR-NF. Although gasoline and diesel fuel would be required to operate construction vehicles, generators, and other construction equipment, fuel would be procured from offsite sources and, therefore, would not be a limited resource for the purposes of this SEIS.

[4] *The construction period is the same regardless of the construction option; the additional excavation required for the Deep Excavation Option would occur in parallel with other activities (for example, preparing laydown areas and installing construction utilities) that would occur under both options.*

Table 4–16 Modified CMRR-NF Alternative, Shallow Excavation Option — Site Infrastructure Requirements for Facility Construction

Resource	*Available Site/System Capacity* [a]	*CMRR-NF Project Requirement*	*Percentage of Available Site Capacity*
Electricity			
Energy (megawatt-hours per year)	601,000	31,000	5
Peak load demand (megawatts)	26	12	46
Fuel			
Natural gas (million cubic feet per year)	5,860	Not applicable	Not applicable
Water (million gallons per year)	130	4	3

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility.
[a] A calculation based on the system-wide (site-wide for water) capacity from data provided in Chapter 3, Table 3–3, of this SEIS.
Source: LANL 2011.

Similar to the Deep Excavation Option, there would be a temporary effect on the water supply at LANL. During the construction phase (about 9 years), it was estimated that approximately 4 million gallons (15 million liters) of water per year (35 million gallons [130 million liters] total) would be needed. This temporary increase in water use would be approximately 3 percent of the available (surplus) capacity at LANL. The volume of groundwater that would be used is within the retained water right quantity at LANL, which is figured on an annual use ceiling of 542 million gallons (2,000 million liters). However, the site is at a baseline of 76 percent of the available capacity due to other site requirements. With the proposed construction included, the site would be at 76.7 percent of capacity. The ROI, which includes water used by LANL and Los Alamos County, is over 91 percent; with the proposed construction included, the ROI would be at 91.7 percent of capacity.

Operations Impacts—Resources needed to support the projected demands on key site infrastructure resources associated with CMRR Facility operations under the Modified CMRR-NF Alternative are presented in **Table 4–17**. CMRR-NF and RLUOB operations together would require 161,000 megawatt-hours per year, or approximately 27 percent of the available (surplus) energy capacity. The peak electrical demand estimate of 26 megawatts, when combined with the projected site-wide peak demand, would use all of the available (surplus) capacity at the site. Regardless of the decisions to be made regarding the CMRR-NF, adding a third transmission line and/or reconductoring the existing two transmission lines are being studied by LANL to increase transmission line capacities up to 240 megawatts to provide additional capacity across the site. If the proposed TA-50 electrical substation is constructed, it would provide reliable additional electrical power as the independent power feed to the existing TA-55 complex and the CMRR Facility. LANL is also considering establishing an independent power feed to the existing TA-55 complex and the CMRR Facility from TA-3 along existing utility rights-of-way. If additional capacity and reliability can be added to the existing TA-3 substation, this would negate the need to build the proposed TA-50 substation.

Natural gas is used to supply boilers and emergency generators, but is restricted to the utility building attached to RLUOB. The required amount would only use about 1 percent of the available site capacity.

Table 4–17 Modified CMRR-NF Alternative — Site Infrastructure Requirements for Modified CMRR-NF and RLUOB Operations

Resource	*Available Site/System Capacity* [a]	*CMRR Facility Requirement*	*Percentage of Available Site Capacity*
Electricity			
RLUOB energy (megawatt-hours per year)		59,000	
Modified CMRR-NF energy (megawatt-hours per year)		102,000	
Modified CMRR-NF and RLUOB energy (megawatt-hours per year)	*601,000*	*161,000*	*27*
RLUOB peak load demand (megawatts)		11	
Modified CMRR-NF peak load demand (megawatts)		15	
Modified CMRR-NF and RLUOB peak load demand (megawatts)	26	26	100
Fuel (million cubic feet per year)			
RLUOB natural gas		38	
Modified CMRR-NF natural gas		20	
Modified CMRR-NF and RLUOB natural gas	5,860	58	1.0
Water (million gallons per year)			
RLUOB water		*7*	
Modified CMRR-NF water		*9*	
Modified CMRR-NF and RLUOB water	*130*	*16*	*12*

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] A calculation based on the system-wide (site-wide for water) capacity from data provided in Chapter 3, Table 3–3, of this SEIS.

Source: LANL 2011.

Under this alternative, water would be needed for building mechanical uses, including a demineralization system, and to meet the potable and sanitary needs of facility support personnel. It was estimated that Modified CMRR-NF and RLUOB operations would require about 16 million gallons (61 million liters) of groundwater per year. During operations, the increase in water would be approximately 12 percent of the available (surplus) capacity at LANL. The volume of groundwater that would be used is within the retained water right quantity at LANL, which is figured on an annual use ceiling of 542 million gallons (2,000 million liters). However, the site is at a baseline of 76 percent of capacity. With the proposed operations included, the site would be at 79 percent of capacity. The ROI, which includes water used by LANL and Los Alamos County, is at over 91 percent; with the proposed Modified CMRR-NF and RLUOB operations included, the ROI would be at 92.4 percent of capacity.

4.3.4 Air Quality and Noise

4.3.4.1 Air Quality

For both of the construction options considered under the Modified CMRR-NF Alternative, air quality emissions were calculated for construction activities, transport of materials to and from the work site, transport of personnel from the proposed parking area in TA-72 to the work site, and production of concrete from the temporary batch plants that would be located on site. A detailed discussion of calculation methods is included in Appendix B. Nonradiological air emissions are discussed for both options. No radiological emissions would occur during the construction phase.

Construction permits for nonradiological air emissions would be required. Specifically, emissions from combustion sources and concrete batch plant would require construction permits from the New Mexico

Environment Department. In addition, pre-construction approval from EPA would be required for radioactive air emissions, in accordance with 40 CFR Part 60, Subpart H. Due to the LANL site-wide operating permit discussed in Chapter 3, Section 3.4.2, a Prevention of Significant Deterioration permit would not be required. It is expected that the LANL site-wide Title V operating permit would require future modification to incorporate permit requirements for construction of the Modified CMRR-NF.

Construction Impacts – Deep Excavation Option—Construction of the Modified CMRR-NF under the Deep Excavation Option would result in temporary emissions from construction equipment, trucks transporting materials, and employee vehicles. Criteria pollutant concentrations at the boundary of TA-55 due to construction activities and at the LANL boundary due to the transport of people and materials were compared to the New Mexico Ambient Air Quality Standards, which are more stringent than the National Ambient Air Quality Standards (see **Table 4–18**). Construction emissions would not exceed the New Mexico Ambient Air Quality Standards or the National Ambient Air Quality Standards for any of the criteria pollutants. These levels are based on the concentrations expected at the boundary of TA-55 during active construction. Actual criteria pollutant concentrations are expected to be less because emission factors were used to complete modeling of construction and associated activities that tend to overestimate impacts. The model generates concentrations based on assumptions for a worst-case scenario. The public would not be allowed access to this area during construction. Emissions calculated to determine potential impacts on the nearest residents located at the Royal Crest Trailer Park, north of the project site, found pollutant concentrations to be well below the most stringent standards. Criteria pollutant concentrations would not exceed the most stringent standards during construction activities or transport of materials to and from the site. Mitigation actions were not considered in the analysis. Actual concentrations are expected to be less than predicted.

Table 4–18 Modified CMRR-NF Alternative, Deep Excavation Option — Pollutant Emissions Compared to New Mexico State Standards

Criteria Pollutant	*Averaging Time*	*NMAAQS* [a] *(parts per million)*	*Calculated Concentration (parts per million)*			
			Construction [b]	*Concrete Batch* [c]	*Materials Transport* [d]	*Personnel Transport* [d]
Carbon monoxide	1 hour	13	0.31	N/A	0.18	<<0.01
	8 hours	8.7	0.22	N/A	0.12	<<0.01
Nitrogen dioxide	Annual	0.05	0.02	N/A	<<0.01	<<0.01
Sulfur dioxide	3 hours	0.5 [e]	0.06	N/A	<<0.01	<<0.01
	24 hours	0.1	0.01	N/A	<<0.01	<<0.01
	Annual	0.02	<<0.01	N/A	<<0.01	<<0.01
PM_{10}	24 hours	150 μg/m³ [e]	15 μg/m³	0.26 μg/m³	10 μg/m³	0.06 μg/m³
Total suspended particulates	24 hours	150 μg/m³	15 μg/m³	0.26 μg/m³	10 μg/m³	0.06 μg/m³
	Annual	60 μg/m³	3.0 μg/m³	0.05 μg/m³	2.0 μg/m³	0.01 μg/m³

<< = much less than; μg/m³ = micrograms per cubic meter; CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; N/A = not applicable; NMAAQS = New Mexico Ambient Air Quality Standards; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

[a] NMAQB 2010.

[b] Construction emissions were modeled using TA-55 as the total area in which pollutants are distributed.

[c] Concrete batch plant emissions were modeled using the area of Technical 63 in which pollutants are distributed.

[d] Emissions from mobile sources were modeled using an area that would encompass the length of road used.

[e] EPA 2010c. There are no NMAAQS for PM_{10}; therefore, NAAQS are used here.

The following corrective actions may be used to decrease construction-related emissions. In addition to standard construction emissions controls, emissions from construction equipment may be mitigated by maintaining the equipment to ensure that the emissions control systems and other components are functioning at peak efficiency. Exposed soil during construction activities is a source of particulate matter (fugitive dust) and may be controlled with routine watering. Application of chemical stabilizers to exposed areas and administrative controls such as planning, scheduling, and the use of special equipment could further reduce emissions.

Radiological releases from construction activities are not expected. As described in Section 2.5, the RLUOB has been constructed and the CMRR-NF site has been excavated down to about 30 feet (9.1 meters) already and no contamination was encountered. Any suspected or known contaminated areas from prior LANL activities would be evaluated to identify procedures for working within those areas and to determine the need to remove site contamination. Contaminated soils would be removed as necessary to protect worker health or the environment before construction was initiated. Any contaminated soil removed would characterized and disposed of appropriately at LANL or an offsite waste management facility.

Construction Impacts – Shallow Excavation Option—The Shallow Excavation Option for the Modified CMRR-NF would also include construction, production of concrete via temporary batch plants, and the transport of personnel and materials to and from the site. Criteria pollutant emissions under the Shallow Excavation Option are summarized in **Table 4–19**. Annual construction and personnel transport emissions are predicted to be comparable to those under the Deep Excavation Option. Less concrete is needed for this option; thus, less particulate matter emissions from the batch plants are expected. Similar to the Deep Excavation Option, criteria pollutant concentrations would not exceed the most stringent standards during construction activities and transport of materials to and from the site. Emissions calculated to determine potential impacts on the nearest residents located at the Royal Crest Trailer Park, north of the project site, found pollutant concentrations to be well below the most stringent standards.

Table 4–19 Modified CMRR-NF Alternative, Shallow Excavation Option — Criteria Pollutant Emissions Compared to New Mexico State Standards

Criteria Pollutant	*Averaging Time*	*NMAAQS* [a] *(parts per million)*	*Calculated Concentration (parts per million)*			
			Construction [b]	*Concrete Batch* [c]	*Materials Transport* [d]	*Personnel Transport* [d]
Carbon monoxide	1 hour	13	0.31	N/A	0.11	<<0.01
	8 hours	8.7	0.22	N/A	0.07	<<0.01
Nitrogen dioxide	Annual	0.05	0.02	N/A	<<0.01	<<0.01
Sulfur dioxide	3 hours	0.5 [e]	0.06	N/A	<<0.01	<<0.01
	24 hours	0.1	0.01	N/A	<<0.01	<<0.01
	Annual	0.02	<<0.01	N/A	<<0.01	<<0.01
PM_{10}	24 hours	150 μg/m[e]	15 μg/m³	0.19 μg/m³	6.0 μg/m³	0.06 μg/m³
Total suspended particulates	24 hours	150 μg/m³	15 μg/m³	0.19 μg/m³	6.0 μg/m³	0.06 μg/m³
	Annual	60 μg/m³	3.0 μg/m³	0.04 μg/m³	1.2 μg/m³	0.01 μg/m³

<< = much less than; μg/m³ = micrograms per cubic meter; CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; N/A = not applicable; NMAAQS = New Mexico Ambient Air Quality Standards; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

[a] NMAQB 2010.

[b] Construction emissions were modeled using TA-55 as the total area in which pollutants are distributed.

[c] Concrete batch plant emissions were modeled using the area of TA-63 in which pollutants are distributed.

[d] Emissions from mobile sources were modeled using an area that would encompass the length of road used.

[e] EPA 2010b. There are no NMAAQS for PM_{10}; therefore, National Ambient Air Quality Standards are used here.

Operations Impacts—Operations impacts from nonradiological and radiological emissions under the Modified CMRR-NF Alternative would be the same as those estimated under the No Action Alternative (see Section 4.2.4.1). **Table 4–20** summarizes the concentrations of criteria pollutants from operations at the Modified CMRR-NF and RLUOB. The maximum ground-level concentrations that would result from Modified CMRR-NF and RLUOB operations at TA-55 would be below ambient air quality standards.

Table 4–20 Modified CMRR-NF Alternative — Nonradiological Air Quality Concentrations at Technical Area 55 Site Boundary – Operations

Criteria Pollutant	*Averaging Time*	*NMAAQS (parts per million)* [a]	*Calculated Concentration (parts per million)* [b]
Carbon monoxide	1 hour	13	0.027
	8 hours	8.7	0.060
Nitrogen dioxide	Annual	0.05	1.2×10^{-5}
Sulfur dioxide	3 hours	0.5 [c]	0.10
	24 hours	0.1	0.014
	Annual	0.02	5.5×10^{-6}
PM_{10}	24 hours	150 μg/m³	1.4 μg/m³
Total suspended particulates	24 hours	150 μg/m³	2.4 μg/m³
	Annual	60 μg/m³	0.0 μg/m³

μg/m³ = micrograms per cubic meter; CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; NMAAQS = New Mexico Ambient Air Quality Standards; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

a NMAAQS are more stringent than the Federal standards; thus, emissions are compared to the latest NMAAQS consistent with other air quality analyses in this SEIS. All emissions were converted from micrograms per cubic meter, as shown in Table 4–10 of the *CMRR EIS*, to parts per million using the appropriate corrections for temperature (70 degrees Fahrenheit) and a site elevation of 7,229 feet, in accordance with New Mexico dispersion modeling guidelines (NMAQB 2010).

b The annual concentrations were analyzed at locations to which the public has access: the site boundary and nearby sensitive areas. Short-term concentrations were analyzed at the site boundary and at the fence line of the technical area to which the public has short-term access.

c NMAAQS does not have a 3-hour standard; thus, the Federal standard (from the NAAQS) is used here.

Source: DOE 2003a.

4.3.4.2 Greenhouse Gas Emissions

Construction Impacts – Deep Excavation Option—Under the Deep Excavation Option, construction of the Modified CMRR-NF at TA-55 would result in temporary greenhouse gas emissions from construction equipment, material transport trucks, personnel commutes, and electricity consumption. Operation of the concrete batch plants would not require natural gas, but would require electricity, which is accounted for in the total electricity use presented in **Table 4–21**.

Emissions of greenhouse gases (see Table 4–21) from these construction activities, excluding electricity use, were estimated to be approximately 12,400 tons of carbon-dioxide equivalent (11,200 metric tons) per year. Compared to the 2008 site-wide greenhouse gas baseline emissions, about 440,000 tons (400,000 metric tons) of carbon-dioxide equivalent per year (LANL 2011)[5], there would be a minimal and temporary increase (about 2.8 percent) in greenhouse gases from the construction of the Modified CMRR-NF under the Deep Excavation Option.

[5] *The projected LANL site-wide greenhouse gas emissions associated with the electrical usage corresponding to the operations selected in the 2008* LANL SWEIS *RODs would be 543,000 tons per year.*

Table 4–21 Modified CMRR-NF Alternative, Deep Excavation Option — Construction Emissions of Greenhouse Gases

Emissions Scope	*Activity*	*Emissions (tons per year)*			
		CO_2	*CH_4 CO_2e*	*N_2O CO_2e*	*Total CO_2e*
Scope 3 [a]	Sitework/grading	2,500	0	5	2,500
	Construction	2,500	3	40	2,540
	Materials transport	6,000	1	10	6,010
	Personnel commutes	1,250	2	27	1,280
	Subtotal	12,300	6	82	12,400
Scope 2 [b]	Electricity Use	20,000	6	86	20,100
	Total	32,300	12	168	32,500

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; CO_2 = carbon dioxide; CH_4 CO_2e = methane in carbon-dioxide equivalent; N_2O CO_2e = nitrous oxide in carbon-dioxide equivalent; CO_2e = carbon-dioxide equivalent.

[a] Scope 3 sources include indirect emissions of construction equipment not owned or controlled by LANL.

[b] Scope 2 sources include indirect emissions from the generation of purchased electricity, where the emissions actually occur at sources off site and not at sources owned or controlled by LANL.

Note: Totals may not equal the sum of the contributions due to rounding.

Total greenhouse gases from construction activities, including electricity consumption, would be approximately 32,500 tons of carbon-dioxide equivalent per year (29,000 metric tons per year). Electricity use during construction of the Modified CMRR-NF Alternative, Deep Excavation Option, would be approximately 5 percent of the total site-wide carbon-dioxide-equivalent emissions.

Direct greenhouse gas emissions at LANL are those described as Scope 1. There are no established thresholds for greenhouse gases, but in draft guidance issued February 18, 2010, the CEQ suggested that proposed actions that are reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon-dioxide equivalent should be evaluated by quantitative and qualitative assessments. This is not a threshold of significance, but a minimum level that would require consideration in NEPA documentation. There are no direct, or Scope 1, greenhouse gas emissions during construction under the Modified CMRR-NF Alternative, Deep Excavation Option.

Construction Impacts – Shallow Excavation Option—Under the Shallow Excavation Option, construction at TA-55 would result in temporary greenhouse gas emissions from construction equipment, material transport trucks, personnel commutes, and electricity consumption. Operation of the concrete batch plants would not require natural gas, but would require electricity. Construction and personnel transport emissions annually are similar to the Deep Excavation Option, but with lower emissions from fewer truck trips. Emissions of greenhouse gases (see **Table 4–22**) from these construction activities were estimated to be approximately 10,900 tons (9,900 metric tons) of carbon-dioxide equivalent per year.

Total greenhouse gases from construction activities, including electricity consumption, would be approximately 31,000 tons of carbon-dioxide equivalent (28,000 metric tons) per year. The electricity use during construction of the Modified CMRR-NF Alternative, Shallow Excavation Option, is approximately 5 percent of the total site-wide carbon-dioxide-equivalent emissions. As with the Deep Excavation Option, there are no direct, or Scope 1, greenhouse gas emissions during construction under the Modified CMRR-NF Alternative, Shallow Excavation Option.

Table 4–22 Modified CMRR-NF Alternative, Shallow Excavation Option — Construction Emissions of Greenhouse Gases

Emissions Scope	*Activity*	*Emissions (tons per year)*			
		CO_2	*CH_4 CO_2e*	*N_2O CO_2e*	*Total CO_2e*
Scope 3 [a]	Sitework/grading	2,500	0	5	2,500
	Construction	2,500	3	40	2,540
	Materials transport	4,600	0	10	4,610
	Personnel commutes	1,200	2	26	1,250
	Subtotal	10,800	5	81	10,900
Scope 2 [b]	Electricity use	20,000	6	86	20,100
	Total	30,800	11	167	31,000

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; CO_2= carbon dioxide; CH_4 CO_2e = methane in carbon-dioxide equivalent; N_2O CO_2e = nitrous oxide in carbon-dioxide equivalent; CO_2e = carbon-dioxide equivalent.

[a] Scope 3 sources include indirect emissions of construction equipment not owned or controlled by LANL.

[b] Scope 2 sources include indirect emissions from the generation of purchased electricity, where the emissions actually occur at sources off site and not at sources owned or controlled by LANL.

Note: Totals may not equal the sum of the contributions due to rounding.

Operations Impacts—Greenhouse gas emissions during operations of both the CMRR-NF and RLUOB from refrigerants used to cool the building and backup generators are approximately 1,860 tons (1,700 metric tons) per year of carbon-dioxide equivalent. Since there would be no new hires under this alternative, emissions from personnel commutes (Scope 3) already included in the baseline are not included here. Compared to the site-wide greenhouse gas emissions, about 440,000 tons (400,000 metric tons) of carbon-dioxide equivalent per year (LANL 2011), there would be a minimal increase (less than 1 percent) in greenhouse gases on site from normal operations of the Modified CMRR-NF and RLUOB.

Direct greenhouse gas emissions at LANL are those described as Scope 1. There are no established thresholds for greenhouse gases, but in draft guidance issued February 18, 2010, the CEQ suggested that proposed actions that are reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon-dioxide equivalent should be evaluated by quantitative and qualitative assessments. This is not a threshold of significance, but a minimum level that would require consideration in NEPA documentation. The only direct (Scope 1) greenhouse gas emissions during operations of the CMRR-NF and RLUOB under the Modified CMRR-NF Alternative would be from backup generators and refrigerants used to cool the building. Together, the Scope 1 emissions during operation of CMRR-NF and the RLUOB under the Modified CMRR-NF Alternative, approximately 1,860 tons (1,700 metric tons), would be below the CEQ suggested level of 25,000 metric tons per year.

Total greenhouse gases, including both indirect (Scope 2 and 3) and direct (Scope 1) emissions, during operation of the CMRR-NF and RLUOB would be approximately 107,000 tons (97,000 metric tons) of carbon-dioxide equivalent per year (see **Table 4–23**). This is approximately 25 percent of the total site-wide carbon-dioxide-equivalent emissions per year. These greenhouse gases emitted by operations under the Modified CMRR-NF Alternative would add a relatively small increment to emissions of these gases in the United States and the world (see Section 4.6).

Table 4–23 Modified CMRR-NF Alternative — Modified CMRR-NF and RLUOB Operations Emissions of Greenhouse Gases

Emissions Scope	*Activity*	*Emissions (tons per year)*				
		CO_2	*CH_4 CO_2e*	*N_2O CO_2e*	*HFC CO_2e*	*Total CO_2e*
Scope 1 [a]	Refrigerants used	N/A	N/A	N/A	1,860	1,860
	Backup generator	3	0	0	N/A	3
	Subtotal	3	0	0	1,860	1,860
Scope 2 [b]	Electricity use	105,000	30	450	N/A	105,000
	Total	105,000	30	450	1,860	107,000

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; CO_2 = carbon dioxide; CH_4 CO_2e = methane in carbon-dioxide equivalent; N/A = not applicable; N_2O CO_2e = nitrous oxide in carbon-dioxide equivalent; HFC CO_2e = hydrofluorocarbons in carbon-dioxide equivalent; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Scope 1 sources include direct emissions by stationary sources owned or controlled by LANL.

[b] Scope 2 sources include indirect emissions from the generators of purchased electricity, where the emissions actually occur at sources off site and not owned or controlled by LANL.

Note: Totals may not equal the sum of the contributions due to rounding.

4.3.4.3 Noise

Construction noise was evaluated using RCNM [Roadway Construction Noise Model], Version 1.1, the Federal Highway Administration's standard model for the prediction of construction noise (DOT 2006). RCNM has the capability to model types of construction equipment that are expected to be the dominant construction-related noise sources associated with this action. All construction noise analyses were assumed to make use of a standard set of construction equipment. Construction noise impacts are quantified using the 8-hour noise level equivalent ($L_{eq[8]}$) noise metric, as calculated on an average busy working day during construction. The maximum sound level (L_{max}) shows the sound level of the loudest piece of equipment, which is generally the driver of the $L_{eq(8)}$ sound level.

Construction noise was evaluated for one construction site; this evaluation may be applied to each of the sites individually as an assessment of the potential negative effects on sensitive receptors in the vicinity of the construction site. Construction noise was evaluated at 100-foot increments from the construction equipment. Noise abatement measures were not considered in this analysis, which provides for a more-conservative analysis. The same types of equipment were assumed to be used on each construction site. At noise levels greater than 65 decibels A-weighted (dBA), the potential for annoyance increases, and at levels above 75 dBA, possible harm to health may occur; thus, noise levels above 65 dBA were used as the significance threshold. **Table 4–24** shows the noise levels expected at receptor distances at 100-foot increments and the residential area 0.6 miles (1.0 kilometer) north of TA-55.

Construction Impacts – Deep Excavation Option—On site, all workers potentially exposed to elevated noise associated with their activities would comply with all hearing-protective requirements specified by OSHA. Any other personnel visiting on site also would adhere to the OSHA standards for hearing protection.

Off site, noise experienced on a day-to-day basis depends on the specific activity under way and its proximity to the site edge, where a receptor may be present. Nevertheless, the relatively low time-averaged noise levels calculated indicate that project-related construction activities would not be excessively intrusive.

Table 4–24 Modified CMRR-NF Alternative — Noise Levels During Modified CMRR-NF Construction

Distance from Equipment (feet)	*Maximum Sound Level (L_{max}) [a] dBA*	*Equivalent Sound Level (L_{eq}) [b] dBA*
100	79	81
200	73	75
300	69	72
400	67	69
500	65	67
1000	59	61
Residential area [c]	49	51

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; dBA = decibels A-weighted.
[a] Calculated maximum sound level is the loudest equipment value.
[b] Equivalent sound level is the sound averaged over an 8-hour period.
[c] Residential area located approximately 0.6 miles (1 kilometer) north of TA-55.

The areas involving construction are situated within areas already exposed to some form of noise from vehicular highway traffic. Construction noise emanating off site would probably be noticeable in the immediate site vicinity, but is not expected to create adverse impacts. Construction-related noise is intermittent and transitory and would cease at the completion of the project. Construction noise would have no adverse effects on residents with construction noise levels of 51 dBA. No adverse effects of construction noise are expected.

Construction Impacts – Shallow Excavation Option—Noise under the Shallow Excavation Option would be the same as shown under the Deep Excavation Option. This option would be completed in the same amount of time as the Deep Excavation Option; because of the distance to the exposed public, no differences in effects from construction noise are expected.

Operations Impacts—Operations of the Modified CMRR-NF and RLUOB would have noise levels similar to those of existing operations at TA-55. A slight increase in traffic and equipment (such as heating and cooling systems) noise near the area is expected. These noise levels would not cause adverse impacts on wildlife or the public located outside of LANL.

4.3.5 Geology and Soils

Construction Impacts – Deep Excavation Option

Ground Disturbance. Under the Deep Excavation Option, minimal additional land would be disturbed at TA-55. RLUOB has already been constructed adjacent to the proposed Modified CMRR-NF site, and up to 30 feet (9 meters) of the 130-foot (40-meter) excavation required for the Deep Excavation Option of the Modified CMRR-NF has already been completed as part of the geologic evaluation of the site. Additional land disturbance at TA-55 would primarily be associated with installation and construction of infrastructure associated with the Modified CMRR-NF, such as buried utilities and security fence relocation. However, other aspects of the project would result in additional land disturbance (see Section 4.3.2.1).

This construction option requires the excavation of an additional 100 feet (30 meters) of bedrock for construction of the Modified CMRR-NF, as approximately 30 feet (9 meters) of the Modified CMRR-NF excavation has already been completed. Some of the material excavated from TA-55 would be reused as fill for other Modified CMRR-NF infrastructure and construction support-related projects, such as fill for the TA-46/63 and TA-48/55 laydown areas. The remaining amount would be staged at a LANL materials staging area for future reuse on other LANL projects. Reuse of this material at LANL would directly offset the future need to transport purchased fill material from offsite locations, as is currently the case because of the limited amount of suitable fill material available within existing LANL borrow pits.

Although many of the areas to be developed are previously disturbed, the following actions would expose soils to wind and water erosion: removal of vegetation, grading for new laydown areas, and temporary stockpiling of soils adjacent to utility trenches and other infrastructure excavations and in staging areas. See Section 4.3.6 for more information related to erosion impacts. The 2008 *LANL SWEIS* analyzed impacts associated with management of 150,000 cubic yards (115,000 cubic meters) per year of spoils from the Modified CMRR-NF site and other construction projects at LANL (DOE 2008a).

Aggregate Supply. Large tonnages of aggregate would be required to support construction activities at TA-55. Approximately 313,000 tons (284,000 metric tons) of coarse aggregate and 320,000 tons (290,000 metric tons) of fine aggregate (sand) would be required to support all concrete operations, including placement of up to 250,000 cubic yards (227,000 cubic meters) of low-slump concrete fill material in the lower 60 feet (18 meters) of the Modified CMRR-NF excavation.

Additional excavation under the Deep Excavation Option would require the removal of approximately 545,000 cubic yards (417,000 cubic meters) of material. Such material would be suitable for construction backfill for this project, as well as for construction projects located throughout LANL, but it is unlikely that the characteristics of this material would make it suitable as aggregate for concrete. Similarly, the East Jemez Road Borrow Pit, located in TA-61, which represents good source material for certain construction purposes, is not anticipated to be used as a source for Modified CMRR-NF construction purposes. For purposes of analysis, aggregate for concrete was assumed to come from sources within 100 miles (160 kilometers) of LANL. Aggregate would be procured from existing commercial vendors operating in accordance with all necessary permits. As practical, nearer sources of materials would be used. There are numerous commercial offsite borrow pits and quarries in the vicinity of LANL, including 11 pits or quarries located within 30 miles (48 kilometers) of LANL.

Seismicity. As discussed in Chapter 3, Section 3.5.4, in 2007, the *Final Report, Update of the Probabilistic Seismic Hazard Analysis and Development of Seismic Design Ground Motions at the Los Alamos National Laboratory (Probabilistic Seismic Hazards Analysis)* (LANL 2007a), was issued, which provided a better assessment of the seismic behavior during a design-basis earthquake. As a result, the hazard assessment for the site of the proposed Modified CMRR-NF has been updated so that these data could be used during facility design to meet DOE orders, requirements, and governing standards.

