CHAPTER 5
ENVIRONMENTAL CONSEQUENCES

5.0 ENVIRONMENTAL CONSEQUENCES

The following sections evaluate the environmental consequences of proposed Los Alamos National Laboratory (LANL) construction and operations on the surrounding region. The impact on each resource area is evaluated for the three proposed alternatives: the No Action Alternative, Reduced Operations Alternative, and Expanded Operations Alternative. In addition, the analysis looks at the cumulative impacts of these alternatives when combined with other past, present, and future actions that could affect the region. As applicable, possible mitigation measures are discussed with regard to implementing one of the proposed alternatives.

As described in earlier chapters, changes have occurred or are expected to take place at LANL that were not anticipated at the time the 1999 *Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (*1999 SWEIS)* was issued together with the Record of Decision (ROD). Such changes include alteration of the physical environment, as well as changes to LANL's operations and capabilities. The Cerro Grande Fire of 2000 resulted in changes to the physical environment in the form of burned habitat, damaged or destroyed structures, and potential for significant runoff and erosion. Another change to the physical environment is the past and planned conveyance of certain lands to Los Alamos County and the transfer of land to the U.S. Department of the Interior (to be held in trust for the San Ildefonso Pueblo) that, in effect, alters the site boundaries and removes from National Nuclear Security Administration (NNSA) stewardship the ecological and cultural resources included in those lands.

Included in the analysis supporting this new Site-Wide Environmental Impact Statement (SWEIS) are the impacts associated with manufacturing plutonium pits at LANL. Under the No Action and Reduced Operations Alternatives, the analysis includes the impacts associated with manufacturing up to 20 pits per year in existing facilities in the Plutonium Facility Complex (Technical Area [TA-] 55). The Expanded Operations Alternative includes the impacts associated with manufacturing up to 80 pits per year in TA-55. Manufacturing pits in TA-55 at any of the levels discussed above is not expected to have a distinguishable effect on a number of resource areas evaluated in this SWEIS. The different levels of pit manufacturing activities in TA-55 would likely cause only minor differences in impacts on land use, visual resources, water resources, geology and soils, air quality, noise, ecological resources, public health, cultural resources, and infrastructure. Depending on the alternative chosen, larger impacts to worker health, socioeconomics, waste management, and transportation would be expected.

The analysis also includes the impacts associated with the remediation of material disposal areas (MDAs) and other potential release sites (PRSs). For several years, the LANL management and operating contractor has conducted an environmental restoration program to identify locations where hazardous constituents may have been released into the environment and to carry out corrective measures in compliance with the Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA). Since 1990, investigations and corrective actions have been carried out in accordance with the LANL Hazardous Waste Facility permit. The Compliance Order on Consent (Consent Order) entered into by the U.S. Department of

Energy (DOE), the University of California as the management and operating contractor, and the State of New Mexico requires a more specific program of studies and corrective measures and that cleanup be completed by 2015. The impacts of implementing the investigations and remediations under the Consent Order are presented as part of the Expanded Operations Alternative. Two scenarios for environmental restoration have been evaluated to bound the range of possible consequences of implementing corrective measures required by the Consent Order. A Capping Option, a Removal Option, and a No Action Option are assumed and evaluated in Appendix I of this SWEIS. The No Action Option is the base case in which remedial investigations and activities would continue at a level comparable to that of recent years, and this option is part of the No Action and Reduced Operations Alternatives[1]. The Capping Option reflects the assumption that the waste and contamination within the MDAs would be left in place and stabilized by installation of evapotranspiration caps as a mitigation measure. The Removal Option reflects the assumption that the waste and contamination within the MDAs would be removed. For both the Capping and Removal Options, several additional PRSs would be remediated annually. These options are intended to bound the range of possible corrective measures and are included in the Expanded Operations Alternative.

As changes in the operations and capabilities active at LANL could change the releases to the environment and the impacts of potential accidents, they are factored into the analyses presented below. In addition to changes in LANL operations and the environment, new projects or ongoing projects to maintain existing LANL capabilities are also evaluated for environmental impacts. The impacts of these individual projects are detailed in Appendices G through J and are discussed in this chapter as appropriate. These projects are generally included as part of the Expanded Operations Alternative.

5.1 Land Resources Impacts

This section addresses the impacts of the No Action, Reduced Operations, and Expanded Operations Alternatives on Land Use and Visual Resources. **Table 5–1** summarizes the expected land use impacts for each of the three alternatives.

5.1.1 Land Use

Land use is defined as, “The way land is developed and used in terms of the kinds of anthropogenic activities that occur (for example, agriculture, residential areas, industrial areas)” (EPA 2003). A comparative methodology was used to determine impacts to land use at LANL. Construction, building modification, operations, and demolition activities associated with each alternative were examined, as appropriate, and compared to existing land use conditions and future land use projections. Impacts were identified as they relate to changes in land use categories, ownership, and alternative or conflicting uses.