Based on the updated seismic hazard analysis, the geotechnical properties of the bedrock (the structural stability of the rock) at the proposed Modified CMRR-NF location have been further evaluated with respect to the proposed Modified CMRR-NF structure and associated depth of excavation. As discussed in Chapter 3, Section 3.5.2, approximately 700 feet (210 meters) of Bandelier Tuff is present beneath the site. The Modified CMRR-NF excavation would be affected by the uppermost units of this geologic formation, consisting of Units 3 (Qbt3) and 4 (Qbt4) of the Tshirege Member of the Bandelier Tuff (see Chapter 2, Figure 2–7). In comparison to the units above and below, the lower part of Unit 3 ($Qbt3_L$) has lower bearing capacity, is more compressible, has higher porosity, and has less cohesion. These rock properties, coupled with the vertical proximity of Unit 3 to the Modified CMRR-NF foundation grade and its lateral proximity to the slope of Twomile Canyon, have led to potentially significant structural design issues, including the following (Kleinfelder 2010a):

- Potential for static deflection (compression)
- Potential for hydro-collapse, due to wetting

- Potential for excessive movement of buttress, due to dynamic slope instability
- Inadequate resistance to dynamic sliding forces
- Seismic shaking and building response

DOE has subsequently completed a draft slope stability analysis and determined that global slope stability is not an issue for the Deep Excavation Option (Flavin 2011).

As previously discussed, a 130-foot (40-meter) excavation would be required for the Modified CMRR-NF construction under the Deep Excavation Option. $Qbt3_L$, the poorly to nonwelded tuff, occurs from a depth of approximately 75 feet (23 meters) to approximately 125 to 130 feet (38 to 40 meters) below ground surface (Kleinfelder 2010b) (see Chapter 2, Figure 2–7). Therefore, under the Deep Excavation Option, $Qbt3_L$ would be excavated and replaced with concrete fill, as evaluated in the *Phase I Ground Modification Alternatives Feasibility Study, Chemistry and Metallurgy Research Replacement (CMRR) Nuclear Facility, Los Alamos National Laboratory* (Kleinfelder 2010a), and as detailed in the *Work Plan, Excavation Support Design, Chemistry and Metallurgy Research Facility Replacement (CMRR) Project, Los Alamos National Laboratory* (Kleinfelder 2010b). A 10-foot-thick (3-meter-thick) basemat and the Modified CMRR-NF foundation would be constructed directly upon this concrete fill material.

To meet the seismic protection design requirements resulting from the *Probabilistic Seismic Hazards Analysis* and other seismic studies (LANL 2005, 2007a, 2008a; Kleinfelder 2010a, 2010b), the Modified CMRR-NF would require additional structural concrete and reinforcing steel for construction of the walls, floors, and roof of the building, beyond what was estimated and analyzed in the 2003 *CMRR EIS* and included under the No Action Alternative for this SEIS. These portions of the Modified CMRR-NF would, accordingly, be thicker and heavier than was previously estimated. In addition, most of the worker access areas inside the building would be constructed with solid floors rather than steel grating floors; fire suppression water storage tanks would be located inside the Modified CMRR-NF rather than using existing exterior water storage tanks (the large size and weight of these tanks require additional building structural considerations); various utilities would be installed with added protection measures; and other seismic protection and safety measures would be incorporated into the building design and the installation of equipment.

All proposed new facilities would be designed, constructed, and operated in compliance with applicable DOE orders, requirements, and governing standards established to protect public and worker health and the environment. DOE Order 420.1B requires that nuclear or nonnuclear facilities be designed, constructed, and operated so that the public, the workers, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes. The order stipulates the natural phenomena hazards mitigation requirements for DOE facilities and specifically provides for re-evaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. DOE Standard 1020-2002 (DOE 2002a) implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components, as well as for evaluation, modification, or upgrade of existing structures, systems, and components, to ensure that DOE facilities can safely withstand the effects of natural phenomena hazards, such as earthquakes. See Section 4.3.10.2 for an evaluation of the potential radiological impacts of an earthquake.

Construction Impacts – Shallow Excavation Option

Ground Disturbance. Under the Shallow Excavation Option, additional land would be disturbed at TA-55 beyond that disturbed under the No Action Alternative. RLUOB has already been constructed adjacent to the Modified CMRR-NF site, and up to 30 feet (9 meters) of the 58-foot (18-meter) excavation required for the Shallow Excavation Option of the Modified CMRR-NF has already been completed as part of the geologic evaluation of the site. Excavation of the additional 28 feet (8.5 meters) would require the removal of approximately 236,000 cubic yards (180,000 cubic meters) of material. This material would be managed the same way as discussed under the Deep Excavation Option.

Aggregate Supply. Approximately 120,000 tons (110,000 metric tons) of coarse aggregate and 120,000 tons (110,000 metric tons) of fine aggregate (sand) would be required to support construction under this construction option. Sources of aggregate for concrete would be the same as discussed under the Deep Excavation Option.

Seismicity. As discussed under the Deep Excavation Option, a comprehensive update to the LANL seismic hazards analysis was completed in June 2007 (LANL 2007a). Based on this updated seismic hazard analysis, the geotechnical properties of the bedrock at the proposed Modified CMRR-NF location have been further evaluated with respect to the proposed Modified CMRR-NF structure and associated depth of excavation. Similar to the Deep Excavation Option, the Modified CMRR-NF excavation under the Shallow Excavation Option would be affected by the uppermost units of this geologic formation, consisting of Units 3 (Qbt3) and 4 (Qbt4) of the Tshirege Member of the Bandelier Tuff (see Chapter 2, Figure 2–8). In comparison to the units above and below, the lower part of Unit 3 ($Qbt3_L$) has lower bearing capacity, is more compressible, has higher porosity, and has less cohesion. These rock properties, coupled with its vertical proximity to the Modified CMRR-NF basemat and foundation grade (about 15 feet [4.6 meters] separate $Qbt3_L$ from the proposed foundation) and its lateral proximity to the slope of Twomile Canyon, have led to potentially significant basemat and structural design issues (Kleinfelder 2010a).

Under the Shallow Excavation Option, a 58-foot (18-meter) excavation would be required for the Modified CMRR-NF construction. $Qbt3_L$, the poorly to nonwelded tuff, occurs from a depth of approximately 75 feet (23 meters) to approximately 125 to 130 feet (38 to 40 meters) below ground surface (Kleinfelder 2010b) (see Chapter 2, Figure 2–8). Therefore, $Qbt3_L$ would remain in place under this construction option, with about 17 feet (5.2 meters) of vertical separation between $Qbt3_L$ and the 10-foot-thick (3-meter-thick) basemat and foundation. The new structures would be designed and constructed in accordance with geotechnical recommendations provided by the contractor engineering firm.

Operations Impacts—Modified CMRR-NF and RLUOB operations would not impact geologic and soil resources at LANL, as no ground disturbance would occur and no additional geologic resources would be required.

4.3.6 Surface-Water and Groundwater Quality

Water quality impacts are not expected to occur as a result of constructing and operating the Modified CMRR-NF at TA-55. Construction activities could lead to a short-term increase in stormwater runoff, erosion, and/or sedimentation, but potential impacts on surface-water quality would be mitigated through implementation of Stormwater Pollution Prevention Plans (SWPPPs) and their designated controls (best management practices). Groundwater quality impacts are not expected during construction or operations under this alternative.

4.3.6.1 Surface Water

There are no natural surface-water drainages in the vicinity of the proposed Modified CMRR-NF at TA-55, and no surface water would be used to support facility construction. During construction, it is expected that portable toilets would be used for construction personnel, resulting in no onsite discharge of sanitary wastewater and no impact on surface waters (DOE 2003a). However, plumbed restrooms made available to construction workers would generate sanitary effluent during the construction period; this effluent would be discharged to sanitary sewer lines for treatment at the Sanitary Wastewater Systems Plant in TA-46, and then piped to TA-3 and discharged to Sandia Canyon via a National Pollutant Discharge Elimination System (NPDES)-permitted outfall (DOE 2008a).

Construction Impacts – Deep Excavation Option—Stormwater runoff from construction activities under the Deep Excavation Option could potentially impact downstream surface-water resources, but would be minimized through stormwater control, implemented as part of an SWPPP, and therefore is not expected to adversely impact downstream surface-water resources. The SWPPP would be prepared, prior to commencement of construction, to implement requirements and guidance from Federal and state regulations under the Clean Water Act, including the NPDES Construction General Permit and Clean Water Act Section 401 and 404 permits. Stormwater management controls, including best management practices for increased stormwater flows and sediment loads, would be included in the construction design specifications (DOE 2008a). To monitor the effectiveness of erosion and sediment control measures, the SWPPP would include a mitigation monitoring program, such as consistent and continual inspection and maintenance, to ensure that an adequate schedule and procedures are in place and implemented.

TA-55 is not in an area that is prone to flooding, and the nearest 100-year floodplains are located at a distance of approximately 650 feet (200 meters) in Twomile Canyon, 1,900 feet (580 meters) in Mortandad Canyon, and 3,000 feet (910 meters) in Pajarito Canyon.

Construction activities associated with the Modified CMRR-NF and the Pajarito Road right-of-way realignment at TA-50 and TA-55 would not require a New Mexico Section 401 Water Quality Certification or U.S. Army Corps of Engineers 404 Dredge and Fill Permit. However, these construction activities would require an NPDES General Permit for Storm Water Discharge from Construction Activities and an associated SWPPP. If oil, gasoline, diesel fuel, or other petroleum products spill onto the ground, they must be cleaned up, containerized, characterized, and disposed of. Excess materials, such as product debris, equipment, chemicals, waste, concrete, asphalt, and stockpiled soil, are considered wastes and would not be abandoned at the end of the project (NNSA 2010a) (see Section 4.3.12 for discussion of construction waste generation and management). The shifted road segment would be closer to the edge of Twomile Canyon, but would remain on the mesa top and not enter the canyon (LANL 2010d). Potential impacts on surface-water quality due to construction for the Pajarito Road realignment would be minimized through implementation of the SWPPP to control soil erosion in accordance with the NPDES Construction General Permit.

Soil and rock material excavated from the Modified CMRR-NF location would be transported by truck to storage areas within LANL in accordance with routine material reuse practices at the site. Best management practices to control stormwater runoff and minimize erosion and/or sedimentation would be employed to protect surface waters. Management of construction fill is expected to have no effect on surface-water quality. An existing stormwater detention pond would be enlarged at TA-63, and an additional detention pond would be constructed to collect and control runout from the TA-46/63 construction laydown area spanning land across the shared boundary of both technical areas. Another detention pond would be constructed to collect and control runout from the TA-48/55 construction laydown area in TA-64. A smaller detention pond would be constructed in TA-50 to collect and control runoff from the Modified CMRR-NF construction site in TA-55 (LANL 2010d).

An SWPPP would be prepared and implemented for construction of a new, permanent 115-kilovolt electrical substation in TA-50. The new substation, located on approximately 1.4 acres (0.6 hectares), would include construction of a short, unpaved service access road from Pajarito Road to the substation (LANL 2010d). Construction of the 115-kilovolt electrical substation in TA-50 is not expected to negatively impact surface-water quality.

Construction Impacts – Shallow Excavation Option—Implementation of the Shallow Excavation Option is expected to result either in impacts similar to those under the Deep Excavation Option for surface-water quality during construction or reduced impacts because there would be less excavated soil under the Shallow Excavation Option that would need to be controlled for erosion and sedimentation. All of the same stormwater management controls identified under the Deep Excavation Option during construction would be utilized if the Shallow Excavation Option is implemented.

Operations Impacts—No impacts on surface-water quality are expected as a result of Modified CMRR-NF and RLUOB operations under this alternative, including operations at RLUOB. No surface water would be used to support the facility, and there would be no direct discharge of effluent to surface waters during facility operations (LANL 2010d).

The Modified CMRR-NF and RLUOB stormwater control system would be sized to collect and manage flow from both buildings and the surrounding area for up to a 25-year design storm. The system includes design features and best management practices that comply with sustainable design principles, as well as LANL and EPA standards. It would include roof drains, ditches, curbs and gutters, catch basins, manholes, storm sewer pipes, and a stormwater sediment basin or detention pond. The stormwater detention pond (located south of Pajarito Road in TA-50) would control erosion from stormwater runoff by detaining and releasing the storm flow in a controlled manner (LANL 2010d).

4.3.6.2 Groundwater

No impacts on groundwater are anticipated to result from construction and operation of the Modified CMRR-NF and RLUOB.

Construction Impacts – Deep Excavation Option—No onsite discharges that would affect groundwater are planned for construction of the Modified CMRR-NF. Appropriate spill prevention, countermeasures, and control procedures (for example, proper management of hazardous and nonhazardous wastes and materials such as diesel fuel or petroleum, oils, and lubricants from construction equipment) would be utilized to minimize potential releases that could affect groundwater.

Construction Impacts – Shallow Excavation Option—Implementation of the Shallow Excavation Option is expected to result in impacts similar to those under the Deep Excavation Option for groundwater quality during construction.

Operations Impacts—No impacts on groundwater resources (that is, groundwater quality or availability) are anticipated during operations of the Modified CMRR-NF or RLUOB under this alternative. No discharges to the surface or subsurface are planned, and spill prevention, countermeasures, and control procedures would be employed to minimize the probability of, and the potential for, an unplanned release that could infiltrate and affect groundwater (LANL 2010a). (The volume of groundwater required during construction and operations is discussed in Section 4.3.3)

4.3.7 Ecological Resources

4.3.7.1 Terrestrial Resources

Construction Impacts – Deep Excavation Option—Under the Deep Excavation Option, the affected areas within TA-5, TA-46, TA-48, TA-50, TA-52, TA-55, TA-63, and TA-64 are located on the mesa top and mostly within the ponderosa pine forest vegetation zone; however, areas within TA-36, TA-51, TA-54, and TA-72 are located on mesa tops or canyons at lower elevations to the east and fall within the pinyon-juniper woodland vegetation zone. About 6 acres (2.43 hectares) of undeveloped land, consisting mostly of ponderosa pine forest, would be permanently disturbed by vegetation removal and grading. About 95 acres (38.4 hectares) of undeveloped land, consisting of grasslands, ponderosa pine forest, and pinyon-juniper woodland, would be temporarily disturbed by vegetation removal and grading (see Table 4–14). Pajarito Road realignment, electrical substation, stormwater detention ponds, construction laydown areas, and concrete batch plants are within or adjacent to developed land or have been previously used for material storage and laydown activities (LANL 2010d). Vegetation and habitat would be most impacted by the parking lot located within TA-72; potential spoils storage areas within TA-51, TA-54, and TA-36; and a construction laydown and support area in TA-5/52. These areas are largely undeveloped and would remove mostly pinyon-juniper woodland. There are several areas of undeveloped land being considered for spoils storage, 30 acres (12.1 hectares) of which would be used on a long-term temporary basis under this construction option. Areas of temporary disturbance would be revegetated using native species following the construction period or, in the case of spoils storage areas, once they are no longer needed (LANL 2010c, 2011).

Where construction would occur on previously developed land, there would be little or no impact on terrestrial resources. Within areas of undeveloped ponderosa pine forest and pinyon-juniper woodland, construction would result in the loss of less-mobile wildlife, such as reptiles and small mammals, and displacement of more-mobile species, such as birds and large mammals. No impacts that would violate provisions of the Bald and Golden Eagle Protection Act or the Migratory Bird Treaty Act have been identified. The *Migratory Bird Best Management Practices Source Document for Los Alamos National Laboratory* provides site-wide mitigation measures, including timing of forest clearing to avoid the breeding season of migratory birds (June 1 through July 31), which would reduce risks to birds protected under the Migratory Bird Treaty Act at LANL (LANL 2010h). Indirect impacts of construction, such as noise or human disturbance, could also temporarily impact wildlife living adjacent to the construction zone. All work areas would be clearly marked to prevent construction equipment and workers from disturbing adjacent natural habitat.

Construction Impacts – Shallow Excavation Option—Potential impacts under the Shallow Excavation Option on terrestrial resources at LANL are similar to those expected under the Deep Excavation Option, with the exception that less land is required for spoils storage. Only about 10 acres (4 hectares) would be needed for spoils storage compared to 30 acres (12 hectares) under the Deep Excavation Option. The two potentially impacted areas would be 9.1 acres (3.7 hectares) of mostly undeveloped pinyon-juniper woodland within TA-51 and 19.1 acres (7.7 hectares) of mostly ponderosa pine forest within TA-5/52 along both sides of Puye Road. Spoils storage sites would potentially be established in either one or both of these areas. Potential impacts on terrestrial resources would be the same as discussed above under the Deep Excavation Option.

Operations Impacts—Operations at the Modified CMRR-NF and RLUOB would have a minimal impact on terrestrial resources within or adjacent to TA-55. Because wildlife residing in the area has already adjusted to levels of noise and human activity associated with current TA-55 operations, it is unlikely to be adversely affected by similar types of activity associated with Modified CMRR-NF and RLUOB operations (DOE 2003b).

4.3.7.2 Wetlands

Construction and Operations Impacts – Deep Excavation and Shallow Excavation Options—As noted in Chapter 3, Section 3.7.2, there is one wetland located within TA-55, four within TA-48, and nine within TA-36. Under the Modified CMRR-NF Alternative, no wetlands would be present in the areas where Modified CMRR-NF construction would occur, meaning there would be no direct impacts on wetlands. The wetlands within TA-48 and TA-55 are located in Mortandad Canyon, north of the project area, and would not be affected by construction. However, under the Deep Excavation Option, wetlands located in

TA-36 could be indirectly affected by possible spoils storage there, with the potential for stormwater runoff and erosion into the Pajarito watershed if TA-36 is selected for spoils storage. A sediment and erosion control plan would be implemented to control stormwater runoff during construction, preventing impacts on the wetlands located farther down Pajarito Canyon. Under the Shallow Excavation Option, there would be no direct or indirect impacts on any LANL wetlands because TA-36 would not be a potential spoils storage area. No impacts on wetlands are expected as a result of Modified CMRR-NF and RLUOB operations under this alternative.

4.3.7.3 Aquatic Resources

Construction and Operations Impacts – Deep Excavation and Shallow Excavation Options—The only aquatic resources present within the potentially impacted areas under the Modified CMRR-NF Alternative are small pools associated with the wetlands. There would be no direct impacts on these resources from the construction of most project elements associated with the Modified CMRR-NF. There could be indirect impacts on aquatic habitat within wetland areas located in TA-36 under the Deep Excavation Option, although, as stated above, a sediment and erosion control plan would be implemented to control stormwater runoff. No impacts on aquatic resources are expected as a result of Modified CMRR-NF and RLUOB operations under this alternative.

4.3.7.4 Threatened and Endangered Species

Construction Impacts – Deep Excavation Option—As noted in Chapter 3, Section 3.7.4, areas of environmental interest for the Mexican spotted owl and the southwestern willow flycatcher have been established at LANL to protect their potential habitat. Portions of TA-55 and other technical areas affected by construction under the Deep Excavation Option include both core and buffer zones for the federally threatened Mexican spotted owl (see **Table 4–25**). Project elements, including Pajarito Road realignment, electrical substation, stormwater detention ponds, construction laydown areas, and concrete batch plants, are within or adjacent to developed land or land that has been previously used for material storage and laydown activities. Therefore, potential habitat that would be removed for these project elements may affect, but is not likely to adversely affect the Mexican spotted owl. Other areas of concern that would impact undisturbed land include all potential spoils storage areas within TA-36, TA-51, and TA-54; a construction laydown and support area in TA-5/52; and a parking lot in TA-72 (see Section 4.3.2.1). Of these areas, the construction laydown and support area in TA-5/52 would fall within core and buffer zones of a Mexican spotted owl area of environmental interest and could impact up to 9.7 acres (3.9 hectares) and 12.9 acres (5.2 hectares) of potential habitat, respectively. Although a small portion of potential Mexican spotted owl habitat would be removed, no owls have been observed in those areas in annual surveys. A spoils storage area within TA-36 would be adjacent to the southwestern willow flycatcher area of environmental interest and would not remove any potential habitat for this species. However, due to possible erosion concerns affecting wetlands in that area, the potential habitat may be affected. No willow flycatchers of the southwestern species have been confirmed on LANL. As stated earlier, a sediment and erosion control plan would be implemented to control stormwater runoff. After biological evaluation, NNSA determined that construction may affect, but is not likely to adversely affect, the Mexican spotted owl or the southwestern willow flycatcher (LANL 2011). NNSA maintains an active process of consultation with the U.S. Fish and Wildlife Service in accordance with requirements of the Endangered Species Act. Consultations resulted in concurrence by U.S. Fish and Wildlife Service with NNSA's determination that construction and operation of the CMRR Facility in TA-55, including use of other areas for construction support activities, may affect, but is not likely to adversely affect, either individuals of threatened or endangered species currently listed by U.S. Fish and Wildlife Service, or their critical habitat at LANL (USFWS 2003, 2005, 2006, 2007, 2009). All project activities would be reviewed for compliance with the *Threatened and Endangered Species Habitat Management Plan* (LANL 2000a). Any lighting would be directed away from canyons and comply with the New Mexico Night Sky Protection Act, and disturbance and noise would be kept to a minimum (LANL 2010c).

Table 4–25 Modified CMRR-NF Alternative — Deep Excavation Option, Impacted Areas of Environmental Interest for the Mexican Spotted Owl

Project Element	*Technical Area*	*Mexican Spotted Owl Areas of Environmental Interest Impacted*	*Potential Impacts*
Pajarito Road realignment	55	Core and buffer	Some habitat would be developed. The National Nuclear Security Administration determined that construction may affect, but is not likely to adversely affect, the Mexican spotted owl due to removal of a small portion of potential habitat. No owls have been observed in the areas where project activity would occur under this alternative.
Electrical substation, stormwater detention ponds	50	Core and buffer	
	64	Slightly within buffer	
Construction laydown/concrete batch plant	46/63	Buffer and slightly within core	
	48/55	Buffer	
Construction laydown and support area	5/52	Core and buffer	
Spoils storage areas	5/52	Core and buffer	
	36	Buffer	
	51	Slightly within buffer	
	54	None	
Temporary power upgrades	55 through 50, 63, and 52 to 5	Core and buffer	
Parking lot and associated road improvements	72	None	

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility.
Source: LANL 2000a, 2011.

Construction Impacts – Shallow Excavation Option—Potential impacts on threatened and endangered species at LANL under the Shallow Excavation Option are similar to those under the Deep Excavation Option, with the exception that only about 10 acres (4 hectares) of spoils storage would be needed from two areas proposed for spoils storage (TA-51 and TA-5/52).

Operations Impacts— Modified CMRR-NF and RLUOB operations would not directly affect any endangered, threatened, or special status species within or adjacent to TA-55. Noise levels associated with the new facility would be low, and human disturbance would be similar to that which already occurs within TA-55. Nighttime lighting could indirectly affect prey species activities; however, any lighting would meet requirements under the New Mexico Night Sky Protection Act. These effects are not likely to adversely affect the Mexican spotted owl potential habitat areas.

4.3.8 Cultural and Paleontological Resources

Construction Impacts – Deep Excavation Option—Construction of the Modified CMRR-NF under the Deep Excavation Option encompasses numerous project elements that would involve both temporary and permanent facilities. These new facilities would have the potential to impact cultural resources within a number of the affected technical areas. **Table 4–26** lists the various project elements and the technical areas in which they would occur. Also presented are the total acreage involved, whether the action would be temporary or permanent, the number of NRHP-listed and -eligible sites within each technical area that could potentially be affected, and whether any eligible sites would be impacted.

Table 4–26 Modified CMRR-NF Alternative — Cultural Resources Impacts

Project Element	*Technical Area*	*Acreage*	*Status*	*NRHP-Listed and -Eligible Sites in Project Element Vicinity*	*Potential Conflict Between Project Element and NRHP-Listed and -Eligible Sites*
Pajarito Road realignment	55	3.4	P	One rock shelter	No effect through avoidance
Electrical substation	50	1.4	P	None	
Stormwater detention ponds	50	0.5	P	None	
	64	1	P	None	
Spoils storage areas					
	36	24.7	T	One 1- to 3-room structure	No effect through avoidance
	36	14.4	T	None	
	51	9.1	T	One cavate	No effect through avoidance
	54	18.6	T	Two 1- to 3-room structures; one complex pueblo; and one pueblo roomblock	No effect through avoidance
Parking lot and associated road improvements	72	13-15	T	Two lithic scatters and rock ring	No effect through avoidance. Northern third of Mortandad Trail would be impacted.
Temporary power upgrades	55 through 59 to 63	25.2	T	None	
	5/52	2	T	One 1- to 3-room structure in TA-5	No effect through avoidance
Construction laydown/concrete batch plant	46/63	40	T	Two 1- to 3-room structures in TA-46	No effect through avoidance
	48/55	20	T	One 1- to 3-room structure in TA-48	No effect through avoidance
Construction laydown and support area	5/52	19.1	T	One 1- to 3-room structure in TA-5; two cavates and one rock shelter in TA-52	No effect through avoidance

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; NRHP = National Register of Historic Places; P = permanent; T = temporary; TA = technical area.

Nine affected technical areas contain NRHP-listed or -eligible sites in the vicinity of project activities (see Table 4–26). In all cases, there would be no effect through avoidance. Under the procedures for compliance with *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (*Cultural Resources Management Plan*) (LANL 2006a), sites would be clearly marked and fenced, as appropriate, to avoid direct or indirect disturbance by construction equipment and workers. Further, construction activities would be monitored to ensure that the sites remain undisturbed. If buried cultural deposits are encountered during construction, activities would cease until their significance is determined and procedures are implemented in accordance with the *Cultural Resources Management Plan.* In addition, if project plans should change such that impacts become unavoidable, LANL would consult with the New Mexico State Historic Preservation Office in accordance with Section 106 of the National Historic Preservation Act of 1966 prior to any ground disturbance taking place.

In the case of TA-72, the northern third of the Mortandad Trail leading to the Mortandad Cave Kiva would be directly impacted or cut by construction of the parking lot. Access to this trail, and hence Mortandad Cave Kiva, is limited to organized tours. The project would work with LANL cultural resources personnel to re-establish the affected portion of the trail and thus maintain continued limited access to the Mortandad

Cave Kiva. However, to help control unauthorized visitation, the parking lot design would incorporate fencing around its perimeter to prevent direct access to the trail.

With respect to traditional cultural properties, it is anticipated that there would be no effect through avoidance. As is the case with other cultural resources, DOE would comply with Section 106 of the National Historic Preservation Act of 1966 should project plans change. Further, DOE would respect the needs of the pueblos during the construction period with regard to times when members might want to participate in ceremonies and rituals (see Chapter 3, Section 3.8.3). There are no known paleontological resources present at TA-55 at LANL. Thus, there would be no impacts on these resources.

Construction Impacts – Shallow Excavation Option—Construction of the Modified CMRR-NF under the Shallow Excavation Option would entail the same project elements noted above for the Deep Excavation Option. However, as only 10 acres (4 hectares) would be required for spoils storage, only TA-5/52 and TA-51 would be considered for this purpose. There are no NRHP-listed or -eligible sites within either of the areas proposed for spoils storage. Thus, there would be no impact on cultural resources from this element of the project.

Operations Impacts—Operation of the Modified CMRR-NF and RLUOB would not directly impact cultural or paleontological resources. Nevertheless, cultural resources would continue to be periodically monitored, and the fencing would be maintained, as appropriate, to ensure that they remain undisturbed. Impacts on the Mortandad Trail are described above.

4.3.9 Socioeconomics

Construction Impacts – Deep Excavation Option—Construction of the Modified CMRR-NF under the Deep Excavation Option would require a peak construction employment level of about 790 workers (LANL 2011). This level of employment would generate about 450 indirect jobs in the region around LANL. The potential total peak employment of 1,240 direct and indirect jobs represents an increase in the ROI workforce of approximately 0.8 percent. Direct construction employment would average 420 workers annually over this time, approximately half of the estimated peak employment. The average direct construction employment would result in about 240 indirect jobs in the region around LANL. This total of 660 direct and indirect jobs represents an approximate 0.4 percent increase in the ROI workforce. These small increases would have little or no noticeable impact on the socioeconomic conditions of the ROI.

Construction Impacts – Shallow Excavation Option—The impacts under the Shallow Excavation Option from construction of the Modified CMRR-NF would be similar to the Deep Excavation Option. The peak employment number of about 790 construction workers would be the same as under the Deep Excavation Option, and the annual average would be 410 workers over the life of the project. The average direct construction employment would result in about 240 indirect jobs in the region around LANL. This total of 650 direct and indirect jobs represents an approximate 0.4 percent increase in the ROI workforce. There would be little or no noticeable impact on the socioeconomic conditions of the ROI.

Operations Impacts—Operations at the Modified CMRR-NF and RLUOB would require a workforce of approximately 550 workers, including workers that would come from other locations at LANL to use the Modified CMRR-NF laboratory capabilities. The number of workers in support of Modified CMRR-NF operations would cause no change to socioeconomic conditions in the LANL four-county ROI. Workers assigned to the Modified CMRR-NF and RLUOB would be drawn from existing LANL facilities, including the CMR Building. The number of LANL employees supporting the Modified CMRR-NF and RLUOB operations would represent only a small fraction of the LANL workforce (approximately 13,500 in 2010) and an even smaller fraction of the regional workforce (approximately 165,000 in 2009).

4.3.10 Human Health Impacts

4.3.10.1 Normal Operations

No radiological risks would be incurred by members of the public from construction activities associated with the Modified CMRR-NF. Construction workers would be at a small risk for construction-related accidents and radiological exposures. They could receive doses above natural background radiation levels from exposure to radiation from other past or present activities at the site. However, these workers would be protected through appropriate training, monitoring, and management controls. Their exposure would be limited to ensure that doses are kept as low as is reasonably achievable.

Occupational injury and illness rates under the Modified CMRR-NF Alternative are projected to follow mostly the patterns observed at LANL sites from 1999 through 2008, as discussed in Chapter 3, Section 3.11, and documented in the *LANL SWEIS* (DOE 2008a). The average injury and illness rates at LANL during this period were 2.40 total recordable cases (TRCs) and 1.18 days away, restricted, or transferred (DART) cases (when workers missed days, their activities were restricted, or they were transferred due to an occupational injury or illness) for every 200,000 hours worked (see Section 3.11). Comparably, the average rates at DOE facilities are projected to result in 1.6 TRCs and 0.7 DART cases, based on the accident cases from 2004 through 2008 (DOE 2011a). Both of these sets of rates are well below industry averages, which in 2009 were 3.6 TRCs and 1.8 DART cases (BLS 2010a).

As stated in Chapter 3, Section 3.11.3, there have been no work-related accident fatalities at LANL for over 10 years. Review of the statistics on injury and illness data for DOE construction contractors from 2003 through March of 2010 identified no injuries resulting in death in over 160 million worker hours. Therefore, to estimate the potential for any fatalities during construction, the DOE-contractor average fatality rate of 0.0008 per 200,000 hours worked was used (DOE 2011a).

Construction Impacts – Deep Excavation Option—Under the Deep Excavation Option, construction of the Modified CMRR-NF would require a peak employment level of 790 workers and an average of 420 workers over the approximate 9-year construction period. Using this level of employment and the TRC and DART rates from LANL and DOE, there would be about 95 TRCs of occupational injury and illness and about 47 DART cases. During the same period, an estimated 0 (0.03) work-related fatalities would occur under the Deep Excavation Option from construction activities.

Construction Impacts – Shallow Excavation Option—Consistent with the Deep Excavation Option, construction of the Modified CMRR-NF under the Shallow Excavation Option would require a peak employment level of 790 workers, but an average of 410 workers over an approximate 9-year construction period. Using this level of employment and using the TRC and DART rates from LANL and DOE, there would be about 92 TRCs of occupational injury and illness and about 45 DART cases. During the same period, an estimated 0 (0.03) work-related fatalities would occur under the Shallow Excavation Option from construction activities.

Operations Impacts—Normal operations of the Modified CMRR-NF and RLUOB at TA-55 are not expected to result in an increase in LCFs among the general public. Under this alternative, the radiological releases to the atmosphere from the Modified CMRR-NF and RLUOB at TA-55 would be similar to those estimated in the *CMRR EIS* and provided in **Table 4–27**. The actinide emissions listed in this table are in the form of plutonium, uranium, thorium, and americium isotopes. In estimating the human health impacts, all actinide emissions were considered to be plutonium-239. This is conservative because the human health impacts on a per-curie basis are greater for plutonium-239 than for the other actinides associated with activities at the Modified CMRR-NF. Liquid radiological effluents would be routed through an existing pipeline to the TA-50 RLWTF, where they would be treated along with other LANL radioactive liquid wastes. The treatment residues would be solidified and disposed of as radioactive waste.

Table 4–27 Modified CMRR-NF Alternative — Modified CMRR-NF and RLUOB Radiological Emissions During Normal Operations

Nuclide	*Emissions (curies per year)*
Actinides	0.00076
Krypton-85	100
Xenon-131m	45
Xenon-133	1,500
Hydrogen-3 (tritium) [a]	1,000

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] The tritium release is in the form of both tritium oxide (750 curies) and elemental tritium (250 curies). Tritium oxide is more readily absorbed by the body and, therefore, the health impact of tritium oxide on a receptor is greater than that for elemental tritium. Therefore, all of the tritium release has been conservatively modeled as if it were tritium oxide.

Source: DOE 2003b.

Table 4–28 shows the annual collective dose to the population projected to be living within a 50-mile (80-kilometer) radius of TA-55 in 2030. The *CMRR EIS* provided estimates of annual collective doses to the general population and an MEI from radioactive releases during normal operations. Appendix B of the *CMRR EIS* documented the methodology and assumptions used in estimating the population and MEI doses. These doses were calculated using the GENII Version 1.485 computer program (Napier et al. 1988), which used dose conversion factors from Federal Guidance Report No. 11 and No. 12 (EPA 1988 and 1993a). The population dose in the *CMRR EIS* was based on the estimated population surrounding TA-55 in 2000. In this SEIS, the estimated population dose centered at TA-55 is based on the 2030 projected population estimate of about 545,000. In addition, in this SEIS, a revised version of the computer program, GENII Version 2 (PNNL 2007), was used, along with updated dose conversion factors. GENII Version 1.485 overestimated the projected dose by not depleting the radioactive cloud as particles settled during its travel downwind. GENII Version 2 does account for depletion, so even though a larger population was used in the current analysis, the new dose estimates are smaller than those provided in the *CMRR EIS* for the same released quantities of radioactive emissions. In addition, the use of revised dose conversion factors for inhalation from Federal Guidance Report No. 13, which are derived from models based on current understanding of the biological behavior of radionuclides in the body and models representing the U.S. population, resulted in lower estimated doses.

Doses were estimated for the general public living within 50 miles (80 kilometers) of the Modified CMRR-NF at TA-55, an average member of the public, and an offsite MEI (a hypothetical member of the public residing at the LANL site boundary who receives the maximum dose). The dose pathways for these receptors include inhalation, ingestion, and direct exposure from immersion in the passing plume and from materials deposited on the ground. To put the doses into perspective, they are compared to doses from natural background radiation[6] levels.

[6] *The term natural background radiation is used to mean the ubiquitous radiation in the environment that the population cannot avoid. It includes a small component of manmade radiation from past nuclear weapons testing.*

Table 4–28 Modified CMRR-NF Alternative — Annual Radiological Impacts of Modified CMRR-NF and RLUOB Operations on the Public

	Population Within 50 Miles (80 kilometers)	*Average Individual Within 50 Miles (80 kilometers)*	*Maximally Exposed Individual*
Dose	1.8 person-rem	0.0033 millirem	0.31 millirem
Cancer fatality risk [a]	1×10^{-3}	2×10^{-9}	2×10^{-7}
Regulatory dose limit [b]	Not applicable	10 millirem	10 millirem
Dose as a percentage of the regulatory limit	Not applicable	0.03	3.1
Dose from natural background radiation [c]	260,000 person-rem	480 millirem	480 millirem
Dose as a percentage of natural background dose	0.0007	0.0007	0.041

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Based on a risk estimate of 0.0006 latent cancer fatalities per person-rem (DOE 2003a).

[b] 40 CFR Part 61, Subpart H, establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations. There is no standard for a population dose.

[c] The annual individual dose from background radiation at LANL is 480 millirem (see source of ubiquitous background radiation in Chapter 3, Section 3.11.1). The 2030 population living within 50 miles (80 kilometers) of TA-55 was estimated to be about 545,000.

Note: To convert miles to kilometers, multiply by 0.62137.

Table 4–28 shows the estimated population dose associated with Modified CMRR-NF operations to be 1.8 person-rem. This population dose would increase the annual risk of a latent fatal cancer in the population by 0.001. Another way of stating this is that the likelihood that one fatal cancer would occur in the population as a result of radiological releases associated with this alternative is about 1 chance in 1,000 per year. Statistically, LCFs are not expected to occur in the population from Modified CMRR-NF operations at TA-55.

The average annual dose to an individual in the population would be 0.0033 millirem under this alternative. The corresponding increased risk of an individual developing a latent fatal cancer from receiving the average dose would be 2×10^{-9}, or about 1 chance in 500 million per year.

The MEI would receive an estimated annual dose of 0.31 millirem. This dose corresponds to an increased annual risk of developing a latent fatal cancer of about 2×10^{-7}. In other words, the likelihood that the MEI would develop a fatal cancer is about 1 chance in 5 million for each year of operations.

Estimated annual doses to workers involved with Modified CMRR-NF and RLUOB operations under this alternative are provided in **Table 4–29**. The average annual worker dose for workers involved in Modified CMRR-NF and RLUOB activities was estimated to be about 140 millirem per radiation worker for Modified CMRR-NF activities and 20 millirem per radiation worker for RLUOB activities (LANL 2011). Therefore, a weighted average of about 109 millirem has been used as the estimate of the average annual worker dose per year of operations at the Modified CMRR-NF and RLUOB at TA-55.

The average annual worker dose of about 109 millirem is well below the DOE worker dose limit of 5 rem (5,000 millirem) (10 CFR Part 835) and is significantly less than the recommended Administrative Control Level of 500 millirem (DOE 1999b). This average annual dose corresponds to an increased risk of a fatal cancer of 0.00007 for each year of operations. In other words, the likelihood that a worker at the Modified CMRR-NF would develop a fatal cancer from annual work-related exposure is about 1 chance in 14,000.

Table 4–29 Modified CMRR-NF Alternative — Annual Radiological Impacts of Modified CMRR-NF and RLUOB Operations on Workers

	Individual Worker	*Worker Population* [a]
RLUOB dose/fatal cancer risk [b]	20 millirem/1 × 10^{-5}	2.8 person-rem/2 × 10^{-3}
Modified CMRR-NF dose/fatal cancer risk [b, c]	140 millirem/8 × 10^{-5}	57.4 person-rem/3 × 10^{-2}
Total	Not applicable	60 person-rem/4 × 10^{-2}
Dose limit [d]	5,000 millirem	Not available
Administrative control level [e]	500 millirem	Not available

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Based on a radiation worker population of 140 for RLUOB and 410 for the Modified CMRR-NF at TA-55. Dose limits and administrative control levels do not exist for worker populations.

[b] Based on the average dose to LANL workers who received a measurable dose in the period from 2007 to 2009 and specific activities associated with the Modified CMRR-NF (LANL 2011). A program to reduce doses to as low as is reasonably achievable would be employed to reduce doses to the extent practicable.

[c] Based on a worker risk estimate of 0.0006 latent cancer fatalities per person-rem (DOE 2003a).

[d] 10 CFR 835.202.

[e] DOE 1999b.

Based on a worker population of 550 combined in the Modified CMRR-NF and RLUOB, the estimated annual worker population dose would be 60 person-rem. This would increase the likelihood of a fatal cancer within the worker population by about 0.04 per year. In other words, on an annual basis, there is less than 1 chance in 25 of one fatal cancer developing in the entire worker population as a result of exposures associated with activities under this alternative.

Occupational injury and illness rates for normal operations under this alternative are projected to follow the patterns observed at LANL sites from 1999 through 2008, as discussed in Chapter 3, Section 3.11.3. Using the average TRC and DART case rates at LANL of 2.4 and 1.18 for every 200,000 hours worked, respectively, it is expected that the workers would experience about 14 TRCs and about 7 DART cases, annually.

Hazardous Chemicals Impacts

No chemical-related health impacts on the public would be associated with the Modified CMRR-NF and RLUOB operations. As stated in the 2008 *LANL SWEIS*, the laboratory quantities of chemicals that could be released to the atmosphere during normal operations are minor quantities and would be below the screening levels used to determine the need for additional analysis. Workers would be protected from adverse effects from the use of hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals.

4.3.10.2 Facility Accidents

The Modified CMRR-NF would include safety features that would reduce the risks of accidents described under the No Action Alternative (2004 CMRR-NF). From an accident perspective, the proposed Modified CMRR-NF built under either construction option would be designed to meet the Performance Category 3 seismic requirements and would have a full confinement system that includes tiered pressure zone ventilation and HEPA filters.

Radiological Impacts

Appendix C of this SEIS provides the methodology and assumptions used in developing facility accident scenarios and estimating doses to the general public within 50 miles (80 kilometers), the offsite MEI, and an onsite worker near the facility. Two of the four accidents analyzed for the 2004 CMRR-NF, as described in Section 4.2.10.2, were modified to account for the design changes needed to ensure the Modified CMRR-NF would survive a design-basis earthquake (see Appendix C). The revised seismic accidents would result in lower released quantities of radioactive material because the Modified CMRR-NF would be designed to survive a design-basis earthquake accident; thus, releases from the Modified CMRR-NF due to such an earthquake would be mitigated, whereas the 2004 CMRR-NF would likely fail in the event of such an earthquake. The Modified CMRR-NF would be a much stronger and seismically resistant structure compared to the 2004 CMRR-NF.

Tables 4–30 and **4–31** provide the accident consequences and risks for the Modified CMRR-NF. Table 4–30 presents the frequencies and consequences of the postulated set of accidents for a noninvolved worker at the technical area boundary, a distance of 240 yards (220 meters), the offsite MEI at the nearest public location (0.75 miles [1.2 kilometers] north-northeast of TA-55), and the general population living within 50 miles (80 kilometers) of the facility. Table 4–31 presents the accident risks, obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur.

Table 4–30 Modified CMRR-NF Alternative — Accident Frequency and Consequences

		Maximally Exposed Individual		*Offsite Population* [a]		*Noninvolved Worker at TA Boundary*	
Accident	*Frequency (per year)*	*Dose (rem)*	*Latent Cancer Fatality* [b]	*Dose (person-rem)*	*Latent Cancer Fatalities* [c]	*Dose (rem)*	*Latent Cancer Fatality* [b]
Safety-Basis Scenarios							
Facility-wide fire	0.0001	1.1	0.0007	720	0 (0.4)	5.9	0.004
Seismically induced spill with mitigation	0.0001	1.5	0.0009	350	0 (0.2)	51	0.06
Seismically induced fire with mitigation	0.0001	0.6	0.0004	480	0 (0.3)	3.4	0.002
Loading-dock spill/fire	0.01	0.028	0.00002	6.4	0 (0.004)	1.0	0.0006
SEIS Scenarios							
Facility-wide fire	0.000001	0.011	0.000007	7.2	0 (0.004)	0.059	0.00004
Seismically induced spill with mitigation	0.0001	0.3	0.0002	69	0 (0.04)	10	0.006
Seismically induced fire with mitigation	0.00001	1.0	0.0006	770	0 (0.5)	5.5	0.003
Loading-dock spill/fire	0.0001	0.028	0.00002	6.4	0 (0.004)	1.0	0.0006

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; SEIS = supplemental environmental impact statement; TA = technical area.

[a] Based on a projected 2030 population estimate of about 545,000 persons residing within 50 miles (80 kilometers) of TA-55.

[b] Increased likelihood of an LCF for an individual if the accident occurs.

[c] Increased number of LCFs for the offsite population if the accident occurs (results rounded to 1 significant figure). When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses.

Table 4–31 Modified CMRR-NF Alternative —Annual Accident Risks

Accident	*Risk of Latent Cancer Fatality*		
	Maximally Exposed Individual [a]	*Offsite Population* [b, c]	*Noninvolved Worker at TA Boundary* [a]
Safety-Basis Scenarios			
Facility-wide fire	7×10^{-8}	4×10^{-5}	4×10^{-7}
Seismically induced spill with mitigation	9×10^{-8}	2×10^{-5}	6×10^{-6}
Seismically induced fire with mitigation	4×10^{-8}	3×10^{-5}	2×10^{-7}
Loading-dock spill/fire	2×10^{-7}	4×10^{-5}	6×10^{-6}
SEIS Scenarios			
Facility-wide fire	7×10^{-12}	4×10^{-9}	4×10^{-11}
Seismically induced spill with mitigation	2×10^{-8}	4×10^{-6}	6×10^{-7}
Seismically induced fire with mitigation	6×10^{-9}	5×10^{-6}	3×10^{-8}
Loading-dock spill/fire	2×10^{-9}	4×10^{-7}	6×10^{-8}

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; SEIS = supplemental environmental impact statement; TA = technical area.

[a] Increased risk of an LCF to the individual.

[b] Increased risk of an LCF in the offsite population.

[c] Based on a projected 2030 population estimate of about 545,000 persons residing within 50 miles (80 kilometers) of TA-55.

The accident with the highest potential risk to the MEI (see Table 4–31) would be a loading-dock spill/fire caused by mishandling material or an equipment failure (safety-basis scenario). This accident would present an annual risk of an LCF to the offsite MEI of 2×10^{-7}. In other words, the offsite MEI's likelihood of developing a latent fatal cancer from this event is about 1 chance in 5,000,000 per year. The accident with the highest potential risk to the offsite population would be a facility-wide fire or the loading-dock spill/fire (safety-basis scenario). These accidents would present increased risks of a single LCF in the entire population by 4×10^{-5} per year; in other words, the likelihood of one fatal cancer in the entire population from either of these events would be about 1 chance in 25,000 per year. Statistically, LCFs would not be expected to occur in the population. The maximum risk of an LCF to a noninvolved worker would be from a seismically induced spill or the loading-dock spill/fire (safety-basis scenario); the risk would be 6×10^{-6}, or about 1 chance in 160,000 per year.

Involved Worker Impacts

Approximately 550 workers would be at the Modified CMRR-NF and RLUOB during operations. Workers near an accident could be at risk of serious injury or death. Following initiation of accident and site emergency alarms, workers in adjacent areas of the facility would evacuate the area in accordance with technical area and facility emergency operating procedures and training.

Hazardous Chemicals and Explosives Impacts

Some of the chemicals that would be used in the Modified CMRR-NF and RLUOB operations are toxic and carcinogenic. The quantities of the regulated hazardous chemicals and explosive materials stored and used would be well below threshold quantities set by the EPA (40 CFR Part 68) and would pose minimal potential hazards to the public health and the environment in an accident condition. These chemicals would be stored and handled in small quantities (10 to a few hundred milliliters) and would only be a hazard to the involved worker under accident conditions.

4.3.10.3 Intentional Destructive Acts

Analysis of the impacts of terrorist incidents on the construction and operation of the Modified CMRR-NF is presented in a classified appendix to this SEIS. The impacts of some terrorist incidents would be similar to the accident impacts described earlier in this section, while some terrorist incidents may have more-severe impacts. A description of how NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems is in Section 4.2.10.3.

4.3.11 Environmental Justice

Construction Impacts – Deep Excavation and Shallow Excavation Options—There would be no disproportionately high and adverse environmental impacts on minority or low-income populations due to construction activities at TA-55 under either construction option of the Modified CMRR-NF Alternative. This conclusion is a result of analyses in this *CMRR-NF SEIS* that determined there would be no significant impacts on human health, ecological resources, cultural and paleontological resources, socioeconomics, or other resource areas described in other subsections of this chapter.

Operations Impacts—Population estimates of the entire population and minority and low-income subsets of the population have been projected to the year 2030 (see Section 4.3.10.1 and Chapter 3, Section 3.10). As shown in **Table 4–32**, the total population within 50 miles (80 kilometers) of TA-55 under the Modified CMRR-NF Alternative is projected to receive an annual dose of approximately 1.8 person-rem and an average annual individual dose of 0.0033 millirem.

The population subset of nonminority individuals would receive the highest average dose, 0.0035 millirem, annually. This dose is very small and represents an increased risk to the exposed individual of developing a latent fatal cancer of 2×10^{-9}, or 1 chance in about 500 million, annually. Doses were also estimated for the following population subsets: all (total) minorities, Native Americans, and Hispanics of any race. The total minority population is expected to receive the largest annual collective dose (1.0 person-rem) because the majority of the population surrounding LANL is considered part of a minority group and an annual average individual dose of 0.0032 millirem. Native Americans living within 50 miles (80 kilometers) of TA-55 would receive a collective dose of 0.09 person-rem annually and an average annual individual dose of 0.0029 millirem. The Hispanic population would receive a collective dose of 0.77 person-rem annually; the average annual individual dose to a member of the Hispanic population would be 0.0031 millirem. These data show that the dose to all population subsets surrounding TA-55 would be small and would not result in adverse impacts on human health. Although the annual population dose to the total minority population is projected to be slightly higher than that to the nonminority population, the difference between doses is not appreciable. Furthermore, the dose to the average individual of the nonminority population is projected to be slightly higher than the projected dose to the average individual in the minority population.

Population doses to persons living below the poverty level are also analyzed in Table 4–32. Low-income populations surrounding TA-55 would receive an annual dose of 0.20 person-rem and an annual average individual dose of 0.0031 millirem. Persons living above the poverty level would receive an annual collective dose of 1.6 person-rem and an annual average individual dose of 0.0034 millirem.

For nonradiological air quality impacts, as shown in Table 4–4, the concentrations of criteria pollutants as a result of Modified CMRR-NF and RLUOB operations under the Modified CMRR-NF Alternative would remain well below the ambient standards established to protect human health. Therefore, the impact of potential nonradiological air pollutant releases on minority or low-income individuals under this alternative would not be considered significant.

Table 4–32 Modified CMRR-NF Alternative — Comparison of Doses to Total Minority, Hispanic, Native American, and Low-Income Populations Within 50 Miles (80 kilometers) and to Average Individuals

	Annual Population Dose (person-rem)	*Annual Individual Dose (millirem)*
Total population	1.8	
Average individual		0.0033
White (non-Hispanic) population	0.81	
Nonminority average individual		0.0035
Total minority population	1.0	
Minority average individual		0.0032
Hispanic population [a]	0.77	
Hispanic average individual		0.0031
Native American population [b]	0.09	
Native American average individual		0.0029
Non-low-income population	1.6	
Non-low-income average individual		0.0034
Low-income population	0.20	
Low-income average individual		0.0031

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility.
[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] The Native American population may include persons who also indicated that they were of Hispanic ethnicity.

Residents of the Pueblo of San Ildefonso have expressed concern that pollution from CMRR Facility operations could contaminate Mortandad Canyon, which drains onto pueblo land and sacred areas. CMRR Facility operations under this alternative are not expected to adversely affect air or water quality or result in contamination of tribal lands adjacent to the LANL boundary.

These data show that the total minority, Native American, Hispanic, and low-income populations would not be subjected to disproportionately high and adverse impacts from normal operations of the Modified CMRR-NF and RLUOB at TA-55.

4.3.12 Waste Management and Pollution Prevention

Construction Impacts – Deep Excavation and Shallow Excavation Options—Under either construction option, acreage would be disturbed in several technical areas in addition to TA-55. Surveys have been conducted to identify potential release sites (PRSs), and no unidentified or unexpected soil contamination or buried media have been encountered (LANL 2010c). There are, however, known PRSs located within the affected technical areas (for example, Material Disposal Area [MDA] C in TA-50), and the potential for contact with contaminated soil or other media would be appropriately considered throughout the construction process. For example, PRS-48-001 is being evaluated for potential impacts resulting from actions in the TA-48/55 laydown and concrete batch plant area. Proper precautions would be taken as needed to minimize the potential disturbance of this or other PRSs. As needed, actions such as appropriate documentation and contaminant removal would be taken by the LANL Environmental Restoration Program in accordance with the 2005 Consent Order[7] and other applicable requirements. Wastes that might be generated from these actions have not been specifically analyzed because the types and quantities

[7] *In March 2005, the New Mexico Environment Department, DOE, and the LANL management and operating contractor entered into a Compliance Order on Consent (Consent Order) (NMED 2005). The purposes of the Consent Order are (1) to define the nature and extent of releases of contaminants at, or from, LANL; (2) to identify and evaluate, where needed, alternatives for corrective measures to clean up contaminants in the environment and prevent or mitigate the migration of contaminants at, or from, LANL; and (3) to implement such corrective measures.*

of waste are unknown. Possible waste volumes that could result from site-wide remediation activities were, however, projected in the 2008 *LANL SWEIS* (see Chapter 3, Section 3.12).

Modified CMRR-NF construction would principally generate nonhazardous solid waste under either the Deep or Shallow Excavation Option. If small quantities of other radioactive or nonradioactive wastes are generated, as experienced during RLUOB construction, the wastes would be managed in accordance with standard LANL procedures (see Chapter 3, Section 3.12). Sanitary wastewater generated as a result of construction activities would be managed using some plumbed restrooms and portable toilet systems, with sanitary wastewater from the restrooms transferred to the Sanitary Wastewater Systems Plant in TA-46 for treatment. No other nonhazardous liquid wastes are expected.

Total and peak annual quantities of construction waste (construction debris and sanitary solid waste generated by construction workers) were estimated for both construction options and are summarized in **Table 4–33**. Under the Modified CMRR-NF Alternative, regardless of the excavation option, the same peak annual waste quantities would be generated and the same total quantity of construction waste (2,600 tons [2,400 metric tons]) would be generated since the difference is due to excavation and other activities during which little construction waste would be generated. Using an average waste density of 0.5 tons per cubic yard, 340 tons (308 metric tons) of peak annual waste would represent about 1 percent of the 59,000 to 62,000 cubic yards (45,000 to 47,000 cubic meters) of construction and demolition waste annually projected in the 2008 *LANL SWEIS* (see Table 4–55).

Table 4–33 Modified CMRR-NF Alternative — Construction Debris and Sanitary Solid Waste Generation for Construction of the Modified CMRR-NF

	Construction Waste (tons) [a]	
Construction Option	***Total***	***Peak Annual***
Deep Excavation	2,600	340
Shallow Excavation	2,600	340

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility.
[a] Construction waste includes construction debris and sanitary solid waste generated by construction workers.
Note: Estimates have been rounded. To convert tons to metric tons, multiply by 0.90718.

The waste would be collected in appropriate waste containers such as dumpsters or rolloffs and regularly disposed of or recycled by transfer to the Los Alamos County Eco Station located at the Los Alamos County Landfill site within the LANL boundary or by transfer to an offsite solid waste facility permitted to accept the waste. Waste transferred to the Los Alamos County Eco Station would be separated into materials suitable for recycle or disposal, and both types of materials would be shipped for offsite disposition. Because the Los Alamos County Eco Station is permitted to accept construction and demolition waste, as well as municipal solid waste, it is expected that the Los Alamos County Eco Station would be able to accept the bulk of the projected waste from the Modified CMRR-NF construction. If waste is generated that is not acceptable at the Los Alamos County Eco Station (for example, petroleum-contaminated soil or other special waste), or for other reasons such as convenience to the government, then the waste would be transferred to an appropriate, permitted offsite facility for disposition.

No impacts on available solid waste management capacity are expected because of the small quantity of waste to be managed annually (340 tons [308 metric tons] of combined construction debris and sanitary solid waste) compared to the total quantities of solid waste addressed on a county and state basis and the large number of available waste disposition facilities within New Mexico. Including the Los Alamos County Eco Stations, 239 landfills, recycling facilities, composting facilities, or transfer stations of convenience were permitted in New Mexico as of July 2009, including 19 facilities permitted to accept special waste, such as petroleum-contaminated soil (NMED 2009). The projected annual quantity of Modified CMRR-NF construction debris and sanitary solid waste represents only about 1 percent of the waste processed in 2009 at the Los Alamos County Eco Station.

Operations Impacts—Projected annual waste generation rates for operations at the Modified CMRR-NF and RLUOB are summarized in **Table 4–34** (LANL 2010c), along with projected overall LANL activities based on information from the 2008 *LANL SWEIS* (DOE 2008a; LANL 2010a). In the following discussion, waste generation rates projected in this *CMRR-NF SEIS* from operation of the Modified CMRR-NF and RLUOB are compared to waste generation rates projected in the 2008 *LANL SWEIS* from operation of the CMR Building and site-wide LANL operations. Radioactive solid and liquid wastes generated from Modified CMRR-NF and RLUOB operations would constitute only fractions of the total quantities of each of these generated wastes (see Table 4–34).

Note that a transition period would initially occur, during which operations at the CMR Building would be transferred to the Modified CMRR-NF. During this transition period, wastes would be generated at both the CMR Building (see Section 4.4.12) and the Modified CMRR-NF and RLUOB, although the annual rates may be less at either facility than the rates estimated in Table 4–34 and in Section 4.4.12.[8] Both on- and offsite waste management capacity are sufficient for this transition period.

Transuranic and Mixed Transuranic Wastes

Activities at the Modified CMRR-NF would generate transuranic and mixed transuranic wastes that would be packaged in containers in accordance with the WIPP acceptance criteria and shipped to WIPP for disposal. The combined annual volume of transuranic and mixed transuranic wastes (88 cubic yards [67 cubic meters]) is about 60 percent larger than that projected for the CMR Building operations in the 2008 *LANL SWEIS* (DOE 2008a). It would represent only about 10 to 20 percent of the annual 440 to 870 cubic yards (340 to 670 cubic meters) of combined transuranic and mixed transuranic waste projected for site-wide LANL operations in the 2008 *LANL SWEIS*. The Modified CMRR-NF would be designed and operated to accommodate the projected waste volumes, and no difficulty in managing the waste for shipment to WIPP is expected on either a facility or a site-wide LANL basis.

Over 50 years of Modified CMRR-NF and RLUOB operations (DOE 2003b), about 4,400 cubic yards (3,400 cubic meters) of transuranic and mixed transuranic wastes would be generated. The total WIPP capacity for transuranic waste disposal is set at 219,000 cubic yards (168,000 cubic meters) of contact-handled transuranic waste pursuant to the Waste Isolation Pilot Plant Land Withdrawal Act (DOE 2002b). Estimates in the *Annual Transuranic Waste Inventory Report – 2010* (DOE 2010b) indicate that about 185,000 cubic yards (141,000 cubic meters) of contact-handled transuranic waste would be disposed of at WIPP, about 36,000 cubic yards (27,500 cubic meters) less than the contact-handled transuranic waste permitted capacity. The projected 50-year total of 4,400 cubic yards (3,400 cubic meters) of transuranic and mixed transuranic waste from Modified CMRR-NF and RLUOB operations would require about 12 percent of the unsubscribed WIPP disposal capacity.

Note that disposal operations at WIPP are currently approved through 2034, based on its operations permit; however, WIPP may meet its statutory disposal limit before the end of the operational period of the Modified CMRR-NF. If necessary, transuranic or mixed transuranic waste generated without a disposal pathway would be safely stored pending development of additional disposal capacity.

[8] *Operations at the Modified CMRR-NF and RLUOB would be limited initially and then increase at the same time that CMR Building operational activities would decrease.*

Table 4–34 Modified CMRR-NF Alternative — Operational Waste Generation Rates Projected for Modified CMRR-NF, RLUOB, and Los Alamos National Laboratory Activities

Waste Type	*Projected Modified CMRR-NF Generation Rate* [a]	*Projected RLUOB Generation Rate* [a]	*Projected Modified CMRR-NF and RLUOB Generation Rate*	*Site-wide LANL Projections*
Transuranic and mixed transuranic (cubic yards per year)	88	0	88	440 to 870 [b]
Low-level radioactive (cubic yards per year)	2,510	130	2,640	21,000 to 115,000 [b]
Mixed low-level radioactive (cubic yards per year)	23.7	2.3	26	320 to 18,100 [b]
Chemical (tons per year) [c]	11.9	0.5	12.4	3,200 to 5,750 [b]
Sanitary solid (tons per year) [d]	71	24	95	– [e]
Sanitary wastewater (gallons per year)	8,315,000	2,485,000	10,800,000	156,000,000 [f]
Radioactive liquid (gallons per year)	248,000 [g]	95,800	344,000	4,000,000 [h]

CMRR-NF = Chemistry and Metallurgy Research Replacement Project Nuclear Facility; LANL = Los Alamos National Laboratory; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] From *CMRR-NF Project and Environmental Description Document* (LANL 2010d) and other sources (LANL 2011).

[b] Projected waste quantities from LANL operations are given as a range in the *LANL SWEIS* (DOE 2008a). The listed value reflects the assumption of the Expanded Operations Alternative in the *LANL SWEIS*, less the waste projected from some activities that were not implemented (see Table 4-55).

[c] Chemical waste is not a formal waste LANL category; however, as was done in the 2008 *LANL SWEIS* (DOE 2008a), the term is used in this SEIS to denote a variety of materials, including hazardous waste regulated under the Resource Conservation and Recovery Act; toxic waste regulated under the Toxic Substances Control Act; and special waste designated under the New Mexico Solid Waste Regulations, including industrial waste, infectious waste, and petroleum-contaminated soil.

[d] The projected quantity of Modified CMRR-NF and RLUOB sanitary solid waste (municipal trash) was estimated by multiplying the projected annual number of full-time equivalent radiation workers (140 for RLUOB and 410 for Modified CMRR-NF) by an assumed annual 344 pounds of waste generated per person per year (see Chapter 3, Section 3.12.2).

[e] Annual sanitary solid waste quantities were not projected in the 2008 *LANL SWEIS*.

[f] The value shown is the annual volume of wastewater processed at the Sanitary Wastewater Systems Plant in TA-46, assuming operation at its 600,000-gallon-per-day design capacity for 260 working days per year (DOE 2003b). Sanitary wastewater and nonradioactive liquid waste are both projected to be routed to the Sanitary Wastewater Systems Plant for treatment.

[g] Includes 247,000 gallons per year of liquid low-level radioactive waste and 950 gallons per year of liquid transuranic waste at the Modified CMRR-NF (Balkey 2011).

[h] The value shown is the projected annual liquid low-level radioactive waste treatment rate at RLWTF assuming implementation of the No Action Alternative in the 2008 *LANL SWEIS*; annual treatment of 30,000 gallons of liquid transuranic waste was also projected (DOE 2008a).

Note: To convert cubic yards to cubic meters, multiply by 0.76456; tons to metric tons, by 0.90718; gallons to liters, by 3.78533.

Low-Level Radioactive Waste

Solid low-level radioactive waste generated from Modified CMRR-NF and RLUOB operations would be characterized and packaged for disposal. Disposal would occur off site at the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) or at a commercial disposal facility or could occur on site while Area G continues to accept waste. Typical disposal containers would include B-25 boxes and 55-gallon (208-liter) drums. About 2,640 cubic yards (2,020 cubic meters) of solid low-level radioactive waste would be generated annually, including the solid low-level radioactive component of liquid wastes treated through RLWTF or a similar facility. This projected volume would represent a 10 percent increase in the low-level radioactive waste annually projected for the CMR Building in the 2008 *LANL SWEIS* (DOE 2008a). The projected waste from Modified CMRR-NF and RLUOB operations would represent about 2 to 13 percent of the projected annual site-wide LANL volume (21,000 to 115,000 cubic yards [16,000 to 88,000 cubic meters]).

Because the Modified CMRR-NF and RLUOB would be designed, constructed, and operated to accommodate the projected waste volumes for the facilities, no difficulties are expected in packaging and staging this waste pending transfer to LANL Area G or shipment to offsite disposal facilities. Disposal capacity is also expected to be available. Annual generation of 2,640 cubic yards (2,020 cubic meters) of low-level radioactive waste from the Modified CMRR-NF and RLUOB operations would represent about 4 percent of the average low-level radioactive waste disposal rate at the NNSS[9] and about 2 percent of the current low-level radioactive waste disposal rate at the commercial facility in Clive, Utah.[10]

Mixed Low-Level Radioactive Waste

Mixed low-level radioactive waste generated from Modified CMRR-NF and RLUOB operations would be packaged and temporarily stored pending transport off site to a commercial treatment, storage, and disposal facility and/or to the NNSS in Nevada. Typical shipment packages would include B-25 boxes and 55-gallon (208-liter) drums. The projected 26 cubic yards (20 cubic meters) of mixed low-level radioactive waste from Modified CMRR-NF operations would be only slightly larger than the annual rate projected from the CMR Building in the 2008 *LANL SWEIS* (DOE 2008a). The projected Modified CMRR-NF and RLUOB volume would represent about 0.1 to 8 percent of the 320 to 18,100 cubic yards (240 to 14,000 cubic meters) of mixed low-level radioactive waste projected for LANL in the 2008 *LANL SWEIS*.

Sufficient offsite treatment, storage, and disposal capacity is expected for the mixed low-level radioactive waste projected from Modified CMRR-NF and RLUOB operations. Several permitted commercial treatment, storage, and disposal facilities exist in the United States (for example, in Florida, Tennessee, Texas, Washington, and Utah), in addition to the mixed low-level radioactive waste disposal capacity available at the NNSS in Nevada, and additional facilities may be used as they are available and appropriate for the waste contents or characteristics. The projected mixed low-level radioactive waste from the Modified CMRR-NF and RLUOB would represent about 2 percent of the average mixed low-level radioactive waste disposal rate at the NNSS[11] and less than 1 percent of the current mixed low-level radioactive waste disposal rate at the commercial facility in Clive, Utah.[12]

Chemical Waste

Chemical waste is not a formal LANL waste category; however, as was done in the 2008 *LANL SWEIS* (DOE 2008a), the term is used in this *CMRR-NF SEIS* to denote a broad category of materials, including hazardous wastes, toxic wastes, and special waste designated under the New Mexico Solid Waste Regulations. Chemical waste generated from Modified CMRR-NF and RLUOB operations would be packaged and shipped to offsite permitted recycle or treatment, storage, and disposal facilities, typically in 55-gallon drums. Temporary storage before offsite shipment may occur at the Modified CMRR-NF and RLUOB or at a permitted LANL storage area. About 12.4 tons (11.2 metric tons) of chemical waste would be generated annually from Modified CMRR-NF and RLUOB operations. This projected rate is only slightly larger than the chemical waste projected for the CMR Building in the 2008 *LANL SWEIS* (DOE 2008a). The projected Modified CMRR-NF and RLUOB operations chemical waste quantity would

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[9] *For the 5 years from 2004 through 2008, an annual average of 62,903 cubic yards of LLW and 1,541 cubic yards of mixed low-level radioactive waste was disposed of at NNSS (Gordon 2009).*
[10] *Based on estimates for three-quarters of calendar year 2010, extrapolated to 1 year (Hultquist 2010).*
[11] *For the 5 years from 2004 through 2008, an annual average of 62,903 cubic yards of LLW and 1,541 cubic yards of mixed low-level radioactive waste was disposed of at NNSS (Gordon 2009).*
[12] *Based on estimates for three-quarters of calendar year 2010, extrapolated to 1 year (Hultquist 2010).*

represent from 0.2 to 0.4 percent of the annual chemical waste projection for LANL in the 2008 *LANL SWEIS*. The Modified CMRR-NF and RLUOB would be designed and operated to accommodate this waste, and no difficulty in managing this waste for shipment for offsite disposition is expected on either a facility or a site-wide LANL basis. Adequate offsite waste disposition capacity is expected for the chemical waste projected from Modified CMRR-NF and RLUOB operations because of the large number of permitted facilities that exist within New Mexico and neighboring states.

Sanitary Solid Waste

Based on the projected number of full-time equivalent workers at the Modified CMRR-NF and RLUOB (550) and the assumption that each worker generates 344 pounds (156 kilograms) of sanitary solid waste (municipal trash) annually (see Chapter 3, Section 3.12.2), about 95 tons (86 metric tons) of sanitary solid waste would be generated annually. This waste would be collected in appropriate waste containers, such as dumpsters, and regularly disposed of or recycled by transfer to the Los Alamos County Eco Station located at the Los Alamos County Landfill site within the LANL boundary or by transfer to an offsite solid waste facility permitted to accept the waste. No impacts on available solid waste management capacity are expected because of the small quantity of sanitary solid waste that would be generated at the Modified CMRR-NF and RLUOB compared to the total quantities of solid waste addressed annually on a county and state basis and the large number of available waste disposition facilities within New Mexico. Ninety-five tons (86 metric tons) of sanitary solid waste generation would represent only about 0.3 percent of the waste processed in 2009 at the Los Alamos County Eco Station (see the *Construction Impacts* discussion within this section).

Sanitary Wastewater

Approximately 10,800,000 gallons (40,900,000 liters) of sanitary wastewater would be generated annually from Modified CMRR-NF and RLUOB operations; this wastewater would to be sent to the Sanitary Wastewater Systems Plant in TA-46 (see Chapter 3, Section 3.12.1). The projected wastewater volume from the Modified CMRR-NF and RLUOB would include 7,300,000 gallons (27,600,000 liters) for sanitary flow and 3,500,000 gallons (13,200,000 liters) for reject water from the facility demineralization water treatment system.[13] This wastewater flow would represent only about 7 percent of the 600,000-gallon-per-day (2.27-million-liter-per-day) design capacity of the Sanitary Wastewater Systems Plant in TA-46, assuming 260 working days per year (DOE 2003b). Therefore, no impacts on available sanitary wastewater treatment capacity are expected from Modified CMRR-NF and RLUOB operations.

Radioactive Liquid Waste

Modified CMRR-NF and RLUOB operations are projected to generate about 344,000 gallons (1.3 million liters) of liquid low-level radioactive waste annually, including about 950 gallons (3,600 liters) of liquid transuranic waste. This liquid waste would be transferred for treatment to RLWTF in TA-50 (Balkey 2011). The treatment process would generate solid low-level radioactive waste (for example, solidified liquids) that would be managed as discussed above. The annual volume of radioactive liquid waste from the Modified CMRR-NF and RLUOB would represent only about 8.5 percent of the annual volume of 4 million gallons (15 million liters) of liquid low-level radioactive waste and 3 percent of the 30,000 gallons (110,000 liters) of liquid transuranic waste projected for RLWTF in the 2008 *LANL SWEIS* (see Table 4–34). The projected liquid waste generation rates from Modified CMRR-NF and RLUOB

[13] *All water supplied to the CMRR-NF would be treated in a demineralization unit to remove silica. This treatment process would reduce maintenance of boilers and other major equipment and increase equipment durability and operating life. The demineralization unit produces treated water that would be supplied to the CMRR-NF and reject water that would be discharged through the CMRR-NF sanitary wastewater system (LANL 2010c).*

have been considered in LANL forecasts for annual receipt of liquid waste at RLWTF (Balkey 2011), and no impacts on radioactive liquid waste treatment and discharge capacity are expected from its operation.

4.3.13 Transportation and Traffic

4.3.13.1 Transportation

The risk of transporting radioactive materials can be affected by a number of factors. These factors are predominantly categorized as either radiological or nonradiological impacts. Radiological impacts are those associated with the accidental release of radioactive materials and the effects of low levels of radiation emitted during normal, or incident-free, transportation. Nonradiological impacts are those associated with the transportation itself, regardless of the nature of the cargo, such as accidents resulting in death or injury when there is no release of radioactive material.

In addition to calculating the radiological risks that would result from all reasonable accidents during transportation of radioactive wastes, NNSA assessed the highest consequences of a maximum reasonably foreseeable accident with a radioactive release frequency greater than 1×10^{-7} (1 chance in 10 million) per year along the route. The consequences were determined for average atmospheric conditions. For additional information on the assumptions and methods used in the transportation analysis, see Appendix B.

At LANL, radioactive materials (SNM, low-level radioactive waste, transuranic waste, etc.) are transported both on site (between the technical areas) and off site to multiple locations. Onsite transportation constitutes the majority of activities that are part of routine operations in support of various programs. The impacts of these activities are part of the impacts of routine operations at these areas. For example, worker dose from handling and transporting radioactive materials is included as part of the worker dose from operational activities. Specific analyses performed in the 2008 *LANL SWEIS* (DOE 2008a) indicate that the projected collective radiation dose for LANL drivers from the projected onsite shipments was, on average, less than 1 millirem per transport. A review of onsite radioactive materials transportation under all alternatives in this *CMRR-NF SEIS* indicates that the 2008 *LANL SWEIS* projection of impacts would envelop the impacts for routine onsite transportation.

Transport of SNM, equipment, and other materials currently located at the CMR Building to a Modified CMRR-NF at TA-55 would occur over a period of 3 years on open or closed roads. The public is not expected to receive any measurable exposure from the one-time movement of radiological materials associated with this action. CMR Building workers could receive a minimal dose from shipping and handling of SNM during the transition from the existing CMR Building to the Modified CMRR-NF at TA-55. Based on a review of radiological exposure information in calendar year 2009, the average dose to LANL workers (including CMR Building workers and material handlers) is about 100 millirem per year. Because the transition to operations at the Modified CMRR-NF at TA-55 would occur over multiple years, the material handler worker dose would be similar to those for normal operations currently performed at the CMR Building.

Offsite transportation of radioactive materials would occur using trucks. The radioactive materials that would be transported include low-level radioactive waste and transuranic waste. For analysis purposes in this SEIS, the destinations for disposal of radioactive wastes were limited to DOE disposal sites such as the NNSS in Nevada and a commercial waste disposal site such as the Energy Solutions disposal site in Clive, Utah; disposal of transuranic waste was assumed to occur at WIPP in New Mexico.

Table 4–35 provides the estimated number of annual offsite shipments of operational wastes under each action alternative. This table also provides the estimated number of offsite shipments resulting from activities associated with construction of the Modified CMRR-NF at TA-55.

Table 4–35 Estimated Annual Offsite Shipments Under the Action Alternatives

	Annual Number of Shipments					
	Operational Wastes				*Construction Shipments* [a]	
Alternative	*Low-Level Radioactive Waste*	*Mixed Low-Level Radioactive Waste*	*Transuranic Waste*	*Hazardous Waste*	*Nonhazardous Waste*	*Materials* [b]
Modified CMRR-NF Alternative, Deep Excavation Option	176	2	13	2	20	4,300
Modified CMRR-NF Alternative, Shallow Excavation Option	176	2	13	2	20	3,300
Continued Use of CMR Building Alternative	21	1	2	1	0	0

CMR = Chemistry and Metallurgy Research; CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility.

[a] Construction values are annualized values based on estimates on construction durations (about 9 years under the Modified CMRR-NF Alternative, Deep Excavation Option and Shallow Excavation Option).

[b] Materials include construction commodities: cements, gravel, sand, ash, structural and rebar steel, etc. These numbers are rounded to the nearest 100 shipments.

Construction Impacts

Routine (Incident-Free) Transportation – Deep Excavation Option—Under the Deep Excavation Option, about 4,300 shipments of construction-generated nonhazardous waste and construction commodities would be made annually (see Table 4–35). The nonhazardous waste would be transported to a regional disposal site in New Mexico (for example, Mountainair, about 130 miles [210 kilometers] away), and the construction commodities would be transported to TA-55 from a distance of up to 100 miles (160 kilometers) for sand, cement, and gravels and up to 500 miles (800 kilometers) for steels. Using these estimates, the total annual projected (one-way) distance traveled on public roads transporting construction materials to and from LANL would be about 470,000 miles (750,000 kilometers). The estimated total transportation is conservative because it assumes that all offsite material shipments would be from a distance of 100 to 500 miles (161 to 800 kilometers). It is likely that many of these shipments would be less than 100 miles (161 kilometers) because shipments of most of these materials should be obtained from Albuquerque or closer. Because no radioactive materials would be transported during construction, no radiological risks would be incurred by members of the transportation crew (truck drivers) from construction activities.

Routine (Incident-Free) Transportation – Shallow Excavation Option—Under the Shallow Excavation Option, about 3,300 shipments of construction-generated nonhazardous waste and construction commodities would be made annually (see Table 4–35). Based on the assumptions described above regarding materials and waste shipment distances, the total annual projected (one-way) distance traveled on public roads transporting construction materials to and from LANL would be about 380,000 miles (610,000 kilometers). As discussed above under the Deep Excavation Option, the estimated total transportation is conservative because it assumes that all offsite material shipments would be from a distance of 100 to 500 miles (161 to 800 kilometers). Because no radioactive materials would be transported during construction, no radiological risks would be incurred by members of the transportation crew (truck drivers) from construction activities.

Transportation Accidents – Deep Excavation Option—Under the Deep Excavation Option, the impacts of transporting construction materials were evaluated in terms of the distance traveled and number of expected traffic accidents and fatalities. The annual transportation impacts under this option would be 0 (0.3) traffic accidents and no (0.03) traffic fatalities.

Transportation Accidents – Shallow Excavation Option—Under the Shallow Excavation Option, the impacts of transporting construction materials were evaluated in terms of distance traveled and number of expected traffic accidents and fatalities. The transportation impacts under this option would be 0 (0.02) traffic accidents and no (0.02) traffic fatalities.

Operations Impacts

Routine (Incident-Free) Transportation—**Table 4–36** summarizes the total transportation impacts, as well as transportation impacts on two nearby LANL transportation routes: (1) LANL to Pojoaque, New Mexico, the route segment used by trucks from LANL, and (2) Pojoaque to Santa Fe, New Mexico, the route segment used by trucks traveling on Interstate 25 (such as trucks traveling to WIPP). For analysis purposes in this SEIS, two sites, the DOE NNSS and a commercial facility in Utah, were selected as possible disposal sites for all low-level radioactive wastes should the decision be made to dispose of low-level radioactive waste off site rather than on site. Differences in distance to these two sites and the affected population along the transportation routes result in a range of impacts under each alternative.

Table 4–36 Modified CMRR-NF Alternative — Annual Risks of Transporting Operational Radioactive Materials

Transport Segments	*Offsite Disposal Option* [a]	*Number of Shipments*	*Round Trip Kilometers Traveled (thousand)*	*Incident-Free*				*Accident*	
				Crew		*Population*			
				Dose (person-rem)	*Risk* [b]	*Dose (person-rem)*	*Risk* [b]	*Radiological Risk* [b]	*Nonradio-logical Risk* [b]
LANL to Pojoaque	NNSS	191	11.9	0.07	0.00004	0.02	0.00001	4×10^{-9}	0.00022
Pojoaque to Santa Fe		191	19.9	0.12	0.00007	0.04	0.00002	4×10^{-9}	0.0004
Total Route		191	461	2.5	0.002	0.8	0.0005	1×10^{-7}	0.007
LANL to Pojoaque	Commercial	191	11.9	0.07	0.00004	0.02	0.00001	4×10^{-9}	0.0002
Pojoaque to Santa Fe [c]		13	1.0	0.03	0.00002	0.01	5×10^{-6}	2×10^{-9}	0.00003
Total Route		191	399	2.2	0.001	0.7	0.0004	1×10^{-7}	0.006

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; LANL = Los Alamos National Laboratory.; NNSS = Nevada National Security Site.

[a] Under this option, low-level radioactive waste would be shipped to either the NNSS or a commercial site in Utah. Transuranic waste would be shipped to WIPP.

[b] Risk is expressed in terms of latent cancer fatalities, except for the nonradiological, where it refers to the number of traffic accident fatalities.

[c] Shipments of low-level radioactive waste to a commercial disposal site in Utah would not pass along the Pojoaque to Santa Fe segment of highway.

Under this alternative, about 191 offsite shipments of radioactive materials would be made annually to the NNSS in Nevada (or a commercial site in Clive, Utah) and WIPP in New Mexico (see Table 4–36). Maximum transportation impacts would be realized if low-level and mixed low-level radioactive waste were shipped to either the NNSS in Nevada or a commercial site in Clive, Utah, instead of being disposed of on site. Transuranic waste would be shipped to WIPP. The total projected (one-way) distance traveled on public roads transporting radioactive materials to various locations would range from about 125,000 to 144,000 miles (200,000 to 231,000 kilometers).

The annual dose to the transportation crew from all offsite transportation activities under the Modified CMRR-NF Alternative was estimated to range from about 2.2 person-rem for disposal at the commercial low-level radioactive waste disposal site in Clive, Utah, to about 2.5 person-rem for disposal at the NNSS in Nevada. The dose to the general population would range from 0.7 to 0.8 person-rem for the commercial site in Clive, Utah, and the NNSS in Nevada, respectively. Accordingly, incident-free transportation would result in a maximum of no (0.002) excess LCFs among the transportation workers and no (0.0005) excess LCFs in the affected population. The estimated dose associated with transport of low-level and mixed low-level radioactive waste to the NNSS in Nevada is higher because of the longer distance traveled and larger affected population. The differences in estimated doses under either disposal option are very small, however, as shown above.

Note that DOE regulations limit the maximum annual dose to a transportation worker to 100 millirem per year unless the individual is a trained radiation worker. The dose to a trained radiation worker is limited to 2 rem per year (DOE 1999b). The potential for a trained radiation worker to develop a fatal latent cancer from an annual dose at the maximum annual exposure is 0.0012. Therefore, an individual transportation worker is not expected to develop a lifetime latent fatal cancer from exposure during these activities.

The doses to the general populations along the routes from LANL to Pojoaque and from Pojoaque to Santa Fe, New Mexico, were estimated to be a maximum of 0.04 person-rem. This dose would result in no (0.00002) excess LCFs among the exposed populations.

Transportation Accidents—Two sets of analyses were performed for the evaluation of transportation accident impacts involving radioactive materials transport: impacts of maximum reasonably foreseeable accidents (accidents with probabilities greater than 1 in 10 million per year [1×10^{-7}]) and impacts of all accidents (total transportation accidents).

For radioactive materials transported under the Modified CMRR-NF Alternative, the maximum reasonably foreseeable offsite truck transportation accident with the greatest consequence would involve a truck carrying contact-handled transuranic waste. The probability that such an accident would occur is about 1 in 3.6 million (2.8×10^{-7}) per year in a suburban area. If such an accident occurs, the consequences in terms of general population dose would be 8 person-rem. Such an exposure would result in no (0.005) excess LCFs among the exposed population. This accident would result in a dose of 8.2 millirem to a hypothetical MEI located at a distance of 330 feet (100 meters) and exposed to the accident plume for 2 hours, with a corresponding risk of developing a latent fatal cancer of about 1 in 200,000 (5×10^{-6}).

Under this alternative, the estimated risks for all projected accidents involving radioactive shipments, regardless of type, are a maximum radiological dose-risk[14] to the general population of about 0.2 person millirem, resulting in 1×10^{-7} LCFs, and a maximum nonradiological (traffic) accident risk of zero (0.007) fatalities.

The maximum radiological transportation accident dose-risk to the general populations along the routes from LANL to Pojoaque and from Pojoaque to Santa Fe, New Mexico, would be 0.0067 person-millirem. This dose would result in no (4×10^{-9}) excess LCFs among the exposed populations. The maximum expected number of traffic accident fatalities along these routes would be zero (0.0004).

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[14] *Dose-risk includes the probability that an accident will occur. Here, these values were calculated by dividing the radiological risks in terms of LCFs given in Table 4–36 (column 9) by 0.0006, which is the risk of an LCF per person-rem of exposure.*

The impacts of transporting nonradiological materials were also evaluated. These impacts are presented in terms of distance traveled and numbers of expected traffic accidents and fatalities. The following assumptions were made: asbestos would be disposed of at a facility in Phoenix, Arizona; hazardous waste would be disposed of at a facility in Andrews, Texas; and solid waste would be disposed of at Mountainair, New Mexico. As indicated in Table 4–35, only two shipments of hazardous materials would be made annually. The transportation under this alternative would result in 666 miles (1,100 kilometers) traveled, no (0.0002) traffic accidents, and no (0.00002) fatalities.

4.3.13.2 Traffic

Construction Impacts – Deep Excavation Option – Truck Traffic—Under the Deep Excavation Option, an additional 100 feet (30 meters) would be excavated during construction of the Modified CMRR-NF, as approximately 30 feet (9.1 meters) of the Modified CMRR-NF excavation have already been completed. Excavation of the additional 100 feet (30 meters) and the associated tunnels would require the removal of approximately 545,000 cubic yards (420,000 cubic meters), or approximately 900,000 tons (820,000 metric tons) of material. This amount of material would require approximately 45,000 20-ton truck trips or 30,000 30-ton truck trips to move. This material would be staged at a LANL materials staging area for future reuse on other LANL projects. Reuse of this material at LANL would directly offset the future need to transport purchased fill material from offsite locations, as is currently the case because of the limited amount of suitable fill material available within existing LANL borrow pits. Excavated soil and rock material from the Modified CMRR-NF would be transported by truck to spoils storage areas within TA-5, TA-36, TA-51, TA-52, or TA-54 in accordance with routine material reuse practices at LANL, and the excavated material (spoils) would ultimately be reused in various construction and landscaping projects at LANL.

As discussed under the No Action Alternative, each round trip to the LANL materials staging area would take approximately 20 minutes. Moving the material generated by excavation under the Deep Excavation Option would take approximately 450 10-hour shifts with one loader and 20-ton trucks or approximately 300 10-hour shifts with one loader and 30-ton trucks. This time period could be shortened by using two loaders and additional trucks. On a per-hour basis, these trips would make little difference to the level of service on Pajarito Road. The acceleration of the loaded earthwork trucks would be slow and would result in lower speeds and some reduction in the level of service in the road segment where the trucks accelerate. Pajarito Road is not accessible by the public.

The use of onsite concrete batch plants under the Deep Excavation Option would be required. The largest volume of concrete would be anticipated in the early years of the project as the 60 feet (18 meters) of low-slump concrete fill and the basemat and foundation of the building are constructed. It is not expected that the plants would be operated simultaneously. Depending on the quality of the concrete specified for the low-slump fill material, it may or may not be necessary to use cement mixers for a trip this short. Regardless of whether cement mixers or dump trucks are used to transport the concrete, the weight limit would be approximately 20 tons (18 metric tons) for three-axle trucks. Wet concrete weighs approximately 2 tons (1.8 metric tons) per cubic yard. Structural concrete for the shell of the Modified CMRR-NF would be conveyed from the batch plant to the site using cement mixer trucks.

Peak operation of the northeast (TA-48/55) concrete plant is expected during the first year of Modified CMRR-NF construction (2012), when the plant would be used to produce an estimated 250,000 cubic yards (190,000 cubic meters) of low-slump concrete that would be placed in the lower 60 feet (18 meters) of the Modified CMRR-NF excavation for soil stabilization (LANL 2010d).

If the peak operation of this concrete plant is 150 cubic yards (115 cubic meters) per hour and 20-ton trucks are used for transport, it would take approximately 170 10-hour shifts to transport 250,000 cubic yards (190,000 cubic meters) of concrete. This timeframe could be reduced to approximately 70 days with 24-hour operations.

Bulk concrete materials would be delivered to the Modified CMRR-NF construction site by either standard three-axle dump trucks (20-ton trucks) or five-axle bottom dump trucks (30-ton trucks).

To support the concrete batch plant operation for all concrete operations, the following materials would be required (LANL 2011):

- Approximately 313,000 tons (284,000 metric tons) of coarse aggregate (15,700 20-ton trucks or 10,400 30-ton trucks)
- Approximately 320,000 tons (290,000 metric tons) of fine aggregate (sand) (16,000 20-ton trucks or 10,700 30-ton trucks)
- Approximately 69,000 tons (63,000 metric tons) of cement (3,500 20-ton trucks or 2,300 30-ton trucks)
- Approximately 37,000 tons (34,000 metric tons) of fly ash (1,900 20-ton trucks or 1,200 30-ton trucks)

This operation would add a maximum of approximately 66 truck trips per hour to Pajarito Road. Current peak-hour traffic volume on Pajarito Road is anticipated to be 800 vehicles per hour (Level of Service D). The capacity of a two-lane roadway is approximately 2,400 trips per hour. The acceleration of the loaded concrete trucks would be slow and, with a distance of less than one-eighth of a mile for some of the loaded concrete trucks, would result in considerably lower speeds in this road segment. The section of Pajarito Road from the floor of the valley to the top of the mesa would also be impacted by the slow speed of loaded trucks climbing this hill. The addition of the truck trips hauling materials for concrete production is not expected to change the level of service on this road segment. This issue could be mitigated by adding a truck climbing lane on this stretch of roadway. During the construction period, climbing lanes could be warranted; however, this condition would be temporary, and truck deliveries could be scheduled to avoid peak traffic hours.

Construction under the Deep Excavation Option would also require the following amounts of steel (LANL 2011):

- Approximately 560 tons (510 metric tons) of structural steel (30 20-ton trucks or 20 30-ton trucks)
- Approximately 18,000 tons of concrete reinforcing steel (900 20-ton trucks or 600 30-ton trucks)

All construction supplies reaching the site must use Pajarito Road. All movement of excavated material from the Modified CMRR-NF to the internal storage areas must use Pajarito Road. The movement of large numbers of heavy trucks can damage the structure of existing pavement, reducing its lifespan and requiring repair or replacement. If the pavement structure is not sufficiently strong, the driving pavement can rut or crumble. The edges of existing pavements are vulnerable to crumbling if sufficient lateral support is not provided. The impacts on Pajarito Road's structural integrity would be similar to those discussed under the No Action Alternative; however, there is a greater chance of structural damage to Pajarito Road under the Modified CMRR-NF Alternative due to the greater total weight of materials that would be transported on the roadway and the longer duration of transports. Pajarito Road may be sufficiently strong to support the transports without damage if the underlying soil is strong. Should damage occur to the roadway surface, Pajarito Road may require rehabilitation or repair sooner than currently anticipated.

Construction Impacts – Deep Excavation Option – Worker Traffic—The workers going to the Modified CMRR-NF are expected to use the public roadways. A peak of 790 workers is anticipated to commute to the parking area at TA-72 (LANL 2010b). For this analysis, the peak commuting time of these workers would align with the peak-hour traffic on the adjoining public roadways. Approximately 500 peak-hour trips are anticipated from a peak of 790 construction workers. These 500 additional peak hour (worker) commuters were added to the existing traffic to determine the anticipated level of service. As shown in **Table 4–37**, the impacts on traffic were compared for the year 2012, the year that the Deep Excavation Option would start, and 2020, the year that construction would be completed under this alternative. No change in the level of service of roadways in the vicinity of LANL is anticipated during the construction period. In addition, the impacts of construction traffic would be minimal as it is anticipated that workers for the Modified CMRR-NF would park at the parking lot in TA-72 and would be bused to the worksite.

Table 4–37 Modified CMRR-NF Alternative — Expected Levels of Service of Roadways in the Vicinity of Los Alamos National Laboratory

Location	*Road Type and Number of Lanes*	*AADT/Year/ Percentage Trucks*	*Existing Traffic*		*Deep Excavation Option*		*Comments (assumed percentage of construction traffic assigned to road segment)(790 workers, 500 VPH peak)*
			AADT/ Peak Hour/ LOS	*AADT/ Peak Hour/ LOS*	*Peak Hour/ LOS*	*Peak Hour/ LOS*	
Year			*2012*	*2020*	*2012*	*2020*	
SR 4 at Los Alamos County Line to SR 501	Minor arterial/ two lanes	734/ 2009/9	760/80/A	840/80/A	130/A	130/A	(10) No change in LOS
SR 4 at Junction Bandelier Park Entrance	Minor arterial/ two lanes	681/ 2009/7	700/70/A	770/80/A	120/A	130/A	(10) No change in LOS
SR 4 at Junction of Pajarito Road – White Rock	Minor arterial/ two lanes	9,302/ 2009/9	9,580/ 960/D	10,580/ 1,060/D	1,410/D	1,510/D	(90) No change in LOS
SR 4 at Junction of Jemez Road	Minor arterial/ two lanes	9,358/ 2009/12	9,640/ 960/D	10,650/ 1,070/D	1,410/D	1,520/D	(90) No change in LOS
SR 501 at Junction of SR 4 to Diamond Drive	Minor arterial/ two lanes	11,848/ 2009/11	12,210/ 1,220/D	13,490/ 1,350/D	1,670/D	1,800/D	(50) No change in LOS
SR 501 at Junction of Diamond Drive and Onward	Primary arterial/ four lanes	21,211/ 2009/8	21,850/ 2,190/C	24,140/ 2,410/C	2,640/C	2,860/C	(90) No change in LOS
SR 501 at Junction 502	Primary arterial/ four lanes – divided	17,807/ 2009/8	18,350/ 1,840/C	20,270/ 2,030/C	1,940/C	2,130/C	(20) No change in LOS
SR 502 at Junction Openheimer Street	Primary arterial/ four lanes – divided	12,817/ 2009/6	13,210/ 1,320/C	14,590/ 1,460/C	1,420/C	1,560/C	(20) No change in LOS
SR 502 East of Junction with SR 4	Primary arterial/ four-lane freeway	6,341/ 2009/12	6,530/ 650/A	7,210/ 720/A	700/A	770/A	(10) No change in LOS

AADT = average annual daily traffic; CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; LOS = level of service; SR = State Road; VPH = vehicles per hour.

Construction Impacts – Shallow Excavation Option – Truck Traffic—The impacts of construction on peak-hour levels of service on public roadways adjoining LANL under the Shallow Excavation Option would be similar to those anticipated under the Deep Excavation Option. Construction under the Shallow Excavation Option would require the excavation and removal of 236,000 cubic yards (180,000 cubic meters), or 390,000 tons (350,000 metric tons) of material. This amount of material would require approximately 19,500 20-ton truck trips or 13,000 30-ton truck trips to move. As under the Deep Excavation Option, the material would be staged for future reuse on other LANL projects.

As discussed under the No Action Alternative, each round trip to the LANL materials staging area would take approximately 20 minutes. To move the material generated by excavation under the Shallow Excavation Option would take approximately 195 10-hour shifts with one loader and 20-ton trucks or approximately 130 10-hour shifts with one loader and 30-ton trucks. This time period could be shortened by using two loaders and additional trucks. As under the Deep Excavation Option, these trips would be make little difference to the level of service on Pajarito Road.

Compared to the Deep Excavation Option, there would be no need for a large volume of concrete for a building foundation subgrade replacement of the poorly welded tuff layer. This would reduce the number of trucks transporting concrete mix from the batch plant to the Modified CMRR-NF. While the total number of trucks would be reduced, the number of trucks in a peak hour is expected to remain the same. Thus, the impact on the roadway level of service would remain the same, although the duration of construction-related traffic would be reduced.

The same amount of steel would be required under the Shallow Excavation Option as under the Deep Excavation Option. To support the concrete batch plant operation under the Shallow Excavation Option for all concrete operations, the following materials would be required (LANL 2011):

- Approximately 120,000 tons (110,000 metric tons) of coarse aggregate (6,000 20-ton trucks or 4,000 30-ton trucks)
- Approximately 120,000 tons (110,000 metric tons) of fine aggregate (sand) (6,000 20-ton trucks or 4,000 30-ton trucks)
- Approximately 26,000 tons (24,000 metric tons) of cement (1,300 20-ton trucks or 900 30-ton trucks)
- Approximately 14,000 tons (13,000 metric tons) of fly ash (700 20-ton trucks or 500 30-ton trucks)

All supplies reaching the site must use Pajarito Road. The structural impacts on internal LANL roadways would be less under the Shallow Excavation Option than the Deep Excavation Option due to the lesser amount of concrete that would be needed to support construction.

Construction Impacts – Shallow Excavation Option – Worker Traffic—The peak number of workers going to the Modified CMRR-NF is expected to be approximately the same under the Shallow Excavation Option as under the Deep Excavation Option. The 790 additional (worker) commuters were added to the existing traffic to determine the anticipated level of service. The impacts on traffic were compared for the year 2012, the year that the Shallow Excavation Option construction would start, and 2020, the year that the Shallow Excavation Option construction would be completed. The results are the same as those shown for the Deep Option in Table 4–37. No change in the level of service of roadways in the vicinity of LANL is anticipated during the construction period. In addition, the impacts of construction traffic would be minimal because it is anticipated that workers for the Modified CMRR-NF would park at the parking lot in TA-72 and would be bused to the worksite.

Operations Impacts—Employees currently working at the existing CMR Building and other facilities at LANL are expected to occupy the Modified CMRR-NF. There would be no net increase in the number of employees at LANL as a result of operating the Modified CMRR-NF. Because no net increase in employees is anticipated to support Modified CMRR-NF operations under the Modified CMRR-NF Alternative, compared with employees supporting the existing CMR Building, there would be no significant impact on traffic or transportation on the public roadways external to LANL and the vehicle access portals. Those employees accessing the CMRR-NF from the east would have a shorter commute on the internal LANL roadway system and those employees accessing the CMRR-NF from the west would have a longer commute on the internal LANL roadway system. No change in the level of service of the internal LANL roadways impacted by these changes in commuting patterns is anticipated.

4.4 Environmental Impacts of the Continued Use of CMR Building Alternative

4.4.1 Continued Use of CMR Building Alternative

This section presents the environmental impacts associated with the Continued Use of CMR Building Alternative. Under this alternative, the existing CMR Building at TA-3 would continue operations with necessary maintenance and component replacements, as described in Chapter 2, Section 2.6.3. Under this alternative, there would be no construction of a new CMRR-NF. CMR Building operations and capabilities would continue to be restricted to levels necessary to maintain an acceptable level of risk to public and worker health and safety. In addition, operation of RLUOB would be included under this alternative, as well as the relocation of a number of people currently working in the CMR Building to RLUOB.

4.4.2 Land Use and Visual Resources

Operations Impacts—Because there would be no land disturbance (no construction) within TA-3 or TA-55 or anywhere else at LANL under this alternative, there would be no impact on land use or the visual environment. Furthermore, continued operation of the existing CMR Building and RLUOB would not change either the land use within or the appearance of TA-3 or TA-55.

4.4.3 Site Infrastructure

Operations Impacts—Projected site infrastructure requirements of CMR Building operations under the Continued Use of CMR Building Alternative are presented in **Table 4–38**. Current CMR Building operations are included in current site requirements and have already been accounted for in the current available site capacities for electricity and water (see Chapter 3, Table 3–3). The addition of RLUOB would add to these requirements under this alternative. As shown in Table 4–38, the combined requirements of the CMR Building and RLUOB make up less than 1 percent of the available site capacity for natural gas and 42 percent of the available site capacity for peak electrical load. Existing infrastructure should be capable of supporting these additional requirements without exceeding capacities. Thus, the net impact on infrastructure is expected to be minimal.

Table 4–38 Continued Use of CMR Building Alternative — Site Infrastructure Requirements for CMR Building and RLUOB Operations

Resource	*Available Site Capacity* [a]	*CMR Building Requirement* [b]	*RLUOB Requirement*	*Total Requirement* [b]	*Percentage of Available Site Capacity*
Electricity					
Energy (megawatt-hours per year)	601,000	No change	59,000	59,000	10
Peak load demand (megawatts)	26	No change	11	11	42
Fuel					
Natural gas (million cubic feet per year)	5,860	No change	38	38	0.6
Water (million gallons per year)	130	No change	7	7	5.4

CMR = Chemistry and Metallurgy Research; RLUOB = Radiological Laboratory/Utility/Office Building.
[a] A calculation based on the system-wide capacity (site-wide for water) minus the current site requirements
[b] The Continued Use of CMR Building Alternative is a continuation of current CMR activities and associated infrastructure requirements. The utilities at the CMR Building are not metered so there are no reliable estimates of utility usage. The values for the "Available Site Capacity" column account for the CMR Building utilities being in the site-wide totals.
Note: Values have been rounded.
Source: LANL 2011.

4.4.4 Air Quality and Noise

4.4.4.1 Air Quality

Operations Impacts—Air quality impacts associated with the continued operation of the existing CMR Building were analyzed under the No Action Alternative in the *CMRR EIS*. There would be no increases in emissions or air pollutant concentrations for nonradiological releases (DOE 2003b).

Operation of RLUOB would have minimal air quality impacts. Sources of emissions would occur from daily employee commutes and the testing of an emergency backup generator. Nonradiological emissions for the criteria pollutants were estimated in **Table 4–39**.

Table 4–39 Continued Use of CMR Building Alternative — Nonradiological Operational Emissions of RLUOB

Criteria Pollutant	*Averaging Time*	*NMAAQS (parts per million)*	*Maximum Incremental Concentration (parts per million)*
Carbon monoxide	1 hour	13.1	0.0004
	8 hours	8.7	0.0003
Nitrogen dioxide	Annual	0.05	5.8×10^{-6}
Sulfur dioxide	3 hours	0.5 [a]	6.5×10^{-5}
	24 hours	0.1	1.4×10^{-5}
	Annual	0.02	2.8×10^{-6}
PM_{10}	24 hours	150 μg/m³	0.007 μg/m³
Total Suspended Particulates	24 hours	150 μg/m³	2.4 μg/m³
	Annual	60 μg/m³	0 μg/m³

μg/m³ = micrograms per cubic meter; CMR = Chemistry and Metallurgy Research; NMAAQS = New Mexico Ambient Air Quality Standards; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; RLUOB = Radiological Laboratory/Utility/Office Building.
[a] NMAAQS does not have a 3-hour sulfur dioxide standard; therefore, the Federal NAAQS standard is used.
Note: Values have been rounded.
Source: LANL 2011.

Radiological emissions, estimated at 0.00003 curies per year of actinides, could be released from the CMR Building operations. Impacts of these radiological releases are discussed in Section 4.4.10.

4.4.4.2 Greenhouse Gas Emissions

Operations Impacts—Operations at the CMR Building and RLUOB would release greenhouse gases from refrigerants, a backup generator, and employee commutes.[15] Greenhouse gas emissions from utilities (for example, electricity) do not occur directly on site. Total greenhouse gases during normal operations of the existing CMR Building and RLUOB would be approximately 3,400 tons (3,100 metric tons) of carbon-dioxide equivalent per year (see **Table 4–40**). The current greenhouse gas inventory for LANL includes the existing CMR Building; therefore, continued operation of this building would not change the site's current greenhouse gas emissions.

Total greenhouse gases, including both indirect (Scope 2) and direct (Scope 1) emissions during operations of the existing CMR Building and RLUOB would be approximately 42,300 tons (38,000 metric tons) of carbon-dioxide equivalent per year (see Table 4–40). Greenhouse gas emissions for the continued use of CMR Building operating with the RLUOB would be approximately 10 percent of the total site-wide carbon-dioxide-equivalent emissions per year. These greenhouse gases emitted by operations under the Continued Use of CMR Building Alternative would add a relatively small increment to emissions of these gases in the United States and the world.

Direct greenhouse gas emissions at LANL are those described as Scope 1. There are no established thresholds for greenhouse gases, but in draft guidance issued February 18, 2010, the CEQ suggested that proposed actions that are reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon-dioxide equivalent should be evaluated by quantitative and qualitative assessments. Together, the Scope 1 emissions under Continued Use of CMR Building Alternative would be approximately 3,400 tons (3,100 metric tons) of carbon-dioxide equivalent per year and are below the CEQ suggested evaluation level of 25,000 metric tons per year.

Table 4–40 Continued Use of CMR Building Alternative — CMR Building and RLUOB Operations Emissions of Greenhouse Gases

		Emissions (tons per year)				
Emissions Scope	***Activity***	***CO_2***	***CH_4 CO_2e***	***N_2O CO_2e***	***HFC CO_2e***	***Total CO_2e***
Scope 1 [a]	Refrigerants used	N/A	N/A	N/A	3,400	3,400
	Backup generator	2	0	0	N/A	2
	Subtotal	2	0	0	3,400	3,400
Scope 2 [b]	Electricity use	38,700	11	160	N/A	38,900
	Total	38,700	11	160	3,400	42,300

CMR = Chemistry and Metallurgy Research; CO_2 = carbon dioxide; CH_4 CO_2e = methane in carbon-dioxide equivalent; N_2O CO_2e = nitrous oxide in carbon-dioxide equivalent; CO_2e = carbon-dioxide equivalent; HFC CO_2e = hydrofluorocarbons in carbon-dioxide equivalent; N/A = not applicable; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Scope 1 sources include direct emissions by stationary sources owned or controlled by LANL.

[b] Scope 2 sources include indirect emissions from the generation of purchased electricity, where the emissions actually occur at sources off site and not at sources owned or controlled by LANL.

Note: Totals may not equal the sum of the contributions due to rounding.

[15] *Since there would be no new hires under this alternative, emissions from personnel commutes included in the baseline inventory are not included here.*

4.4.4.3 Noise

Operations Impacts—Under this alternative, there would be no new construction or major changes in operations or employment levels. Thus, there would be no change in noise impacts under the Continued Use of CMR Building Alternative.

4.4.5 Geology and Soils

Operations Impacts—Geologic impacts associated with continued operations at the existing CMR Building would primarily consist of regional and local seismic hazards, including earthquakes and potential fault rupture, as summarized in Chapter 3, Section 3.5, and further detailed in the *CMRR EIS* (DOE 2003b) and the *LANL SWEIS* (DOE 2008a). In particular, core drilling studies and geologic mapping have established a number of secondary fault features at TA-3, including a high-angle, southwest-to-northeast-trending fault trace associated with the Rendija Canyon Fault Zone beneath the northern portion of the CMR Building. These fault studies indicate that 8 feet (2.4 meters) of fault displacement have occurred at the CMR Building site. Although the potential for ground deformation from fault rupture is relatively low, with a minimum recurrence interval of 4,000 years, the presence of identified fault structures in association with an identified active and capable fault zone (per 10 CFR Part 100, Appendix A) restricts the operational capability of the existing CMR Building without substantial upgrades and repairs.

Under this alternative, there would be no additional impacts on geology and soils from operations of RLUOB at TA-55 under normal operating conditions.

4.4.6 Surface-Water and Groundwater Quality

Under this alternative, no impacts on surface-water resources or groundwater quality are anticipated during CMR Building and RLUOB operations. Industrial and sanitary effluents would be discharged to sanitary sewer lines for treatment at the Sanitary Wastewater Systems Plant in TA-46. Spill prevention, countermeasures, and control procedures would be employed during operations and transmission of wastewaters from TA-3 and TA-55 to minimize the probability of, and the potential for, an unplanned release that could infiltrate and affect groundwater (LANL 2010d).

4.4.7 Ecological Resources

There would be no new impact on terrestrial and aquatic resources, wetlands, or threatened and endangered species at LANL because no new facilities would be built under the Continued Use of CMR Building Alternative. The CMR Building and RLUOB would not produce emissions or effluent of a quality or at levels that would likely affect wildlife and other ecological resources.

4.4.8 Cultural and Paleontological Resources

Because there would be no land disturbance (no construction) under this alternative, there would be no impact on cultural resources. Further, continued operations at the existing CMR Building or RLUOB would not affect these resources within either TA-3, TA-55, or the site as a whole. Impacts of CMR Building decontamination, decommissioning, and demolition (DD&D) are addressed in Section 4.5.1.

4.4.9 Socioeconomics

Operations Impacts—Under the Continued Use of CMR Building Alternative, the current employment of approximately 210 workers at the existing CMR Building would continue, although many of these workers may have their offices moved to RLUOB. RLUOB operations would also draw about 140 employees from other locations on the site. No new employment of workers would be required. Therefore, there would be no additional impact on the socioeconomic conditions around LANL under this alternative.

4.4.10 Human Health Impacts

4.4.10.1 Normal Operations

The inventory of radioactive material released in air emissions would be smaller under this alternative than under other alternatives. The inventory of radionuclides emitted under this alternative includes only actinides and none of the fission products and tritium that could be associated with a fully operating CMRR-NF. Emissions from RLUOB, which has a radiological laboratory, would be expected to be a small fraction of those estimated to be released from the CMR Building and are not analyzed separately.

The air emissions would be in the form of plutonium, uranium, thorium, and americium isotopes. For conservatism in estimating the human health impacts, all emissions were considered to be plutonium-239 because the human health impacts on a per-curie basis are greater for plutonium-239 than for the other actinides associated with CMR Building activities. **Table 4–41** shows the annual collective dose to the general public living within 50 miles (80 kilometers) of the CMR Building, an average member of the public living within this radius, and an offsite MEI (a hypothetical member of the public residing at the LANL site boundary who receives the maximum dose).

Table 4–41 shows that the annual collective dose to the population living within a 50-mile (80-kilometer) radius of the CMR Building was estimated to be 0.014 person-rem under this alternative. This dose would increase the annual risk of a single latent fatal cancer in the population by 8×10^{-6}. Another way of stating this is that the likelihood that one fatal cancer would occur in the projected 2030 population of about 536,000 people from radiological releases associated with the CMR Building located at TA-3 is about 1 chance in 125,000 per year.

Table 4–41 Continued Use of CMR Building Alternative — Annual Radiological Impacts of CMR Building Operations on the Public

	Population Within 50 Miles (80 kilometers)	*Average Individual Within 50 Miles (80 kilometers)*	*Maximally Exposed Individual*
Dose	0.014 person-rem	0.000027 millirem	0.0023 millirem
Cancer fatality risk [a]	8×10^{-6}	2×10^{-11}	1×10^{-9}
Regulatory dose limit [b]	Not applicable	10 millirem	10 millirem
Dose as a percentage of regulatory limit	Not applicable	0.0003	0.02
Dose from background radiation [c]	260,000 person-rem	480 millirem	480 millirem
Dose as a percentage of background dose	5×10^{-6}	5×10^{-6}	0.0005

CMR = Chemistry and Metallurgy Research.

[a] Based on a risk estimate of 0.0006 latent cancer fatalities per person-rem (DOE 2003a).

[b] 40 CFR Part 61, Subpart H, establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations. There is no standard for a population dose.

[c] The annual individual dose from background radiation at LANL is 480 millirem (see source of ubiquitous background radiation in Chapter 3, Section 3.11.1). The 2030 projected population living within 50 miles (80 kilometers) of TA-3 was estimated to be about 536,000.

Note: To convert miles to kilometers, multiply by 0.62137.

The average annual dose to an individual in the population would be 0.000027 millirem under this alternative. The corresponding increased risk of an individual developing a fatal cancer from receiving the average dose would be 2×10^{-11} per year, or essentially zero.

The MEI would receive an estimated annual dose of 0.0023 millirem. This dose corresponds to an increased annual risk of developing a fatal cancer of 1×10^{-9}. In other words, the likelihood that the MEI would develop a fatal cancer is about 1 chance in 1 billion for each year of CMR Building operations.

Estimated annual doses to workers involved with CMR Building activities under this alternative are provided in **Table 4–42**. The estimated worker doses are based on historical exposure data for LANL workers and estimates for work to be performed at RLUOB (LANL 2011). Based on the reported data, the average annual dose to a LANL worker who received a measurable dose was 93 millirem. A value of 100 millirem has been used as the estimate of the average annual worker dose per year of operations at the CMR Building.

The average annual worker dose of 100 millirem at the CMR Building and 20 millirem at RLUOB is well below the DOE worker dose limit of 5 rem (5,000 millirem) (10 CFR Part 835) and is significantly less than the recommended Administrative Control Level of 500 millirem (DOE 1999b). The CMR Building average annual dose corresponds to an increased risk of a fatal cancer of 0.00006 per year. In other words, the likelihood that a CMR Building worker would develop a fatal cancer from work-related exposure is about 1 chance in 17,000 for each year of operations.

Table 4–42 Continued Use of CMR Building Alternative — Annual Radiological Impacts of CMR Building and RLUOB Operations on Workers

	Individual Worker	*Worker Population* [a]
CMR Building dose/fatal cancer risk [b, c]	100 millirem/0.00006	21 person-rem/0.013
RLUOB dose/fatal cancer risk [c]	20 millirem/0.00001	2.8 person-rem/0.0017
Total	Not applicable	24 person-rem/0.014
Dose limit [d, e]	5,000 millirem	Not applicable
Administrative control level [f]	500 millirem	Not applicable

CMR = Chemistry and Metallurgy Research; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Based on a worker population of approximately 210 for continued operations at the CMR Building and 140 for RLUOB after activities have transitioned to RLUOB.

[b] Based on the average dose to LANL workers who received a measurable dose in the period from 2007 to 2009. A program to reduce doses to as low as is reasonably achievable would be employed to reduce doses to the extent practicable.

[c] Based on a worker risk estimate of 0.0006 latent cancer fatalities per person-rem (DOE 2003a).

[d] Dose limits and administrative control levels do not exist for worker populations.

[e] 10 CFR 835.202.

[f] DOE 1999b.

Based on a radiation worker population of approximately 350 under this alternative (210 for CMR Building and 140 for RLUOB), the estimated annual worker population dose would be 24 person-rem. This worker population dose would increase the likelihood of a fatal cancer within the worker population by 0.01 per year. In other words, on an annual basis, there is about 1 chance in 100 of one latent fatal cancer developing in the entire worker population as a result of exposures associated with this alternative. The average annual worker dose of about 68 millirem is well below the DOE worker dose limit of 5 rem (5,000 millirem) (10 CFR Part 835) and is significantly less than the recommended Administrative Control Level of 500 millirem (DOE 1999b). This average annual does corresponds to an increased risk of a latent fatal cancer of 0.00004 for each year of operations. In other words, the likelihood that a worker would develop a fatal cancer from annual work-related exposure is about 1 chance in 25,000.

Occupational injury and illness rates for normal operations under this alternative are projected to follow the patterns observed at LANL, as discussed in Chapter 3, Section 3.11.3. Using the worker population of 350, it is expected that the workers would experience about 9 TRCs and about 4 DART cases annually.

Hazardous Chemicals Impacts

No chemical-related health impacts would be associated with this alternative. As stated in the *LANL SWEIS*, the quantities of chemicals that could be released to the atmosphere during normal operations would be both minor and below the screening levels used to determine the need for additional analysis. There would be no construction and operational increase in the use of chemicals under this alternative. Workers would be protected from hazardous chemicals by adherence to OSHA and EPA occupational standards that limit concentrations of potentially hazardous chemicals.

4.4.10.2 Facility Accidents

This section presents a discussion of the potential health impacts on members of the public and workers from postulated accidents at the CMR Building. Under this alternative, the CMR Building and operations would remain unchanged from current limited operations.

Radiological Impacts

Radiological impacts from facility accidents at the CMR Building were evaluated in the *CMRR EIS*. Appendix C of the *CMRR EIS* and Appendix C of this *CMRR-NF SEIS* provide the methodology and assumptions used in developing facility accident scenarios and estimating doses to the general public within 50 miles (80 kilometers), the MEI, and an onsite worker near the facility. However, the material at risk within the CMR Building has been revised to reflect the reduced operating limits currently imposed in the facility due to safety and seismic concerns associated with the facility, as described below. The only other changes in the parameters used from those presented in Appendix C of the *CMRR EIS* are a new population distribution within 50 miles (80 kilometers) of the CMR Building projected to 2030 (projected to be about 536,000 persons), as well as a revised distance to the nearest offsite individual of 0.42 miles (0.67 kilometers) from the CMR Building. All other assumptions are consistent with those presented in Appendix C of the *CMRR EIS*. The doses presented in the *CMRR EIS* were calculated using MACCS2, Version 1.12. In this *CMRR-NF SEIS*, doses were estimated using MACCS2, Version 1.13.1, which corrected numerous known errors in the previous version of the code.

The accident scenarios in the *CMRR EIS* for the CMR Building were reviewed and compared with the accidents in the recent safety analysis documentation for the CMR Building (LANS 2011a). For this existing building, the safety-basis scenarios and the NEPA scenarios are similar because they are based on the existing facility and the existing safety analyses. The principal differences between the safety-basis approach and the NEPA approach are the degrees of conservatism in the estimations of the material at risk, release mechanisms, damage ratios, fractions made airborne and respirable, and leak path factors. The safety-basis scenarios below assume damage ratios of 1.0, which are likely conservative by a factor of 10 or more. The fractions made airborne and respirable by the real-world stresses implied by these scenarios are also conservative. Because of the age and construction of the building, the NEPA scenarios would assume similar damage ratios and leak path factors to those of the safety-basis scenarios, and no separate analyses are provided. It is estimated that real-world releases for any of these CMR Building accident scenarios would be somewhat lower than these safety-basis estimates. Operational practices and limits at the CMR Building limit the potential consequences of these accidents by limiting the material at risk within the building.

Tables 4–43 and **4–44** provide the revised population doses and risks from facility accidents. Table 4–43 presents the frequencies and consequences of a postulated set of accidents for the public, represented by the MEI and the general population living within 50 miles (80 kilometers) of the CMR Building, and a noninvolved worker located at the technical area boundary, a distance of 300 yards (280 meters) from the CMR Building. Table 4–44 presents the cancer risks, obtained by multiplying each accident's consequences by the upper limit on the likelihood (frequency per year) that the accident would occur.

Table 4–43 Continued Use of CMR Building Alternative — Accident Frequency and Consequences

		Maximally Exposed Individual		*Offsite Population* [a]		*Noninvolved Worker at TA Boundary*	
Accident	*Frequency (per year)*	*Dose (rem)*	*Latent Cancer Fatality* [b]	*Dose (person-rem)*	*Latent Cancer Fatalities* [c]	*Dose (rem)*	*Latent Cancer Fatality* [b]
Wing-wide fire [d]	0.01	0.26	0.0002	130	0 (0.08)	0.65	0.0004
Seismically induced spill	0.01	2.2	0.001	450	0 (0.3)	21	0.03
Seismically induced fire	0.0001	4.3	0.003	900	1 (0.5)	42	0.05
Loading-dock spill/fire	0.01	0.07	0.00004	8.5	0 (0.005)	0.7	0.0004

CMR = Chemistry and Metallurgy Research; TA = technical area.
[a] Based on a projected 2030 population estimate of about 536,000 persons residing within 50 miles (80 kilometers) of TA-3.
[b] Increased likelihood of an LCF for an individual if the accident occurs.
[c] Increased number of LCFs for the offsite population if the accident occurs (results rounded to 1 significant figure). When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses.
[d] A major fire involving two wings.

Table 4–44 Continued Use of CMR Building Alternative — Annual Accident Risks

	Risk of Latent Cancer Fatality		
Accident	*Maximally Exposed Individual* [a]	*Offsite Population* [b, c]	*Noninvolved Worker at TA Boundary* [a]
Wing-wide fire	2×10^{-6}	8×10^{-4}	4×10^{-6}
Seismically induced spill	1×10^{-5}	3×10^{-3}	3×10^{-4}
Seismically induced fire	3×10^{-7}	5×10^{-5}	5×10^{-6}
Loading-dock spill/fire	4×10^{-7}	5×10^{-5}	4×10^{-6}

CMR = Chemistry and Metallurgy Research; TA = technical area.
[a] Risk of increased likelihood of an LCF to the individual.
[b] Risk of increased number of LCFs for the offsite population.
[c] Based on a projected 2030 estimated population of about 536,000 persons residing within 50 miles (80 kilometers) of TA-3.

The accident with the highest potential risk to the offsite population (see Table 4–44) would be an earthquake that would severely damage the CMR Building, resulting in a seismically induced spill of radioactive materials with an annual risk of an LCF for the offsite MEI of 1×10^{-5}. In other words, the offsite MEI's likelihood of developing a latent fatal cancer from this event is about 1 chance in 100,000. This accident would increase the risk of a single LCF in the entire population by 3×10^{-3} per year. In other words, the likelihood of one fatal cancer in the entire population from this event would be about 1 chance in 333 per year. Statistically, the radiological risk for the average individual in the population would be small. The risk of an LCF to a noninvolved worker located at a distance of 300 yards (280 meters) from the CMR Building would be 3×10^{-4}, or about 1 chance in 3,333 per year.

Involved Worker Impacts

Approximately 210 workers would be at the CMR Building during operations in the event of an accident. Workers near an accident could be at risk of serious injury or death. Following initiation of accident and site emergency alarms, workers in adjacent areas of the facility would evacuate the area in accordance with technical area and facility emergency operating procedures and training.

Hazardous Chemicals and Explosives Impacts

Some of the chemicals used in the CMR Building are both toxic and carcinogenic. The quantities of the regulated hazardous chemicals and explosive materials stored and used in the facility are well below the threshold quantities set by the EPA (40 CFR Part 68) and pose minimal potential hazards to the public health and the environment in an accident condition. These chemicals are stored and handled in small quantities (10 to a few hundred milliliters) and would only be a hazard to the involved worker under accident conditions.

4.4.10.3 Intentional Destructive Acts

Analysis of the impacts of terrorist incidents on operations of the CMR Building is presented in a classified appendix to this SEIS. The impacts of some terrorist incidents would be similar to the accident impacts described earlier in this section, while some terrorist incidents may have more-severe impacts. A description of how NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems is in Section 4.2.10.3.

4.4.11 Environmental Justice

Operations Impacts—Population estimates of the entire population and minority and low-income subsets of the population have been projected to the year 2030 (see Section 4.4.10.1 and Chapter 3, Section 3.10). As shown in **Table 4–45**, the total population within 50 miles (80 kilometers) of TA-3 under the Continued Use of CMR Building Alternative is projected to receive an annual dose of approximately 0.014 person-rem and an average annual individual dose of 2.7×10^{-5} millirem.

The population subset of nonminority individuals would receive the highest average dose, 3.1×10^{-5} millirem, annually. This dose is very small and represents an increased risk to the exposed individual of developing a latent fatal cancer of 2×10^{-11}, or 1 chance in about 50 billion, annually. Doses also were estimated for the following population subsets: all (total) minorities, Native Americans, and Hispanics of any race. The total minority population is expected to receive an annual collective dose of 0.0073 person-rem and annual average individual dose of 2.4×10^{-5} millirem. Native Americans living within 50 miles (80 kilometers) of TA-3 would receive a collective dose of 0.00057 person-rem annually and an average annual individual dose of 1.8×10^{-5} millirem. The Hispanic population would receive a collective dose of 0.0052 person-rem annually; the annual average dose to a member of the Hispanic population would be 2.1×10^{-5} millirem. These data show that the dose to all populations surrounding TA-3 would be small and would not result in adverse impacts on human health. Although the annual population dose to the total minority population is projected to be slightly higher than that to the nonminority population, the difference between doses is not appreciable and is because the majority of the population surrounding LANL is considered part of a minority group. Furthermore, the dose to the average individual in the nonminority population is projected to be slightly higher than the projected dose to the average individual in the total minority population.

Table 4–45 Continued Use of CMR Building Alternative — Comparison of Doses to Total Minority, Hispanic, Native American, and Low-Income Populations Within 50 Miles (80 kilometers) and to Average Individuals

	Annual Population Dose (person-rem)	*Annual Individual Dose (millirem)*
Total population	0.014	
Average individual		2.7×10^{-5}
White (non-Hispanic) population	0.0070	
Nonminority average individual		3.1×10^{-5}
Total minority population	0.0073	
Minority average individual		2.4×10^{-5}
Hispanic population [a]	0.0052	
Hispanic average individual		2.1×10^{-5}
Native American population [b]	0.00057	
Native American average individual		1.8×10^{-5}
Non-low-income population	0.013	
Non-low-income average individual		2.8×10^{-5}
Low-income population	0.0013	
Low-income average individual		2.1×10^{-5}

CMR = Chemistry and Metallurgy Research.
[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] The Native American population may include persons who also indicated that they were of Hispanic ethnicity.

Population doses to persons living below the poverty level are also analyzed in Table 4–45. Low-income populations surrounding TA-3 would receive an annual dose of 0.0013 person-rem and an annual average individual dose of 2.1×10^{-5} millirem. Persons living above the poverty level would receive an annual collective dose of 0.013 person-rem and an annual average individual dose of 2.8×10^{-5} millirem.

For nonradiological air quality impacts, as discussed in Section 4.4.4.1, there would be no increases in emissions or air pollutant concentrations for nonradiological releases due to CMR Building or RLUOB operations under the Continued Use of CMR Building Alternative. Nonradiological emissions would remain well below the ambient standards established to protect human health. Therefore, the impact of potential nonradiological air pollutant releases on minority or low-income individuals under this alternative would be considered minor.

Residents of the Pueblo of San Ildefonso have expressed concern that pollution from CMRR Facility operations could contaminate Mortandad Canyon, which drains onto pueblo land and sacred areas. CMRR Facility operations under this alternative are not expected to adversely affect air or water quality or result in contamination of tribal lands adjacent to the LANL boundary.

These data show that the total minority, Native American, Hispanic, and low-income populations would not be subjected to disproportionately high and adverse dose impacts from normal operations under the Continued Use of CMR Building Alternative.

4.4.12 Waste Management and Pollution Prevention

Operations Impacts –The projected annual waste volumes from the CMR Building and RLUOB are listed in **Table 4–46** for transuranic and mixed transuranic wastes, low-level and mixed low-level radioactive wastes, and chemical wastes. The projected volumes for the CMR Building are based on average waste generation rates for the CMR Building for the years 2004 through 2008, while the projected volumes for RLUOB are the same as those shown in Section 4.3.12. (The projected volumes for the CMR Building are smaller than the volumes for these wastes projected for operation of the CMR Building under all alternatives in the 2008 *LANL SWEIS* [DOE 2008a]). The CMR Building and RLUOB are designed and operated to accommodate these waste volumes, and no difficulty in managing these volumes for onsite disposal or shipment for offsite disposition would be expected on either a CMR Building and RLUOB or LANL site-wide basis.

Table 4–46 Continued Use of CMR Building Alternative — Operational Waste Generation Rates Projected for CMR Building, RLUOB, and Los Alamos National Laboratory Activities

Waste	*CMR Building*	*RLUOB*	*Total*	*Site-wide LANL Projections*
Transuranic and mixed transuranic (cubic yards per year)	8.2	0	8.2	440 to 870 [a]
Low-level radioactive (cubic yards per year)	190	130	310	21,000 to 115,000 [a]
Mixed low-level radioactive (cubic yards per year)	1.8	2.3	4.1	320 to 18,100 [a]
Sanitary solid (tons per year) [b]	36	24	60	– [c]
Sanitary wastewater (gallons per year)	2,730,000	2,485,000	5,215,000	156,000,000 [d]
Liquid low-level radioactive (gallons per year)	67,600	95,800	163,000	4,000,000 [e]
Chemical (tons per year) [f]	0.88	0.50	1.4	3,200 to 5,750 [a]

CMR = Chemistry and Metallurgy Research; RLUOB = Radiological Laboratory/Utility/Office Building.

[a] Projected waste quantities from LANL operations are given as a range in the *LANL SWEIS* (DOE 2008a). The listed value reflects the assumption of the Expanded Operations Alternative in the *LANL SWEIS*, less the waste projected from some activities that were not implemented (see Table 4–55).

[b] The projected quantity of CMR Building and RLUOB sanitary solid waste (municipal trash) was estimated by multiplying the projected annual number of full-time equivalent radiation workers (140 for RLUOB and 210 for CMR Building) by an assumed annual 344 pounds (156 kilograms) of waste generated per person per year (see Chapter 3, Section 3.12.2).

[c] Annual sanitary solid waste quantities were not projected in the 2008 *LANL SWEIS*.

[d] The value shown is the annual volume of wastewater processed at the Sanitary Wastewater Systems Plant in TA-46, assuming operation at its 600,000-gallon-per-day (2.27-million-liter-per-day) design capacity for 260 working days per year (DOE 2003b). Sanitary wastewater and nonradioactive liquid waste are both projected to be routed to the Sanitary Wastewater Systems Plant for treatment.

[e] The value shown is the projected annual liquid low-level radioactive waste treatment rate at RLWTF assuming implementation of the No Action Alternative in the 2008 *LANL SWEIS*; annual treatment of 30,000 gallons of liquid transuranic waste was also projected (DOE 2008a).

[f] Chemical waste is not a formal LANL waste category; however, as was done in the 2008 *LANL SWEIS* (DOE 2008a), the term is used in this supplemental environmental impact statement to denote a broad category of materials, including hazardous wastes, toxic wastes, and special waste designated under the New Mexico Solid Waste Regulations.

Note: Totals may not equal the sum of the contributions due to rounding. To convert cubic yards to cubic meters, multiply by 0.76456; tons to metric tons, by 0.90718; gallons to liter, by 3.78533.

Source: DOE 2008a; LANL 2007d, 2009, 2010a.

Radioactive and Chemical Waste

Since the total radioactive and chemical waste volumes listed in Table 4–46 are all smaller than the volumes projected in Section 4.3.12 for the combination of the Modified CMRR-NF and RLUOB and in Section 4.3.12, it was concluded that there would be no significant impacts on available treatment, storage, or disposal capacity expected for the analyzed onsite and offsite waste disposition facilities, a similar conclusion can be made for this alternative.

Sanitary Solid Waste

The CMR Building employs approximately 210 workers (LANL 2011). If each employee generates 344 pounds (156 kilograms) of sanitary solid waste (municipal trash) (see Chapter 3, Section 3.12.2), the

CMR Building would generate about 36 tons (33 metric tons) of sanitary solid waste annually. In addition, about 24 tons (22 metric tons) of sanitary solid waste are projected to result from RLUOB operations annually, or about 60 tons (54 metric tons) from both facilities. This waste would be collected in appropriate waste containers, such as dumpsters, and would be regularly disposed of or recycled by transfer to the Los Alamos County Eco Station located at the Los Alamos County Landfill site within the LANL boundary or by transfer to an offsite solid waste facility permitted to accept the waste. No impacts on available solid waste management capacity are expected because of the small quantity of sanitary solid waste to be managed from CMR Building and RLUOB operations compared to the total quantities of solid waste annually addressed on a county and state basis and the large number of available waste disposition facilities within New Mexico. The annual sanitary solid waste generation from both facilities would represent less than 1 percent of the waste processed in 2009 at the Los Alamos County Eco Station.

Sanitary Wastewater

Under the Continued Use of CMR Building Alternative, the CMR Building would continue to generate sanitary liquid wastewater that would be piped to the Sanitary Wastewater Systems Plant in TA-46 for treatment. Treated wastewater would be pumped to TA-3 to be either recycled at the TA-3 power plant (as makeup water for the cooling towers) or discharged into Sandia Canyon via permitted outfall number 001 (LANL 2010a). The CMR Building sanitary wastewater generation rate is projected to be 2,730,000 gallons for 260 days (10,000,000 liters) per year, assuming that 210 workers each generate 50 gallons (190 liters) of wastewater per day (DOE 2003b). The RLUOB sanitary wastewater generation rate is estimated to be 2,485,000 gallons (9,410,000 liters) per year. The combined wastewater generation rate from both facilities is thus about 5,215,000 gallons (20,000,000 liters) per year. The daily generation rate would represent about 3 percent of the 600,000-gallon-per-day (2.3-million-liter-per-day) design capacity of the Sanitary Wastewater Systems Plant (DOE 2003a). Therefore, no impacts on available sanitary wastewater treatment capacity are expected from CMR Building and RLUOB operations.

Nonradioactive Liquid Waste

The CMR Building would continue to generate industrial wastewater, and it is expected that this wastewater would continue to be transferred to the Sanitary Wastewater Systems Plant for treatment. If the CMR Building continues to generate a few hundred thousand gallons of industrial wastewater annually (see Chapter 3, Section 3.12.1.4), no impacts on Sanitary Wastewater Systems Plant treatment capacity are expected. Similarly, the small quantities of nonradioactive liquid waste that might be generated at RLUOB would be routed to the Sanitary Wastewater Systems Plant for treatment.

Radioactive Liquid Waste

The CMR Building would continue to generate radioactive liquid waste that would be piped for treatment to RLWTF in TA-50. About 67,600 gallons (256,000 liters) per year of liquid low-level radioactive waste have been projected for CMR Building operations and little or no liquid transuranic waste (Balkey 2011). In addition, about 95,800 gallons (363,000 liters) of liquid low-level radioactive waste and no liquid transuranic waste are annually projected from RLUOB operations. About 163,000 gallons (617,000 liters) per year of liquid low-level radioactive waste and little or no liquid transuranic waste are projected from both facilities. The projected volume would represent about 4 percent of the projected RLWTF treatment rate in the 2008 *LANL SWEIS* (under the *LANL SWEIS* No Action Alternative) (DOE 2008a). No impacts on radioactive liquid waste treatment and discharge capacity are expected from CMR Building and RLUOB operations.

4.4.13 Transportation and Traffic

4.4.13.1 Transportation

Routine (Incident-Free) Transportation

Operations Impacts—**Table 4–47** summarizes the total transportation impacts, as well as transportation impacts on two nearby LANL transportation routes: LANL to Pojoaque, New Mexico, the route segment used by trucks from LANL, and Pojoaque to Santa Fe, New Mexico, the route segment used by trucks traveling on Interstate 25 (such as trucks traveling to WIPP). As stated in Section 4.3.13.1, for analysis purposes in this SEIS, two sites, the DOE NNSS and a commercial facility in Utah, were selected as possible disposal sites for all low-level radioactive waste should the decision be made to dispose of low-level radioactive waste off site. Differences in distance to these two sites and the affected population along the transportation routes result in a range of impacts under each alternative.

Table 4–47 Continued Use of CMR Building Alternative — Annual Risks of Transporting Operational Radioactive Materials

				Incident-Free				Accident	
				Crew		Population			
Transport Segments	Offsite Disposal Option [a]	Number of Shipments	Round Trip Kilometers Traveled (thousands)	Dose (person-rem)	Risk [b]	Dose (person-rem)	Risk [b]	Radiological Risk [b]	Nonradiological Risk [b]
LANL to Pojoaque	NNSS	24	1.5	0.009	6×10^{-6}	0.003	2×10^{-6}	5×10^{-10}	0.00003
Pojoaque to Santa Fe	NNSS	24	2.5	0.02	0.00001	0.005	3×10^{-6}	3×10^{-10}	0.00005
Total Route	NNSS	24	57	0.3	0.0002	0.1	0.00006	1×10^{-8}	0.0009
LANL to Pojoaque	Commercial	24	1.5	0.009	6×10^{-6}	0.003	2×10^{-6}	5×10^{-10}	0.00003
Pojoaque to Santa Fe [c]	Commercial	2	0.2	0.004	2×10^{-6}	0.001	8×10^{-7}	2×10^{-10}	4×10^{-6}
Total Route	Commercial	24	50	0.3	0.0002	0.09	0.00005	1×10^{-8}	0.0008

CMR = Chemistry and Metallurgy Research; LANL = Los Alamos National Laboratory; NNSS = Nevada National Security Site.

[a] Under this option, low-level and mixed low-level radioactive waste would be shipped to either the NNSS or a commercial site in Utah. Transuranic waste would be shipped to the Waste Isolation Pilot Plant.

[b] Radiological risk is expressed in terms of latent cancer fatalities, while nonradiological risk is expressed in terms of the calculated number of traffic accident fatalities.

[c] Shipments of low-level radioactive waste to a commercial disposal site in Utah would not pass along the Pojoaque to Santa Fe segment of highway.

Note: Due to rounding, the risk values may differ slightly from those calculated by multiplying the reported dose times the dose factor of 0.0006 LCFs per rem.

Under this alternative, about 24 offsite shipments of radioactive materials would be made annually to the NNSS in Nevada (or a commercial site in Utah) and WIPP in New Mexico. Maximum transportation impacts would be realized if low-level radioactive waste and mixed low-level radioactive waste were shipped to either the NNSS in Nevada or a commercial site in Utah instead of being disposed of on site. Transuranic waste would be shipped to WIPP. The total projected (one-way) distance traveled on public roads transporting radioactive materials to various locations would range from about 15,500 to 17,700 miles (25,000 to 28,500 kilometers).

The maximum annual dose to the transportation crew from all offsite transportation activities under this alternative was estimated to be about 0.3 person-rem, for both disposal options. The dose to the general population would be about 0.09 to 0.1 person-rem. Accordingly, incident-free transportation would result in a maximum of no (0.0002) excess LCFs among the transportation workers and no (0.00006) excess LCFs in the affected population. The estimated dose associated with transport of low-level radioactive waste and mixed low-level radioactive waste to the NNSS is slightly higher because of the longer distance traveled and larger affected population. The differences in estimated doses under either disposal option are very small.

Note that DOE regulations limit the maximum annual dose to a transportation worker to 100 millirem per year unless the individual is a trained radiation worker. The dose to a trained radiation worker is limited to 2 rem per year (DOE 1999b). The potential for a trained radiation worker to develop a fatal latent cancer from an annual dose at the maximum annual exposure is 0.0012. Therefore, an individual transportation worker is not expected to develop a lifetime fatal latent cancer from exposure during these activities.

The doses to the general populations along the routes from LANL to Pojoaque and from Pojoaque to Santa Fe were estimated to be a maximum of 0.005 person-rem. This dose would result in no (3×10^{-6}) excess LCFs among the exposed populations.

Transportation Accidents

Operations Impacts—As stated earlier in Section 4.3.13.1, two sets of analyses were performed for the evaluation of transportation accident impacts involving radioactive materials transport: impacts of maximum reasonably foreseeable accidents (accidents with probabilities greater than 1 in 10 million per year [1×10^{-7}]) and impacts of all accidents (total transportation accidents).

For radioactive materials transported under this alternative, the maximum reasonably foreseeable offsite truck transportation accident with the greatest consequence would involve a truck carrying contact-handled transuranic waste. The probability that such an accident would occur is about 1 in 1.5 million (6.7×10^{-7}) per year in a rural area.[16] If such an accident occurs, the consequences in terms of general population dose would be 0.2 person-rem. Such an exposure could result in no (0.0001) excess LCFs among the exposed population. This accident would result in a dose of 8.2 millirem to a hypothetical MEI located at a distance of 330 feet (100 meters) and exposed to the accident plume for 2 hours, with a corresponding risk of developing a latent fatal cancer of about 1 in 200,000 (5×10^{-6}).

Under the Continued Use of CMR Building Alternative, estimates of the total offsite transportation accident risks for all projected accidents involving radioactive shipments, regardless of type, are a maximum radiological dose-risk[17] to the general population of 0.02 person-millirem, resulting in 1×10^{-8} LCFs and a maximum nonradiological (traffic) accident risk of zero (0.003) fatalities.

The maximum radiological transportation accident dose-risk to the general populations along the routes from LANL to Pojoaque and from Pojoaque to Santa Fe, New Mexico, would be 0.03 person-millirem. This dose would result in no (2×10^{-9}) excess LCFs among the exposed populations. The maximum expected traffic accident fatalities along these routes would be zero (0.00005).

[16] *The likelihood of an accident in an urban or suburban area is much less than 1 in 10 million per year.*
[17] *Dose-risk includes the probability that an accident will occur. Here, these values were calculated by dividing the radiological risks in terms of LCFs given in Table 4–47 (column 9) by 0.0006, which is the risk of an LCF per person-rem of exposure.*

The impacts of transporting various nonradiological materials are presented in terms of distance traveled and numbers of expected traffic accidents and fatalities. This alternative does not include new construction. Therefore, the transport would be limited to the transport of hazardous wastes generated during normal operations, which is expected to be about one shipment per year (see Table 4–35). Based on the travel assumptions described in Section 4.3.13.1, the transportation under this alternative would result in about 330 miles (530 kilometers) traveled, no (0.00001) traffic accidents, and no (0.000001) fatalities.

4.4.13.2 Traffic

Operations Impacts—As the continued CMR Building and RLUOB operations would require the same number of employees as currently working these activities on the site, no changes in traffic are anticipated. There would be no change in the impact on traffic or transportation on the internal LANL road system, the vehicle access portals, or the public roadways external to LANL over the existing conditions.

4.5 Facility Disposition

4.5.1 Impacts of CMR Building Decontamination and Decommissioning

Chapter 2, Section 2.8, describes the contaminated areas, equipment, and systems within the CMR Building and the processes that would be undertaken for building DD&D. For purposes of analysis, only disposition of the entire CMR Building is addressed in detail because activities associated with this option would have the greatest potential environmental consequences, including generation of the largest amount of wastes. DD&D procedures for dispositioning the CMR Building would be common actions across each of the alternatives analyzed in this *CMRR-NF SEIS* (see Chapter 2, Section 2.8.11).

Disposition impacts of the demolition of the CMR Building are discussed qualitatively below for air quality and noise, surface-water and groundwater quality, ecological resources, and human health. Quantitative information has not been presented for these resource areas because project-specific work plans have not been prepared and the CMR Building has not been completely characterized with regard to types and locations of contamination. The waste materials that could be generated by the demolition of the CMR Building are addressed quantitatively, however, as are the impacts of transporting this waste to offsite management facilities; the waste generation and transportation impacts data have been updated since the 2003 *CMRR EIS*. Additional impacts could result from environmental restoration of potential release sites associated with the CMR Building and its vicinity. These potential release sites will be characterized and remediation decisions made in accordance with established processes, including the 2005 Consent Order.

Example potential release sites associated with the CMR Building include the solid waste management units and areas of concern summarized in the following text box.

Example Potential Release Site Associated with the Chemistry and Metallurgy Research Building

Solid Waste Management Unit (SWMU) 03-034(a) consists of two stainless steel and two concrete underground liquid storage tanks located near Wing 9 of the Chemistry and Metallurgy Research (CMR) Building that for a number of years received radioactive liquid waste from Wing 9. A sump pit serving the concrete tanks was used to drain liquid waste to a radioactive liquid waste line to be pumped to the Radioactive Liquid Waste Treatment Facility. Both sets of tanks have been taken offline, and the waste line to the tanks was removed.

Area of Concern (AOC) 03-004(c) is an active dumpster storage area located on an asphalt-covered surface at the main loading dock of the CMR Building, used for staging of boxed low-level radioactive waste before disposal. Runoff from this AOC flows to a storm drain that discharges at an outfall (SWMU 03-054(e)) into Mortandad Canyon. The AOC has been sampled and additional samples will be obtained, leading to a remediation recommendation (LANL 2010g).

SWMU 03-054(e) is an outfall located in upper Mortandad Canyon that discharges effluent from several exterior sources from the CMR Building, including roof drains and surface-water runoff from the asphalt area around the building. The SWMU has been sampled and additional samples will be obtained, leading to a remediation recommendation (LANL 2010g).

Air Quality and Noise

Removal of the CMR Building would result in emissions associated with equipment and vehicle exhaust, as well as particulate emissions (fugitive dust) from demolition activities. Demolition would be expected to result in elevated particulate concentrations in the immediate vicinity of TA-3. Concentrations of other criteria pollutants would increase, but would not be expected to exceed ambient standards in areas where the public has regular access. Demolition activities may also result in radiological releases.

Noise levels during disposition activities at the CMR Building would be consistent with those typical of construction activities. As appropriate and in accordance with DOE regulations (10 CFR Part 851), workers would be required to wear hearing protection to avoid adverse effects on hearing. Noninvolved workers at nearby facilities within TA-3 would be able to hear some of the activities; however, the level of noise would not likely be distracting because construction noise at LANL is common. Some wildlife species may avoid the immediate vicinity of the CMR Building due to noise as demolition proceeds; however, any effects on wildlife resulting from noise associated with demolition activities would be temporary.

Surface-Water and Groundwater Quality

Little or no impacts on water resources are expected. Demolition of the CMR Building would not disturb surface water or generate liquid effluents. Silt fences and other best management practices would be employed to ensure that fine particulates would not be transported by stormwater into surface-water features in the vicinity of the CMR Building. Potable water use at the site would be limited to that necessary for washing equipment, dust control, and worker sanitary facilities.

Ecological Resources

All disposition activities would take place within TA-3, an area that has been dedicated to industrial use since the early 1940s. There are some small trees and shrubs around the CMR Building, but the immediate area consists mostly of roads, parking areas, and concrete pads. Wildlife in the vicinity could be temporarily disturbed by demolition activity and noise when the building is razed, building foundation and buried utilities are removed, contaminated soils are excavated, and waste is trucked to disposal sites.

Cultural Resources

Under Section 106 of the National Historic Preservation Act, any adverse effects on NRHP-eligible properties must be resolved prior to commencement of project activities. In the case of the CMR Building, which has been determined to be eligible for listing due to its association with events during the Cold War years and its architectural and engineering significance (Garcia, McGehee, and Masse 2009), removal of equipment and DD&D of the facility would constitute an adverse effect. In conjunction with the State Historic Preservation Office, NNSA has developed documentation measures to reduce adverse effects on NRHP-eligible properties at LANL. These measures are incorporated into formal memoranda of agreement between NNSA and the New Mexico Historic Preservation Division. Typical memoranda of agreement terms include the preparation of a detailed report containing the history and description of the affected properties. Other terms include the identification of all drawings for each property, the production of medium-format archival photographs, and the preparation of LANL historic building survey forms. Documentation measures included in NNSA memoranda of agreement are carried out to the standards of the Historic American Building Survey/Historic American Engineering Record (HABS/HAER). Specific levels of HABS/HAER documentation are determined on a case-by-case basis.

Human Health

The primary source of potential consequences to workers and members of the public would be associated with the release of radiological contaminants during the decontamination and demolition processes. The only radiological impact on noninvolved workers or members of the public would be from radiological air emissions. Any emissions of contaminated particulates would be reduced by the use of plastic draping and contaminant containment, coupled with HEPA filtration.

Demolition of the CMR Building would involve the removal of radioactively contaminated and/or asbestos-contaminated material. Asbestos-contaminated material would be removed in accordance with asbestos abatement guidelines. Workers would be protected by personal protective equipment and other engineered and administrative controls. No asbestos would likely be released that could affect members of the public.

Waste Management

All wastes would be handled, managed, packaged, and disposed of in the same manner as wastes generated by other activities at LANL (see Chapter 3, Section 3.12). The amounts and types of wastes are expected to be within the capacity of existing waste management systems and are not expected to impact waste management operations at LANL or elsewhere. Waste minimization and pollution prevention principles would be used to the maximum extent practicable under DOE policy.

Projected annual and total waste quantities per waste type for DD&D of the CMR Building are summarized in **Table 4–48** using a work completion time period of 2 to 4 years.[18] Waste projections are uncertain and have been updated from those presented in the 2003 *CMRR EIS* and 2008 *LANL SWEIS* (DOE 2003b, 2008a) by scaling estimates of contaminated surfaces and equipment (LANL 2003, DOE 2003a) to waste volumes generated from DD&D of known contaminated structures at the former Rocky Flats Plant.

[18] The waste projections do not include wastes that could result from remediation decisions for potential release sites that may be located at or in the vicinity of the CMR Building. These potential release sites will be characterized and remediation decisions made in accordance with established processes, including the 2005 Consent Order.

Transuranic (and mixed transuranic) waste would be generated from DD&D of heavily contaminated ducts, radioactive liquid waste piping, hot cells, conveyors, gloveboxes, hoods, and other equipment. Transuranic waste would be packaged in drums or standard waste boxes and shipped to WIPP in reusable Type B shipping packages certified by the U.S. Nuclear Regulatory Commission. The total WIPP capacity for transuranic waste disposal is set at 6.18 million cubic feet (175,600 cubic meters) pursuant to the Waste Isolation Pilot Plant Land Withdrawal Act (DOE 2002b), or 219,000 cubic yards (168,485 cubic meters) of contact-handled transuranic waste (DOE 2009a). Estimates in the Annual *Transuranic Waste Inventory Report – 2010* indicate that approximately 185,000 cubic yards (141,000 cubic meters) of contact-handled transuranic waste would be disposed of at WIPP (emplaced volume plus stored volume) (DOE 2010b), approximately 36,000 cubic yards (27,500 cubic meters) less than the contact-handled transuranic waste permitted capacity. The projected DD&D total of 150 cubic yards (120 cubic meters) would require less than 1 percent of the unsubscribed WIPP disposal capacity. Note that disposal operations at WIPP are currently approved through 2034, based on its operations permit; however, WIPP may meet its statutory disposal limit before the end of the operational period of the Modified CMRR-NF. If necessary, transuranic or mixed transuranic waste generated without a disposal pathway would be safely stored pending development of additional disposal capacity.

Table 4–48 Continued Use of CMR Building Alternative — Projected Waste Generation from Decontamination, Decommissioning, and Demolition of the CMR Building

Waste Stream	*Annual Waste Generation*	*Total Waste Generation*
Transuranic waste (cubic yards) [a]	38 – 75	150
Bulk and packaged low-level radioactive waste (cubic yards) [b]	9,500 – 19,000	38,000
Mixed low-level radioactive waste (cubic yards) [c]	70 – 140	280
Solid waste (cubic yards) [d]	27,500 – 53,000	110,000
Chemical waste (tons) [e]	65 – 130	260

CMR=Chemistry and Metallurgy Research.

[a] Includes mixed transuranic waste.

[b] Three-quarters of the low-level radioactive waste is projected to be bulk material to be shipped for disposal in soft-sided liners or bags; the remaining waste is projected to be packaged in containers such as drums and boxes.

[c] Expected to principally include asbestos waste contaminated with radionuclides.

[d] Includes demolition debris and sanitary solid waste generated by workers.

[e] Chemical waste is not a formal LANL waste category; however, as was done in the *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2008a), the term is used in this supplemental environmental impact statement to denote a variety of materials, including hazardous waste designated under Resource Conservation and Recovery Act regulations; toxic waste (asbestos and polychlorinated biphenyls) designated under the Toxic Substances Control Act; and special waste designated under the New Mexico Solid Waste Regulations, including industrial waste, infectious waste, and petroleum-contaminated soil. The waste is expected to be principally asbestos waste.

Note: Total may not equal the sum of the contributions due to rounding. To convert cubic yards to cubic meters, multiply by 0.76456; gallons to liters, by 3.78533.

Source: DOE 2003a, 2008a; LANL 2003.

Bulk low-level radioactive waste would be packaged in soft-sided liners and bags and shipped in reusable intermodal containers, while packaged low-level radioactive waste would be packaged in containers such as B-25 boxes or 55-gallon drums. The waste could be transported off site to NNSS or to commercially licensed facilities for disposal and/or disposed of on site at TA-54, while Area G continues to accept waste.

It is expected that the bulk of the low-level radioactive waste generated by the demolition of the CMR Building would be disposed of at facilities at the NNSS; the existing commercial facility at Clive, Utah; or other commercial facilities as they become available. If CMR Building DD&D requires 2 years to complete, the 19,000 cubic yards (15,000 cubic meters) of low-level radioactive waste projected to be generated annually would represent about 30 percent of the average low-level radioactive waste disposal rate at the NNSS and about 9 percent of the current low-level radioactive waste disposal rate at the Clive, Utah, commercial facility (see Section 4.2.12). Considering both facilities, offsite disposal capacity is believed to be adequate.

Mixed low-level radioactive waste would principally consist of asbestos waste contaminated with radionuclides. It would be packaged in containers such as B-25 boxes or 55-gallon drums pending shipment to an offsite treatment, storage, and disposal facility.[19] It is expected that the projected annual generation of mixed low-level radioactive waste would be within the current disposal capacities of the NNSS in Nevada and the commercial facility in Clive, Utah. Using a time period of 2 years, the 140 cubic yards (110 cubic meters) of mixed low-level radioactive waste projected to be generated annually would represent about 9 percent of the average mixed low-level radioactive waste disposal rate at the NNSS and about 2 percent of the current mixed low-level radioactive waste disposal rate at the commercial facility in Clive, Utah (see Section 4.3.12). Furthermore, several additional mixed low-level radioactive waste treatment, storage, and disposal facilities are nationally available.

Solid waste consisting of demolition debris and sanitary solid waste was projected to total up to 53,000 cubic yards (41,000 cubic meters) per year. This waste would be collected in appropriate waste containers such as 20-cubic-yard rolloffs or dumpsters and regularly recycled or disposed of by transfer to the Los Alamos County Eco Station within LANL or to an offsite solid waste facility permitted to accept the waste. No impacts on available solid waste management capacity are expected because of the large number of waste disposition facilities permitted within New Mexico (see Section 4.3.12).

Chemical waste (principally including asbestos that is not radioactively contaminated, but also including polychlorinated biphenyls and Resource Conservation and Recovery Act [RCRA]-regulated hazardous waste) would be packaged in containers such as 55-gallon drums and shipped to offsite recycle or treatment, storage, and disposal facilities. It is expected that the amount of chemical waste generated by demolition of the CMR Building would not exceed the disposal capacity of existing facilities (see Section 4.3.12). Several permitted treatment, storage, and disposal facilities exist within New Mexico and neighboring states; 19 facilities are permitted in New Mexico for disposal of special waste such as asbestos. In addition, 10 permitted treatment, storage, and disposal facilities for hazardous waste existed in New Mexico as of 2008, and 39 permitted companies for treatment or disposal of polychlorinated biphenyls existed in the United States as of 2010.

About 68,000 gallons (260,000 liters) per year of liquid low-level radioactive waste are projected to be generated during CMR Building decommissioning. This waste would be transferred to RLWTF at TA-50 for treatment (Balkey 2011). Liquid waste from decommissioning of the CMR Building has been considered in LANL forecasts for annual receipt of liquid waste at RLWTF (Balkey 2011), and no impacts on RLWTF capacity are expected.

Transportation

Waste from DD&D of the CMR Building would be transported by truck to recycle or treatment, storage, and disposal sites at LANL or offsite locations. Transport of radioactive waste would present potential risks to workers and the public from radiation exposure as the waste packages are transported along roads and highways. There would also be potential public risks from radiation exposure (expressed as LCFs) should hypothetical traffic accidents result in release of radioactive material, as well as nonradiological risks of public fatalities resulting from the mechanical forces involved in an accident. Possible accident risks from transport of nonradioactive wastes would only involve nonradiological public fatality risks.

[19] *Asbestos waste contaminated with radionuclides may also be disposed of at LANL TA-54, while Area G continues to accept waste.*

Table 4–49 lists the estimated annual number of offsite shipments of wastes from DD&D of the CMR Building using an assumed 2-year completion time period.

Table 4–49 Continued Use of CMR Building Alternative — Annual Number of Offsite Shipments of Wastes from Decontamination, Decommissioning, and Demolition of the CMR Building

Number of Shipments				
Low-Level Radioactive Waste	*Mixed Low-Level Radioactive Waste*	*Transuranic Waste*	*Hazardous Waste*	*Nonhazardous Waste*
1,110	10	10	20	2,700

CMR = Chemistry and Metallurgy Research.
Note: Annual shipment estimates have been rounded.

Table 4–50 summarizes total annual transportation impacts, as well as annual transportation impacts for two transportation routes nearby LANL: LANL to Pojoaque, New Mexico, which is the route segment used by trucks to and from LANL, and Pojoaque to Santa Fe, New Mexico, which is the route segment used by all trucks traveling on Interstate 25 (such as trucks traveling to WIPP). For purposes of analysis, the NNSS in Nevada and a commercial facility in Utah were used as possible disposal sites for low-level radioactive waste and mixed low-level radioactive waste if these wastes are all transported to offsite facilities. The differences in distance from LANL and the affected population along the different transportation routes between these two sites result in a range of impacts.

Table 4–50 Continued Use of CMR Building Alternative — Annual Risks of Transporting Radioactive Waste from Decontamination, Decommissioning, and Demolition of the CMR Building

				Incident-Free				*Accident*	
				Crew		*Population*			
Transport Segments	*Offsite Disposal Option* [a]	*Annual Number of Shipments*	*Round Trip Kilometers Traveled (thousands)*	*Dose (person-rem)*	*Risk* [b]	*Dose (person-rem)*	*Risk* [b]	*Radio-logical Risk* [b,c]	*Nonradiological Risk* [b]
LANL to Pojoaque	NNSS	1,130	70.3	0.05	0.00003	0.01	0.00001	9×10^{-10}	0.001
Pojoaque to Santa Fe		1,130	117.5	0.09	0.00005	0.02	0.00001	7×10^{-10}	0.002
Total		1,130	2,812	1.9	0.001	0.42	0.0003	1×10^{-7}	0.04
LANL to Pojoaque	Commercial	1,130	70.3	0.05	0.00003	0.01	0.00001	9×10^{-10}	0.001
Pojoaque to Santa Fe [d]		10	0.8	0.02	0.00001	0.006	0.000004	8×10^{-15}	0.00002
Total		1,130	2,423	1.6	0.001	0.4	0.0002	9×10^{-8}	0.04

CMR = Chemistry and Metallurgy Research; LANL = Los Alamos National Laboratory; NNSS = Nevada National Security Site.
[a] For purposes of analysis, low-level and mixed radioactive wastes would be shipped to either the NNSS or to a commercial site in Utah. All transuranic wastes would be shipped to the Waste Isolation Pilot Plant.
[b] Radiological risk is expressed in terms of latent cancer fatalities, while nonradiological risk is expressed in terms of the calculated number of traffic accident fatalities. Radiological risk was determined using a risk of 0.0006 latent cancer fatalities per person-rem (DOE 2003a).
[c] Radiological accident risk in this table is presented in terms of dose-risk, which considers the probabilities that a range of accidents would occur.
[d] Shipments of low-level radioactive waste to a commercial disposal site in Utah would not pass along the Pojoaque to Santa Fe segment of highway.

DD&D of the CMR Building could be completed in as few as 2 years, during which there would be a total of 2,260 offsite shipments of radioactive waste, or an average of 1,130 shipments each year. If DD&D takes a longer time to complete, the annual impacts would be smaller, although the total impacts of shipping all radioactive waste would remain the same. For purposes of analysis, radioactive wastes would be shipped to the NNSS in Nevada (or a commercial site in Utah), and WIPP in New Mexico. The total annual projected (one-way) distance traveled on public roads by trucks transporting radioactive waste would range from about 0.75 million to 0.87 million miles (1.2 to 1.4 million kilometers).

Impacts of Incident-Free Transportation—The annual dose to the transportation crew from offsite transportation of CMR Building DD&D waste was estimated to range from about 1.6 person-rem for disposal at the commercial disposal site in Utah to about 1.9 person-rem for disposal at the NNSS in Nevada. The dose to the general population (up to about 0.4 person-rem) would be nearly the same whether the waste is shipped to the commercial site in Utah or to the NNSS in Nevada. Using a risk of 0.0006 LCFs per person-rem (DOE 2003a), incident-free transportation would result in no (up to 0.001) excess LCFs among transportation workers and no (up to 0.0003) excess LCFs in the affected population. The estimated doses associated with transport of low-level radioactive waste and mixed low-level radioactive waste to the NNSS in Nevada are higher than those for transport to Utah because of the longer distance traveled and larger affected population. The differences in estimated doses under either disposal option are very small, however, as shown above.

Note that DOE regulations limit the maximum annual dose to a transportation worker to 100 millirem per year unless the individual is a trained radiation worker. The dose to a trained radiation worker is limited to 2 rem per year (10 CFR Part 835). Using a risk of 0.0006 LCFs per rem (DOE 2003a), the potential for a trained radiation worker to develop a fatal latent cancer from an annual dose at the maximum annual exposure would be 0.0012. Therefore, an individual transportation worker is not expected to develop a lifetime fatal latent cancer from exposure during these activities.

The maximum annual dose to the general populations along the routes from LANL to Pojoaque and from Pojoaque to Santa Fe, New Mexico, was estimated to be 0.02 person-rem. Using a risk of 0.0006 LCFs per person-rem (DOE 2003a), this dose would result in no (0.00001) excess LCFs among the exposed populations.

The maximum dose to an MEI residing at the edge of the transportation route was estimated to be about 0.0002 millirem per shipment. If this individual were similarly exposed to radiation from all shipments of radioactive waste from DD&D of the CMR Building, the maximum annual dose would be about 0.22 millirem, with a risk of developing an LCF of 1.4×10^{-7} (about 1 in 7.3 million).

Impacts of Accidents during Transportation—As stated in Section 4.2.13, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of all conceivable accidents (total transportation accidents) and impacts of maximum reasonably foreseeable accidents. The first (probabilistic) analysis takes into account the probability of an accident along the transport route and the potential releases to the environment caused by a spectrum of possible accident scenarios, from low-probability accidents with high consequences (large releases) to high-probability accidents (fender benders) with low or no consequences (small or no releases). The consequences and probabilities are summed over all accident probabilities and severity categories to result in probability-weighted values in terms of dose-risk (person-rem) and risk (LCF). The second analysis (maximum reasonably foreseeable accident analysis) presents the public consequences that would result from a severe accident in an urban or suburban area that has a probability greater than 1 in 10 million per year (1×10^{-7}).

As listed in Table 4–50, the maximum radiological transportation accident risk, reflecting all projected accidents involving radioactive shipments regardless of type, is 1×10^{-7} LCFs using a risk of 0.0006 LCFs per person-rem (DOE 2003a). There would be no (0.04) risk of a fatality from nonradiological (traffic) accidents.

The maximum radiological transportation accident risk to the general population along the routes from LANL to Pojoaque and from Pojoaque to Santa Fe, New Mexico, would be 9×10^{-10} excess LCFs among the exposed populations. There would be no (0.001) risk of a fatality from nonradiological (traffic) accidents along these routes.

The maximum reasonably foreseeable offsite truck transportation accident with the greatest consequence would involve a truck carrying contact-handled low-level radioactive waste. The probability that such an accident would occur is about 1 in 667,000 (1.5×10^{-6}) per year in an urban area. If such an accident were to occur, the consequences in terms of general population dose would be about 0.015 person-rem. Using a factor of 0.0006 LCFs per rem or person-rem, such a dose would result in no (9×10^{-6}) excess LCFs among the exposed population. This accident would result in a dose of 0.002 millirem to a hypothetical MEI located at a distance of 330 feet (100 meters) from the accident and exposed to the accident plume for 2 hours. The corresponding risk to the MEI of developing a latent fatal cancer would be about 1 in 793 million (1.2×10^{-9}).

Impacts of Nonradioactive Waste Transportation—Nonradioactive waste includes demolition debris and sanitary solid waste, as well as chemical waste (mostly consisting of asbestos material). This waste would be shipped to recycle or treatment, storage, and disposal facilities within New Mexico or nearby states. The impacts of transporting this waste were determined by estimating the number of possible fatalities that could result from waste transportation accidents. The number of fatalities was determined as the product of the projected distance traveled by the waste trucks annually and the statistical probability of an accident fatality per distance traveled. Based on the assumptions listed in Section 4.2.13.1, transport of nonradiological waste from CMR Building DD&D would result in about 700,000 miles (1.1 million kilometers) traveled, no (0.2) traffic accidents, and no (0.02) fatalities.

4.5.2 Impacts of 2004 CMRR-NF Decontamination and Decommissioning

Disposition of the 2004 CMRR-NF would be considered at the end of its operational life. Impacts would depend on the disposition decision, which could range from reuse to DD&D of the entire 2004 CMRR-NF. If complete DD&D is chosen, it is expected that impacts would be comparable to, or, for many resource areas, smaller than those for DD&D of the CMR Building (see Section 4.5.1). Although similar activities involving radioactive material would be performed, the design, construction, and operation of the 2004 CMRR-NF would incorporate the waste minimization and equipment and operational space decontamination principles that have been learned and implemented since the CMR Building was constructed in the early 1950s. Known hazardous or toxic materials, such as asbestos and polychlorinated biphenyls, also would be avoided or minimized during 2004 CMRR-NF construction and operations, and waste minimization and pollution prevention principles would be implemented. All DD&D activities would be conducted in accordance with applicable Federal and state requirements. Specific resource areas are briefly addressed below.

Air Quality and Noise—There would be air emissions from operation of equipment and vehicles, as well as noise. Airborne emissions of pollutants would likely be smaller than those for DD&D of the CMR Building because known hazardous or toxic materials would be avoided or minimized during 2004 CMRR-NF construction and operations. Noise impacts on humans and wildlife would be temporary.

Surface-Water and Groundwater Quality—Little or no impacts on water resources would result from DD&D of the 2004 CMRR-NF. Applicable best management practices would be implemented to reduce the potential for surface-water impacts.

Ecological Resources—Disposition of the 2004 CMRR-NF would take place in a heavily industrialized area. Any wildlife in the area could be temporarily impacted by disposition activities, but impacts would be minimized in accordance with applicable requirements, including protection of specific species.

Cultural Resources—Cultural resources would be managed and protected in accordance with applicable requirements at the time of DD&D of the 2004 CMRR-NF.

Human Health—Human health would be protected in accordance with applicable Federal and state requirements. Any impacts on workers and the public from disposition activities are expected to be less than those associated with DD&D of the CMR Building because known hazardous or toxic materials, such as asbestos and polychlorinated biphenyls, would be avoided or minimized during 2004 CMRR-NF construction and operations.

Waste Management—Waste quantities from DD&D of the 2004 CMRR-NF are expected to be comparable to or (likely) smaller than those for DD&D of the CMR Building. As noted above, although similar activities would be conducted, construction and operation of the 2004 CMRR-NF would reflect 50 years of experience in facility design and operations, and pollution prevention and waste minimization practices would be implemented. Thus, less radioactive and chemical waste is expected than from DD&D of the CMR Building.

The quantity of nonradioactive waste that is expected from DD&D of the 2004 CMRR-NF is expected to be comparable to that for DD&D of the CMR Building. On one hand, the projected floor space of the 2004 CMRR-NF (200,000 square feet [18,600 square meters]) is less than half that of the CMR Building (550,000 square feet [51,100 square meters]), suggesting the quantity of demolition debris from DD&D of the 2004 CMRR-NF would be less than half of that from DD&D of the CMR Building. On the other hand, the 2004 CMRR-NF might be constructed with thicker flooring and walls than the CMR Building, suggesting that the quantity of waste per unit of floor area from DD&D of the 2004 CMRR-NF would be larger than that for DD&D of the CMR Building. These competing influences suggest that the amount of demolition debris from both DD&D of the CMR Building and the 2004 CMRR-NF would be roughly equivalent.

Transportation—2004 CMRR-NF demolition wastes would be transported to recycle or treatment, storage, and disposal sites at LANL or offsite locations in compliance with applicable requirements. Potential impacts are expected to be similar in magnitude to those for CMR Building DD&D, although there could be fewer radioactive waste shipments because less radioactive waste is expected. Impacts cannot be quantified at this time because potential recycle or treatment, storage, and disposal facilities cannot be identified and population distributions along possible transportation routes are unknown.

4.5.3 Impacts of Modified CMRR-NF Decontamination and Decommissioning

Disposition of the Modified CMRR-NF building would be considered at the end of its operational design life of at least 50 years. Impacts would depend on the disposition decision, which could range from reuse to DD&D of the entire facility. If DD&D of the entire facility is chosen, impacts are expected to be comparable to those described under disposition of the CMR Building (see Section 4.5.1). For the same reasons as those discussed in Section 4.5.2, the quantity of demolition debris under this alternative may exceed that from DD&D of the CMR Building because of the increase in the overall size of the Modified CMRR-NF and the thickness of its walls.

4.6 Cumulative Impacts

In accordance with CEQ regulations, a cumulative impacts analysis includes "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time" (40 CFR 1508.7).

The cumulative impacts analysis for this SEIS includes (1) an examination of cumulative impacts presented in the 2008 *LANL SWEIS*; (2) an evaluation of cumulative impacts since the 2008 *LANL SWEIS* was issued, which are presented in this chapter; and (3) a review of the environmental impacts of past, present, and reasonably foreseeable actions in the region.

Primary sources of information on LANL contributions to cumulative impacts, other than this *CMRR-NF SEIS* and the 2008 *LANL SWEIS*, are listed below:

- *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*, DOE/EIS-0026-S-2 (DOE 1997b)
- *Environmental Surveillance at Los Alamos During 2008*, LA-14304-ENV (LANL 2010a)
- NOI to Prepare an *Environmental Impact Statement for the Operation of a Biosafety Level 3 Facility at Los Alamos National Laboratory, Los Alamos, New Mexico*, 70 FR 228, November 29, 2005
- *Final Complex Transformation Supplemental Programmatic Environmental Impact Statement*, DOE/EIS-0236-S4F (DOE 2008c)
- *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (GTCC EIS)*, DOE/EIS-0375-D (DOE 2011b)

It is also necessary to consider activities implemented by other Federal, state, and local agencies and individuals outside LANL, but within its ROI, including state or local development initiatives; new residential development; new industrial or commercial ventures; clearing land for agriculture; new utility or infrastructure construction and operation; and new waste treatment and disposal activities.

Sandia National Laboratories' main facility in Albuquerque is located approximately 60 miles (97 kilometers) from LANL. Due to this distance, cumulative impacts other than air emissions are not expected to be influenced by Sandia National Laboratories. For radiological air emissions, the 2009 Sandia National Laboratories dose to the offsite MEI was estimated to be 0.00048 millirem, and the 2009 population dose was estimated to be 0.063 person-rem (SNL 2010). The Sandia National Laboratories MEI dose is less than 0.001 percent of the LANL MEI dose, and the Sandia National Laboratories population dose is about 0.002 percent of the LANL population dose. Because the combined impacts would be very small, there would be no significant impact from Sandia National Laboratories, and it is not considered in this cumulative impacts section.

The City of Santa Fe, New Mexico; Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, and Taos Counties, New Mexico; the Santa Clara and San Ildefonso Pueblos in New Mexico; the New Mexico Department of Transportation; BLM; and the U.S. Forest Service were contacted for information regarding expected future activities that could contribute to cumulative impacts. The City of Santa Fe and Mora and

Sandoval Counties did not identify any major future actions (Romero 2011, Schiavo 2011, Sena 2011). San Miguel County, Santa Fe County, Taos County, and the Santa Clara and San Ildefonso Pueblos did not provide information for the cumulative impacts analysis. The following activities in the region surrounding LANL were identified:

- Rio Arriba County identified a road construction project involving the repaving of approximately 5.6 miles (9 kilometers) of U.S. Route 64 from Lumberton to Monero, New Mexico. The project is located more than 50 miles (80 kilometers) from LANL (Kilgour 2011).

In addition, Los Alamos County has closed the Los Alamos County Landfill and is considering use of the San Juan-Chama water allotment. Solid wastes are now shipped out of the county via the new Eco Station, which consists of the solid waste transfer station (LAC 2010a). The Bayo Wastewater Treatment Facility in Santa Fe County was replaced in 2007 with an advanced wastewater treatment facility in Pueblo Canyon. The abandoned Bayo Wastewater Treatment Facility will be demolished and the site will be reclaimed for natural open space (LAC 2010b). In December of 2010, the Los Alamos Department of Public Utilities released its "Conservation Plan for Water and Energy," which addresses the supply- and demand-side conservation measures for potable water, electricity, and natural gas. The report states that Los Alamos has reached an agreement with the U.S. Bureau of Reclamation for an additional 1,200 acre-feet, or 391 million gallons (1,500 million liters), per year of San Juan-Chama surface water that is currently inaccessible (LADPU 2010).

A number of projects were identified that would affect the Santa Fe National Forest, including drilling and operating two oil wells, reservoir and dam repair, thinning and prescribed fire, fire salvage, mineral extraction, and grazing allotment (USFS 2010a).

BLM identified smaller projects that would affect BLM lands, such as continued road maintenance, timber harvesting, and grazing permit renewals, as well as larger projects such as the Sandoval County Oil and Gas Lease Sale; *Draft Taos Resource Management Plan*; Mid-America Pipeline Western Expansion Project; Buckman Water Diversion Project; and Windstream Communication's Fiber-Optic Project (BLM 2010b). These larger projects are described below.

- The Sandoval County Oil and Gas Lease Sale involves BLM's offering of two parcels of about 2,500 acres each (1,000 hectares), located in northern Sandoval County between Cuba and Torreon, New Mexico, at the April 2010 oil and gas lease sale. A Finding of No Significant Impact and a Decision Record were signed on February 2, 2010. The plots of land are located approximately 45 miles (72 kilometers) west of LANL (BLM 2010c).

- The *Draft Taos Resource Management Plan* is meant to provide guidance for the management of public lands and resources administered by the Taos Field Office of BLM. When completed, the plan will guide the Taos Field Office in the implementation of all its subsequent management actions and site-specific activities (BLM 2010b).

- The Mid-America Pipeline Western Expansion Project would add 12 separate loop sections to the existing liquefied natural gas pipeline to increase system capacity. A 23-mile (37-kilometer) segment would be placed in Sandoval County, 30 miles (48 kilometers) from the LANL boundary (BLM 2006a). This segment would be constructed parallel to and 25 feet (7.6 meters) away from the existing pipeline right-of-way.

- The Buckman Water Diversion Project diverts water from the Rio Grande for use by the City of Santa Fe and Santa Fe County. The diversion project withdraws water from the Rio Grande approximately 3 miles (5 kilometers) downstream from where New Mexico State Road 4 crosses the river. The pipelines for this project largely follow existing roads and utility corridors. Potential impacts on fish and aquatic habitats below the proposed project due to effects on water flow are minimal (BDDP 2010a; BLM and USFS 2007). An independent peer review was conducted on behalf of the Buckman Direct Diversion Board to obtain an independent analysis and synthesis of existing information to support a description of potential tap water health risks. This review found no risk to human health from drinking water provided by the Buckman Water Diversion Project (BDDP 2010b). A Memorandum of Understanding regarding water quality monitoring between the Buckman Direct Diversion Board and DOE was published on May 12, 2010, establishing the roles and responsibilities of each agency. The memorandum involves DOE's funding of sampling programs and analysis to ensure no contamination enters the water supply, as well as coordination and sharing of data obtained from sampling between both agencies (BDDP 2010a).

- Windstream Communication's Fiber-Optic Project involves adding approximately 21 miles (43 kilometers) of buried fiber-optic cable in Sandoval County. The cable would link the Cuba exchange in the northeast with an existing fiber-optic line in the southwest (BLM 2009a). A Finding of No Significant Impact and Decision Record for the project were released on November 4, 2009. The project is approximately 40 miles (64 kilometers) northwest of LANL (BLM 2009b, 2009c).

Another project would upgrade the existing 46-kilovolt transmission loop system that serves central Santa Fe County with a 115-kilovolt system (PNM 2005). No major new transmission lines are planned for the region around LANL (WAPA 2010).

No new Federal highways are planned within 50 miles (80 kilometers) of LANL (CFLHD 2009). A number of state transportation projects are ongoing or planned. Many of these are relatively minor maintenance, upgrading, widening, and resurfacing projects. Some of the more-substantial transportation projects in the region include the following (NMDOT 2010):

- U.S. Route 84/285 reconstruction from Pojoaque to Española, New Mexico
- New Mexico State Road 502 reconstruction
- Interstate 25 Corridor Study

Although maintenance of the transportation infrastructure in the region would continue and a number of upgrade, expansion, and widening projects are scheduled over the next 5 years or so, no new major highway projects are scheduled that could substantially contribute to cumulative impacts at LANL.

The list of EPA National Priorities List sites (also known as Superfund sites) was reviewed to determine whether these sites could contribute to cumulative impacts at LANL. Only one site is within 50 miles (80 kilometers) of LANL. The North Railroad Avenue groundwater contamination plume is located over 12 miles (19 kilometers) from the LANL boundary in Rio Arriba County (EPA 2010a).

Most of these actions at other sites are not expected to affect the cumulative impacts of LANL activities because of their distance from LANL; their routine nature; their relatively small size; and the zoning, permitting, environmental review, and construction requirements they must meet. Available documentation reviewed to assess cumulative impacts includes the following sources:

U.S. Bureau of Land Management

- *Final Environmental Impact Statement for the Buckman Water Diversion Project* (BLM and USFS 2007)
- An Independent Peer Review and a Memorandum of Understanding for the *Final Environmental Impact Statement for the Buckman Water Diversion Project* (BDDP 2010a, 2010b)
- *San Juan Public Lands (San Juan Field Center & San Juan National Forest) Final Environmental Impact Statement (EIS) Northern San Juan Basin Coal Bed Methane Project* (BLM 2006b)
- Draft Taos Resource Management Plan (BLM 2010a)

U.S. Forest Service

- "Schedule of Proposed Action 1/01/2011 to 3/31/2011, Santa Fe National Forest" (USFS 2011)
- *Decision Notice and Finding of No Significant Impact for the Restoration of Los Alamos Dam and Reservoir* (USFS 2010b)

U.S. Bureau of Reclamation

- *Upper Rio Grande Basin Water Operations Review Final Environmental Impact Statement* (ACE, Reclamation, and ISC 2007)
- *Final Environmental Impact Statement City of Albuquerque Drinking Water Project* (Reclamation 2004)

National Park Service

- *Fire Management Plan for Bandelier National Monument* (NPS 2005)

State of New Mexico

- *2004–2006 State of New Mexico Integrated Clean Water Act §303(d) §305(b) Report* (NMED 2004)
- "State of New Mexico Standards for Interstate and Intrastate Surface Waters" (NMAC 20.6.4)

Most present and reasonably foreseeable future actions planned for LANL were addressed in the 2008 *LANL SWEIS*. In this section, cumulative site impacts are presented only for those resources that were not addressed in the 2008 *LANL SWEIS* and could reasonably be expected to be affected by the preferred alternative. These include site infrastructure, sustainability, air quality, ecological resources, human health effects of normal operations, waste management, and transportation of radioactive materials. Cumulative impacts associated with the remaining resource areas (such as socioeconomics and surface-water quality) would not change from those presented in the 2008 *LANL SWEIS* due to environmental impacts associated with implementing any of the alternatives evaluated in this SEIS. The methodology for assessing cumulative impacts is presented in Appendix B.

Site Infrastructure Requirement Impacts – Implementation of the Modified CMMR-NF Alternative would result in the greatest cumulative infrastructure impacts when added to the projected infrastructure requirements for other LANL activities and the demands of other non-LANL users. **Table 4–51** presents the estimated combined infrastructure requirements during construction of the Modified CMRR-NF in addition to other LANL and non-LANL requirements during the same timeframe. Included in the other LANL site requirements would be the continued operation of the CMR Building. Should these projections be fully realized, LANL and Los Alamos County could cumulatively require 91 percent of the current electric peak load capacity, 57 percent of the total available electrical capacity, 92 percent of the available water capacity, and 27 percent of the available natural gas capacity. In the near term, no infrastructure capacity constraints are anticipated. LANL operational demands to date on key infrastructure resources, including electricity and water, have been below the levels projected in the 2008 *LANL SWEIS* and well within site capacities. For example, actual electric peak load for LANL in 2008 was approximately 63 megawatts compared to the 109 megawatts projected in the 2008 *LANL SWEIS* (LANL 2010a). Inclusion of infrastructure requirements associated with the construction of potential alternatives being analyzed for the *GTCC EIS* at LANL could increase the requirements for electric peak load by 3 percent, electricity by 1 percent, and water by less than 1 percent (DOE 2011b).

Table 4–51 Estimated Combined Infrastructure Requirements at Los Alamos National Laboratory (Construction)

Resource	*System Capacity* [a]	*LANL Current Site Requirement* [b]	*Current Los Alamos County Requirement* [b]	*Available System Capacity*	*Modified CMRR-NF Alternative* [c]	*Remaining Capacity*
Electricity						
Energy (megawatt-hours per year)	1,314,000	563,000	150,000	601,000	31,000–36,000	565,000–570,000
Peak load demand (megawatts)	150	101	23	26	12	14
Natural Gas (million cubic feet per year)	8,070	1,200	1,020	5,860	0	5,860
Water (million gallons per year)	1,807	412	1,241	153	3.8–4.6	148–149

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; LANL = Los Alamos National Laboratory.

[a] Data from 2008 *LANL SWEIS*, Chapter 5, Table 5–83, for the No Action Alternative.

[b] Data from Tables 3.4.1-1, 3.4.2-1, 3.4.2-2, 3.4.3-1 of the *SWEIS Yearbook – 2008* (LA-UR-10-03439), with the exception of the Los Alamos County requirement for natural gas, which was calculated using the projected requirement for the No Action Alternative in the 2008 *LANL SWEIS* (Table 5–83) and data from Table 3.4.1-1 of the *SWEIS Yearbook – 2008*. In addition, adjustments were made to reflect higher usage associated with the Metropolis Complex and Material Disposal Area remediation activities as included in the Expanded Operations Alternative in the *LANL SWEIS* (selected in the associated Records of Decision) and exclusion of requirements associated with the 2003 CMRR Facility, as included in the No Action Alternative in the *LANL SWEIS*.

[c] Data from Table 4–15 of this supplemental environmental impact statement.

Note: To convert gallons to liters, multiply by 3.7854.

Source: DOE 2008b; LANL 2011.

Table 4–52 presents the estimated combined infrastructure requirements of operating the Modified CMRR-NF and RLUOB in addition to other LANL and non-LANL requirements during the same timeframe. Requirements to operate the Modified CMRR-NF are higher than those associated with operating either the existing CMR Building (under the Continued Use of CMR Building Alternative) or those estimated for the 2004 CMRR-NF (under the No Action Alternative). Should these projections be fully realized, LANL and Los Alamos County could cumulatively require 100 percent of the current electric peak load capacity, 67 percent of its total available electrical capacity, 92 percent of the available water capacity, and 28 percent of the available natural gas capacity. Of most concern is the potential to exceed electric peak load capacity. Regardless of the decisions to be made regarding the CMRR-NF, adding a third transmission line and/or reconductoring the existing two transmission lines are being studied by LANL to increase transmission line capacities up to 240 megawatts, providing additional capacity across the site. If the proposed TA-50 electrical substation is constructed, it would provide reliable additional electrical power as the independent power feed to the existing TA-55 complex and the CMRR Facility. LANL is also considering establishing an independent power feed to the existing TA-55 complex and the CMRR Facility from TA-3 along existing utility rights-of-way. If additional capacity and reliability can be added to the existing TA-3 substation, this would negate the need to build the proposed TA-50 substation.

Table 4–52 Estimated Combined Infrastructure Requirements at Los Alamos National Laboratory (Operations)

Resource	*System Capacity* [a]	*Current LANL Requirement* [b]	*Current Los Alamos County Requirement* [b]	*Available System Capacity*	*Modified CMRR-NF Alternative* [c]	*Remaining Capacity*
Electricity						
Energy (megawatt-hours per year)	1,314,000 [d]	563,000	150,000	601,000	161,000	440,000
Peak load demand (megawatts)	150 [d]	101	23	26	26	0
Natural Gas (million cubic feet per year)	8,070	1,200	1,020	5,860	58	5,800
Water (million gallons per year)	1,807	412	1,241	153	16	137

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; LANL = Los Alamos National Laboratory.

[a] Data from 2008 *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico (LANL SWEIS)*, Chapter 5, Table 5–83, for the No Action Alternative.

[b] Data from Tables 3.4.1-1, 3.4.2-1, 3.4.2-2, 3.4.3-1 of the *SWEIS Yearbook – 2008* (LA-UR-10-03439), with the exception of the Los Alamos County requirement for natural gas, which was calculated using the projected requirement for the No Action Alternative in the 2008 *LANL SWEIS* (Table 5–83) and data from Table 3.4.1-1 of the *SWEIS Yearbook – 2008.* In addition, adjustments were made to reflect higher usage associated with the Metropolis Complex and Material Disposal Area remediation activities as included in the Expanded Operations Alternative in the *LANL SWEIS* (selected in the associated Records of Decision) and exclusion of requirements associated with the 2003 CMRR Facility, as included in the No Action Alternative in the *LANL SWEIS.*

[c] Data from Table 4–17 of this supplemental environmental impact statement.

[d] Does not include addition of an electrical substation in TA-50 capable of providing up to another 40 megawatts peak load capacity.

Note: To convert gallons to liters, multiply by 3.7854.

Sources: DOE 2008b; LANL 2011.

Los Alamos County, as owner and operator of the Los Alamos Water Supply System, is now the primary water supplier serving LANL. DOE transferred ownership of 70 percent of its water rights to the county and leases the remaining 30 percent. LANL is currently using approximately 76 percent of its water allotment, and the county is using about 98 percent of its allotment. County concerns about its water availability will be heightened if development plans move forward for construction of additional homes in White Rock and Los Alamos on land that is being conveyed to the county from LANL.

Los Alamos County has implemented a "Conservation Plan for Water and Electricity" (LADPU 2010). In this plan, the county describes a number of steps it has taken to conserve water, including an effluent reuse washwater system associated with the county's wastewater treatment plant that is estimated to conserve approximately 12 million gallons (45 million liters) annually (LADPU 2010). Los Alamos County has the right to use up to 390 million gallons (1.5 billion liters) of San Juan-Chama Transmountain Diversion

Project water annually and is in the process of determining how best to make this water accessible to the county (LADPU 2010). Neither the conservation savings nor the San Juan-Chama water was included in the analysis shown above.

In addition, the use of the Sanitary Effluent Reclamation Facility at LANL may be expanded to include other areas of LANL. Plans are to expand the Sanitary Effluent Reclamation Facility to provide additional treatment to treated effluent from the Sanitary Wastewater Systems Plant to allow the reclaimed water to be used to support the water demands for the TA-3 Power Plant, the Metropolis Center for Modeling and Simulation, and the Laboratory Data Communications Center. Such expansions could save millions of gallons of water annually.

Sustainability—Concern for sustainability of resources is increasing in response to a variety of limiting factors. Not only is the Federal Government responding to this direction, but also state and local governments and private citizens. At every level, conservation and "green" practices and choices are taking hold to conserve natural resources by using them efficiently. DOE has responded to this by adopting policy and issuing directives that require the inclusion of sustainable principles in building design.

As described in Appendix B, Section B.2.3, LANL is responsible for meeting goals for conserving and reducing water and energy use on a site-wide effort. The *LANL Engineering Standards Manual* (ISD 341-2, Chapter 14), *Sustainable Design Guide* (2002) provides direction for energy- and water-efficient design and construction of new and renovated facilities. These closely mirror the principles and strategies embedded in achieving Leadership in Energy and Environmental Design® (LEED) certification under the various U.S. Green Building Council rating systems. Improved performance in new and existing facilities, decommissioning of older facilities, and improving the performance of existing infrastructure are all needed strategies to meet long-term goals for reduced consumption.

As part of its site-wide commitment to sustainability, LANL outlined goals and methods in the *Fiscal Year 2011 Site Sustainability Plan* (LANL 2010e) for managing energy and water needs and controlling its generation of greenhouse gases. The plan balances the need to provide for demands of its specialized nuclear facilities and evolving capabilities with those of achieving sustainability goals site-wide. Some planned projects are specifically aimed at improving supply infrastructure, such as the Sanitary Effluent Reclamation Facility and the planned addition of the electrical substation in TA-50. The plan identifies actions for providing onsite renewable energy systems, such as coordination with Los Alamos County to modify existing utility contracts to allow for purchasing of electricity from photovoltaic sources.

Other measures address pollution prevention and minimization of waste. Measures to achieve this are varied. For example, recommissioning existing heating, ventilating, and air conditioning systems ensure the systems are operating efficiently. Requiring high-performing, sustainable building standards in new construction and major renovations and reducing the footprint of heated space (through demolition of outdated and redundant facilities) will achieve a more-effective use of energy and reduce water use over the long term. Other projects would replace old, inefficient systems and equipment (such as the old steam plant). Bringing on Smart Grid technologies over the next 5 years would manage demand and energy flow, reducing the need to size systems for high peak demands. Implementation of a Sustainable Acquisition Plan and Energy Savings Performance Contracts will require vendors and contractors to provide products and services that meet sustainable criteria for environmentally preferable, non-ozone-depleting, recycled content and nontoxic materials, as well as energy efficiency. The benefits of these changes will take several years to fully realize and will depend on future funding.

The inclusion of LEED certification for new facilities (including the Modified CMRR-NF) is part of the larger effort to reduce energy intensity at LANL and to shift to sustainability. The Modified CMRR-NF incorporates these goals to the extent achievable while meeting other requirements for safety and security. The inclusion of energy- and water-efficient systems and design and the use of environmentally sound materials and construction practices would lessen the anticipated impact of this new facility on achieving site-wide sustainability compared to an equivalent standard facility without these measures.

Air Quality Impacts—The effect of expanded operations at the Modified CMRR-NF under the Modified CMRR-NF Alternative on air quality conditions at LANL would be equal to or higher than those estimated under the Continued Use of CMR Building Alternative because of the higher level of operations in the Modified CMRR-NF and the restrictions on the amount of materials and on operations in the CMR Building. The effect of the Modified CMRR-NF would be well within the levels of concentrations analyzed under the No Action Alternative in the *LANL SWEIS*, which were below the New Mexico Ambient Air Quality Standards and Federal standards for all of the criteria pollutants. As such, LANL would remain in compliance with all Federal and state ambient air quality standards, as shown in **Table 4–53.** Effects on air quality from associated construction and excavation activities would be temporary and localized, as discussed in the air quality sections of this chapter.

Table 4–53 Nonradiological Air Quality Concentration at Technical Area 55 Site Boundary – Operations

Criteria Pollutant	*Averaging Time*	*New Mexico Ambient Air Quality Standards (ppm)*	*Calculated Concentration (ppm)* [a]	*Maximum Facility-Wide Concentration (ppm)* [a]
Carbon monoxide	1 hour	13	0.027	1.2
	8 hours	8.7	0.060	0.22
Nitrogen dioxide	Annual	0.05	1.2×10^{-5}	0.00
Sulfur dioxide	3 hours [b]	0.5	0.10	0.20
	24 hours	0.1	0.01	0.04
	Annual	0.02	5.5×10^{-6}	0.00
PM_{10}	24 hours	150 μg/m^3	1.40 μg/m^3	102 μg/m^3
Total suspended particulates	24 hours	150 μg/m^3	2.4 μg/m^3	135 μg/m^3
	Annual	60 μg/m^3	0.00 μg/m^3	5.7 μg/m^3

μg/m^3 = micrograms per cubic meter; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; ppm = parts per million.

[a] The annual concentrations were analyzed at locations to which the public has access: the site boundary and nearby sensitive areas. Short-term concentrations were analyzed at the site boundary and at the fence line of the technical area to which the public has short-term access.

[b] New Mexico does not have a standard for sulfur dioxide 3-hour or PM_{10} 24-hour; thus, the Federal standard was used.

Source: DOE 2003a, 2008a.

Greenhouse Gas Impacts—The greenhouse gases emitted by operations at the Modified CMRR-NF and RLUOB would add a relatively small increment to emissions of these gases in the United States and the world. Overall greenhouse gas emissions in the United States during 2008 totaled about 7,775 million tons (7,053 million metric tons) of carbon-dioxide equivalent (DOE 2009b). By way of comparison, annual operational emissions of greenhouse gases from the Modified CMRR-NF and RLUOB would equal about 0.001 percent of the United States' total emissions in 2008. However, emissions from the proposed facility in combination with past and future emissions from all other sources would contribute incrementally to climate change. At present, there is no methodology that would allow DOE to estimate the specific impacts this increment of climate change would produce in the vicinity of the facility or elsewhere.

Ecological Resources Impacts—Most of the construction activities for the Modified CMRR-NF would take place on previously disturbed land with little value as habitat. There would be short-term impacts on non-protected species. Best management practices and implementation measures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000a) and supporting documentation would be used during construction activities across the site, including on those associated with the proposed Modified CMRR-NF site and its various support areas (laydown areas, batch plants, spoils areas, parking areas) to minimize the potential for adverse effects on plant and animal communities and on threatened and endangered or special interest species. Proposed construction sites and associated support areas would be surveyed for the presence of special status species, including threatened and endangered species, before construction begins, and appropriate actions would be developed. After construction, temporary structures would be removed and the sites would be regraded and revegetated with native species.

Public and Occupational Health and Safety – Normal Operations Impacts—**Table 4–54** presents the estimated cumulative impacts of radiological emissions and radiation exposure under the 2008 *LANL SWEIS* Expanded Operations Alternative (DOE 2008a), the doses associated with operation of the Modified CMRR-NF and RLUOB under the Modified CMRR-NF Alternative of this SEIS, plus doses associated with the disposal of greater-than-Class C waste at LANL. The estimated doses under the *LANL SWEIS* Expanded Operations Alternative, which reflects the highest level of operations that would be expected to occur at LANL, represent a conservative estimate of the doses that could result from ongoing LANL activities because they include doses associated with the continued operation of the Los Alamos Neutron Science Center (LANSCE) and ongoing remediation of MDAs at LANL. Operation of LANSCE is the predominant contributor to offsite dose to the population surrounding LANL. Remediation of MDAs at LANL is the predominant contributor to worker dose.

Table 4–54 Estimated Cumulative Radiological Impacts from Normal Operations

	Maximally Exposed Individual		*Population Within 50 Miles (80 kilometers)*		*Site Workers*	
	Dose (millirem per year)	***LCF Risk per Year***	***Collective Dose (person-rem per year)***	***Excess LCFs per Year***	***Collective Dose (person-rem per year)***	***Excess LCFs per Year***
LANL SWEIS Expanded Operations Alternative	8.2	4.9×10^{-6}	36	0.022	543	0.33
Modified CMRR-NF Alternative	0.31	1.9×10^{-7}	1.8	0.001	Included above	Included above
GTCC EIS	N/A	N/A	N/A	N/A	5	0.003
Total LANL Dose	8.5	5.1×10^{-6}	37.8	0.023	548	0.33

CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; LCF = latent cancer fatality; N/A = not available.
Source: DOE 2008a, 2011b.

The Modified CMRR-NF Alternative impacts are expected to be about equal to those that would have been realized from operation of the 2004 CMRR-NF and greater than those associated with continued operation of the CMR Building due to reduced operations at that building. In addition, the *LANL SWEIS* totals include operation of the CMRR Facility, and this analysis does not make any adjustment for a reduction in dose that would be realized when the existing CMR Building is completely shut down. Beyond activities at LANL, no other activities in the area surrounding LANL are expected to result in radiological impacts on the public beside those associated with natural background radiation and other background radiation, as discussed in Chapter 3, Section 3.11.1. The projected dose from continued LANL operations is a small fraction of the dose persons living near LANL receive annually from natural background radiation and other sources such as diagnostic x-rays.

No LCFs are expected for the MEI or the general population. The dose to the offsite MEI is expected to remain within the 10-millirem-per-year limit required by 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities." There would be a small increase in the annual risk of an LCF among the general public from LANL operations: from 1 chance in 45 to 1 chance in 43.

If the Expanded Operations Alternative MDA Removal Option were implemented, collective worker doses would average approximately 540 person-rem per year. The addition of impacts from the operation of the Modified CMRR-NF and RLUOB would not change this estimate because the worker dose of approximately 61 person-rem per year was included in the estimate in the 2008 *LANL SWEIS* (DOE 2008a). The 540 person-rem projected dose under the Expanded Operations Alternative in the *LANL SWEIS* corresponds to an annual risk of an LCF in the worker population of 0.3 (or for each 3 years of operation, 1 chance of an LCF in the worker population). Worker doses would decrease by about 140 person-rem per year after the MDA remediation work is completed (DOE 2008a). Inclusion of the *GTCC EIS* (DOE 2011b) estimate for work at LANL, should that alternative be chosen, would add about 5 person-rem per year, but would not increase the annual risk to workers appreciably. Individual worker doses would be maintained as low as is reasonably achievable and within applicable regulatory limits.

The estimated doses shown in Table 4–54 are a very small fraction of the normal background dose received by the population in and around LANL. Chapter 3, Section 3.11.1, of this *CMRR-NF SEIS* provides an analysis of radiation in the environment around LANL that is attributed to external, naturally occurring radiation and radiation from past and present operations at LANL. Natural background radiation was estimated to range from approximately 340 to 580 millirem per year, compared to the estimated doses from LANL operations of 8.5 millirem per year to the MEI and less than 0.1 millirem per year to the average individual living within 50 miles (80 kilometers) of LANL.

Waste Management Impacts—Cumulative amounts of waste generated at LANL would be greatest if the Expanded Operations Alternative described in the 2008 *LANL SWEIS* (DOE 2008a) is fully implemented. This alternative included substantial waste generation rates at LANL, largely due to remediation of MDAs and DD&D of facilities. **Table 4–55** presents the estimated annual amount of radioactive and nonradioactive waste that would be generated at LANL if the Modified CMRR-NF is constructed and DD&D of the existing CMR Building is performed. The Modified CMRR-NF Alternative waste generation rates are expected to be about equal to those that would have be realized from operation of the 2004 CMRR-NF and greater than those associated with continued operation of the CMR Building due to reduced operations at that building. Table 4–55 also includes the revised waste generation estimates associated with DD&D of the CMR Building (see Section 4.5.1).

The contribution to cumulative waste management impacts from other proposed actions at LANL, particularly the overall waste generation at LANL during the next 10 years from the disposition of buildings and environmental restoration efforts, could be large. Construction and demolition wastes would be recycled and reused to the extent practicable. Existing waste treatment and disposal facilities would be used according to specific waste types. The estimated waste generation totals for LANL have been adjusted to reflect the cancellation of the Global Nuclear Energy Partnership program, the decision not to build a Consolidated Nuclear Facility at LANL, and a reduction in the amount of waste associated with building pits at LANL. The Expanded Operations Alternative in the 2008 *LANL SWEIS* included waste associated with the production of 80 pits per year at LANL. NNSA decisions did not include this expansion of pit production at LANL so the waste associated with this expansion has been removed from the 2008 projection.

Table 4–55 Estimated Annual Cumulative Waste Generated at Los Alamos National Laboratory (cubic yards)

Waste Type	*LANL Operations* [a]	CMRR-NF SEIS *Modified CMRR-NF Alternative* [b]	*CMR Building DD&D* [c]	*Revised LANL Operations*
Expanded Operations Transuranic	530 to 3,300	88	38 to 75	570 to 1,030
Less Manufacturing of up to 80 Pits	0 to -250			
Less GNEP	0 to -900			
Less Consolidated Nuclear Facility	0 to -1,200			
Less earlier CMR Building Operations Estimate	-90			
Less earlier CMR Building DD&D Estimate	0			
Plus GTCC [d]	0			
Revised Total	440 to 870			
Low-level radioactive	27,700 to 141,400	2,640	9,500 to 19,000	33,000 to 137,000
Less Manufacturing of up to 80 Pits	0 to -410			
Less GNEP	0 to -3,400			
Less Consolidated Nuclear Facility	0 to -12,000			
Less earlier CMR Building Operations Estimate	-2,600			
Less earlier CMR Building DD&D Estimate	-4,000 to -8,000			
Plus GTCC [d]	5			
Revised Total	21,000 to 115,000			
Mixed low-level radioactive	390 to 18,300	26	70 to 140	420 to 18,300
Less Manufacturing of up to 80 Pits	0			
Less GNEP	0 to -4			
Less Consolidated Nuclear Facility	0 to -72			
Less earlier CMR Building Operations Estimate	-30			
Less earlier CMR Building DD&D Estimate	-38 to -75			
Plus GTCC [d]	0			
Revised Total	320 to 18,100			
Construction and Demolition Waste	64,000 to 72,000	2600	27,500 to 55,000	177,000 to 208,000
Less earlier CMR Building DD&D Estimate	-5,000 to -10,000			
Plus GTCC [d]	88,000			
Revised Total	147,000 to 150,000			
Chemical Waste (million pounds)	6.4 to 12.9	0.024	0.13	6.6 to 11.8
Less Consolidated Nuclear Facility	0 to -1.4			
Less earlier CMR Building Operations Estimate	-0.025			
Plus GTCC [d]	0.05			
Revised Total	6.4 to 11.5			

CMR = Chemistry and Metallurgy Research; CMRR-NF = Chemistry and Metallurgy Research Building Replacement Nuclear Facility; DD&D = decontamination, decommissioning, and demolition; GNEP = Global Nuclear Energy Partnership; GTCC = greater-than-Class C; LANL = Los Alamos National Laboratory.

[a] Data from Table 5–84 of the 2008 *LANL SWEIS* Expanded Operations Alternative divided by 10 to show annual rates, except GTCC.

[b] Data from Table 4–15 of this *CMRR-NF SEIS*, except GTCC.

[c] Data from Table 4–43 of this *CMRR-NF SEIS*, except GTCC. Work to be done over a 2- to 4-year period.

[d] Highest annual data computed from information in Table 5.3.11–1 of the *GTCC EIS* (DOE 2011b).

Source: DOE 2008a; LANL 2011.

Transuranic wastes generated during DD&D of the existing CMR Building would be within the level of impacts forecast under the Expanded Operations Alternative described in the 2008 *LANL SWEIS*. The available capacity of WIPP, or the new capacity of its replacement facility, is expected to be sufficient to accommodate the estimated cumulative volumes of transuranic waste from LANL operations (DOE 2008a). After the adjustments discussed above, site-wide waste projections would be higher for construction and demolition waste than those estimated under the Expanded Operations Alternative in the 2008 *LANL SWEIS* (DOE 2008a) due to the increased waste estimates for DD&D of the existing CMR Building. As described in the 2008 *LANL SWEIS*, low-level radioactive waste generation rates would be substantial under the Expanded Operations Alternative if all waste from MDAs were removed. Offsite disposal options for most of the low-level radioactive waste at LANL include NNSA's NNSS and commercial facilities (LANL 2008a). Mixed low-level radioactive waste generation is also projected to potentially increase, but the quantity would be much smaller than the quantity of low-level radioactive waste generated. Mixed low-level radioactive waste may be sent off site for treatment of the hazardous component and possibly returned to LANL (or elsewhere) for disposal as low-level radioactive waste. For commercial facilities, some restrictions apply to acceptance of waste based on the origin (state of origin and DOE- or non-DOE-generated) and radiological characteristics of the waste.

Significant quantities of nonradioactive solid wastes, including construction and demolition debris, would be generated under the Expanded Operations Alternative if all wastes were removed from MDAs. Demolition of the CMR Building would increase the lower and upper bounds of this estimate based on the latest projections for the amount of this waste that may be generated during the demolition period. Construction of the Borehole Alternative for disposal of greater-than-class C waste at LANL would also increase the generation of solid waste at LANL, should this alternative be implemented. The closure of the Los Alamos County Landfill means that solid wastes would be disposed of via the Los Alamos County Eco Station, where wastes would be segregated and then transported to an appropriately permitted solid waste landfill. Construction and demolition wastes would be recycled and reused to the extent practicable. Debris that cannot be recycled would be disposed of at solid waste landfills or construction and demolition debris landfills.

Radioactive Material Transportation Impacts—The collective doses, cumulative health effects, and traffic fatalities resulting from approximately 130 years (from 1943 to 2073) of radioactive material and waste transport across the United States were estimated in Table 5–85 of the 2008 *LANL SWEIS*[20] (DOE 2008a). The total collective worker doses from all types of shipments (general transportation, historical DOE shipments, reasonably foreseeable actions, and shipments under the 2008 *LANL SWEIS* No Action Alternative) were estimated to be 381,700 person-rem. The total collective doses to the general public were estimated to be 343,680 person-rem, which would result in about 206 excess LCFs among the affected general population. The total estimated traffic fatalities associated with accidents involving radioactive material and waste transports would be up to 119. The majority of the collective doses for workers and the general population would be associated with the general transportation of radioactive material. Examples of these activities include shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level radioactive waste to commercial disposal facilities. The majority of the traffic fatalities would be due to the general transportation of radioactive materials (28 fatalities) and reasonably foreseeable actions (85 fatalities). The estimated doses associated with radioactive material transportation associated with the Modified CMRR-NF under any of the alternatives being considered in this SEIS, and as described in Section 4.3.13, would not change these estimates.

4.7 Mitigation

Following the issuance of a ROD, NNSA is required to prepare a mitigation action plan that addresses any mitigation commitments expressed in the ROD (10 CFR 1021.331). The mitigation action plan would explain how certain measures would be planned and implemented to mitigate any adverse environmental impacts identified in the ROD. The mitigation action plan would be prepared before NNSA would take any action requiring mitigation.

Based on the analyses of the environmental consequences resulting from the proposed action, no mitigation measures would be necessary for many of the resource areas because the potential environmental impacts would be well below acceptable levels of promulgated standards. Activities would follow standard procedures for minimizing construction impacts on air and surface-water quality, noise, operational and public health and safety, and accident prevention. These practices are required by Federal and state licensing and permitting requirements, as discussed in Chapter 5. The 2008 *LANL SWEIS* (DOE 2008a)

[20] *Included in these estimates for LANL were shipments associated with the CMR Building and the CMRR Project.*

provides a discussion of existing programs and controls at LANL that ensure that construction activities and operations are performed within the constraints of applicable regulations, applicable DOE orders, contractual requirements, and approved policies and procedures. Examples of these programs and controls include the Environmental Surveillance and Compliance Program, the *Threatened and Endangered Species Habitat Management Plan*, the *Cultural Heritage Management Plan*, the NPDES Industrial Stormwater Permit Program, and the Groundwater Protection Management Program.

Public comments indicated concern about water usage and construction traffic. The following paragraphs discuss possible mitigation actions for these, as well as electrical usage.

Although projections indicate that LANL operational demands would remain within the site's annual water use ceiling quantity, total water demand within LANL and Los Alamos County is approaching 92 percent of the county-managed rights to withdraw water from the regional aquifer. Water reduction goals at LANL include reducing the use of potable water by at least 16 percent of the 2007 level by fiscal year 2015. Executive Order 13514 requires a 26 percent reduction in potable water by fiscal year 2020, as well as a 20 percent reduction in industrial, landscaping, and agricultural water use by fiscal year 2020 from a fiscal year 2010 baseline. In light of these goals, the CMRR Project is investigating the use of treated effluent water in construction activities.

With the additional projected demands of the Modified CMRR-NF, peak electrical power demand would be at the current capacity. Independent of a decision on the CMRR-NF, adding a third transmission line and/or reconductoring two existing lines to increase transmission capacity to LANL and Los Alamos County are being studied. One or both of these actions, plus construction of the proposed TA-50 substation or providing another power feed from the TA-3 substation, would add the capacity to meet the peak power demand.

Construction of the Modified CMRR-NF would affect both traffic on the roads around LANL and on site. There would be up to 790 construction workers during the peak construction period under both options of the Modified CMRR-NF Alternative. Under this alternative, construction workers would park their personal vehicles in a parking lot to be built in TA-72 and would be shuttled by bus to the construction site. Scheduling work shifts and transportation of construction materials to off-peak times may alleviate traffic congestion if that becomes a problem. In addition, lighting in the parking lot could be turned off at night when not required by workers to mitigate light impacts on nearby areas.

4.8 Resource Commitments

This section describes the unavoidable, adverse environmental impacts that could result from the proposed action; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity; and irreversible and irretrievable commitments of resources. Unavoidable, adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures. The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity addresses issues associated with the condition and maintenance of existing environmental resources used to support the proposed action and the utility of these resources after their use. Resources that would be irreversibly and irretrievably committed are those that cannot be recovered or recycled and those that are consumed or reduced to unrecoverable forms.

4.8.1 Unavoidable, Adverse Environmental Impacts

Implementing the alternatives considered in this SEIS would result in unavoidable, adverse impacts on the human environment. In general, these impacts would come from incremental impacts attributed to the operations of either the existing CMR Building or a CMRR-NF at TA-55.

CMRR-NF and RLUOB operations at LANL would have minimal unavoidable, adverse impacts related to air emissions and greenhouse gas emissions. Air emissions would include various chemical or radiological constituents in the routine emissions typical of nuclear facility operations, although CMRR-NF and RLUOB activities would not release major emissions to the atmosphere at LANL. Air emissions at LANL would occur regardless of CMRR-NF and RLUOB activities. These impacts have been addressed in various LANL NEPA documents. Overall air quality at LANL would not be changed by implementing any of the alternatives analyzed in this SEIS.

Operations at the existing CMR Building or the CMRR-NF at TA-55 would result in unavoidable radiation exposure to workers and the general public. Workers would be exposed to radiation and chemicals associated with analytical chemistry and materials characterization, uranium processing, actinide research, processing and fabrication, and metallography. The incremental annual dose contribution from operations at the existing CMR Building or the CMRR-NF at TA-55 to the offsite MEI, general population, and workers is discussed in Sections 4.2.10, 4.3.10, and 4.4.10.

The generation of radioactive and nonradioactive waste would be unavoidable. Any waste generated during operations would be collected, treated, stored, and eventually removed for suitable recycling or disposal in accordance with applicable EPA regulations.

The decontamination and decommissioning of the CMR Building would result in the one-time generation of radioactive and nonradioactive waste material that could affect storage requirements. This would be an unavoidable impact on the amount of available and anticipated storage space and the requirements of disposal facilities at LANL or off site.

Temporary construction impacts associated with the construction of the CMRR-NF at TA-55 would also be unavoidable. These impacts would include the generation of fugitive dust; noise; associated greenhouse gases; increased construction vehicle and worker traffic; temporary disruption of habitat for non-protected species; and the use of resources, including land, mineral, and energy resources.

4.8.2 Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Implementation of any of the proposed alternatives, including the No Action Alternative, would cause short-term commitments of resources and would permanently commit certain resources (such as energy). Under each alternative, the short-term use of resources would result in potential long-term benefits to the environment and the enhancement of long-term productivity by decreasing overall health risks to workers, the public, and the surrounding environment by reducing their exposure to hazardous and radioactive substances.

Under the proposed action, overall CMRR-NF and RLUOB operations would not change from those operations described in the 2008 *LANL SWEIS* (DOE 2008a) for the existing CMR Building. The short-term use and commitment of environmental resources under the No Action and Modified CMRR-NF Alternatives would include the use of space and materials required to construct the new building, the commitment of new operations support facilities, transportation, and use of other consumable resources and materials for CMR operations. Workers, the public, and the environment would be exposed to increased amounts of hazardous and radioactive materials over the short term from the relocation of CMR Building operations under these alternatives and the associated materials, including process emissions and the handling of waste from equipment refurbishment.

Regardless of the alternative selected, air emissions associated with either the existing CMR Building or the CMRR-NF and RLUOB would introduce small amounts of radiological and nonradiological constituents to the air of the regions around LANL. These emissions would result in additional air pollutants and exposure, but would not impact compliance with air quality or radiation exposure standards at LANL. There would be no significant residual environmental effects on long-term environmental viability.

The management and disposal of sanitary solid waste and nonrecyclable radiological waste over the project's lifespan would require a small increase in energy and space at LANL treatment, storage, and disposal facilities or their replacement offsite disposal facilities. Regardless of the alternative selected, land required to meet the solid waste needs would require a long-term commitment of terrestrial resources.

Continued employment, expenditures, and tax revenues generated during the implementation of any of the alternatives would directly benefit the local, regional, and state economies over the short term. Long-term economic productivity could be facilitated by local governments investing project-generated tax revenues into infrastructure and other required services.

The short-term resources needed to construct and operate the CMRR-NF and RLUOB at LANL would not affect the long-term productivity of LANL. Workers, the public, and the environment could be exposed to increased amounts of hazardous and radioactive materials over the period of construction due to relocation of materials, including process emissions, and handling of radioactive waste.

4.8.3 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources under each alternative potentially would include land, mineral, and energy resources during the lifespan of the project and the energy and water used during operations.

Energy expended would be in the form of fuel for equipment and vehicles, electricity for facility operations and construction (under some alternatives), and human labor. CMRR-NF construction and CMRR-NF or CMR Building and RLUOB operations would generate nonrecyclable waste streams, such as radioactive and nonradioactive solid waste and some wastewater. Construction of CMRR-NF would consume large quantities of construction materials such as steel, sand, gravel, flyash, and cement. However, certain materials and equipment used during construction and operations could be recycled.

Land would be used for both the construction of a new facility and the disposal of hazardous and radioactive waste. The commitment of land for the new facility is discussed in Sections 4.2.1, 4.3.1, and 4.4.1.