[1] *NNSA intends to implement actions necessary to comply with the Consent Order regardless of decisions it makes on other actions analyzed in this SWEIS.*

Table 5–1 Summary of Environmental Consequences of Land Use Changes

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Conveyance and Transfer – 1,820 acres (737 hectares) remain to be conveyed or transferred. – Development could occur on up to 826 acres (334 hectares). – Potential introduction of incompatible land uses. – Loss of recreational opportunities. *Electrical Power System Upgrades* – 473 acres (191 hectares) affected by upgrades. – Project generally compatible with existing land use, but some constraint on high explosives testing and future experimental use within part of LANL. *Wildfire Hazard Reduction Program* – No impact *Disposition of Flood Retention Structures* – No impact	Same as No Action Alternative	Same as No Action Alternative plus: *MDA Remediation Project* – Fewer restrictions on land use for the Removal Option than for the Capping Option. – No major changes in land use designations in most cases because surrounding land uses would remain in their current classification; however, some land use changes possible. *Security-Driven Transportation Modifications Project* – Most development would not conflict with current land use designations. – Auxiliary Action A – Within scope of current land use plans. – Auxiliary Action B – Partially within scope of current land use plans; however, plans have no provision for a bridge over Sandia Canyon.
Affected Technical Areas			
TA-3	No change in land use	Same as No Action Alternative	*Replacement Office Buildings Project* – 13 acres (5.3 hectares) of undisturbed land would be developed. – Development would be consistent with a change in future land use from Reserve to Physical/Technical Support.
TA-21	No change in land use	Same as No Action Alternative	*TA-21 Structure DD&D Project* – Future LANL development could negate the proposed change in land use from the current designation to Reserve.
TA-72	No change in land use	Same as No Action Alternative	*Remote Warehouse and Truck Inspection Station* – Construction would affect 4 acres (1.6 hectares) of undisturbed land. – Land use designation would change from Reserve to Physical/Technical Support.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Key Facilities			
Pajarito Site (TA-18)	No change in land use	Same as No Action Alternative	*TA-18 DD&D* Land use could change from Nuclear Material Research and Development to Reserve.
Radiochemistry Facility (TA-48)	No change in land use	Same as No Action Alternative	*Radiological Sciences Institute* – 12.6 acres (5.1 hectares) of undeveloped land to be developed. – Land use change is consistent with future land use designations.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in land use	Same as No Action Alternative	*Radioactive Liquid Waste Treatment Facility Upgrade* – Construction of new liquid waste management buildings would not result in a change in land use. – New evaporation tanks, if built, would likely result in a change in land use designation from Reserve to Waste Management. – Construction would affect up to 5.4 acres (2.2 hectares) of undeveloped land.
Solid Radioactive and Chemical Waste Facilities (TA-54 and Generic Site)	No change in land use	Same as No Action Alternative	*Waste Management Facilities Transition* – No change in land use within TA-54 – Construction of the TRU (Transuranic) Waste Facility could affect up to 7 acres (2.8 hectares) of undeveloped land and could result in a change in land use designation.
Bioscience Facilities	No change in land use	Same as No Action Alternative	*Science Complex* – Construction would affect 5 acres (2 hectares) of undeveloped land. – For Options 1 and 2, development would be consistent with a change in future land use from Reserve to Experimental Science. – For Option 3 there would be no change in land use designation.

MDA = material disposal area; TA = technical area; DD&D = decontamination, decommissioning, and demolition.

5.1.1.1 No Action Alternative

The No Action Alternative is discussed in terms of the existing environment as it relates to land use; actions that DOE has decided upon, but has not fully implemented; and the results of National Environmental Policy Act (NEPA) compliance reviews issued since the *1999 SWEIS*. Impacts on land use are described in terms of projects that affect the site as a whole and those that affect only specific TAs. Key Facilities are addressed separately. Only those projects that have been evaluated via their respective environmental analyses to have an impact on land use are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

Since issuance of the *1999 SWEIS* ROD, NEPA documentation has been prepared for two projects that are being implemented and have potential impacts on land use across a number of TAs: (1) conveyance and transfer of land under Public Law 105-119, and (2) proposed electrical power system upgrades (DOE 1999a, 1999d, 2000a).

Conveyance and transfer of land from DOE to Los Alamos County and the U.S. Department of the Interior to be held in trust for the Pueblo of San Ildefonso began in 2002. At the end of 2006, 2,259 acres (914 hectares) had been turned over (see Chapter 4, Section 4.1.1). To meet the requirements of Public Law 105-119, Section 632 and the extension mandated in the Defense Authorization Act, the remaining acreage (1,820 acres [737 hectares]) may be turned over by 2012. The direct impact of the conveyance and transfer process on land use is a reduction in the land area of LANL to its present size of about 25,600 acres (10,360 hectares). Indirect impacts (impacts resulting from actions undertaken by the recipients after conveyance and transfer of the tracts) include possible development or redevelopment of up to 826 acres (334 hectares), potential introduction of land uses that would be incompatible with adjacent land owners' resource protection efforts, and loss of recreational opportunities on some tracts (DOE 1999d).

Although the electrical power system upgrades are not expected to have a major effect on existing land uses, they would affect up to 473 acres (191 hectares) and be 19.5 miles (31 kilometers) in length. In general, project-related activities would traverse the southwestern portion of LANL, entering the site from the east at TA-70 and proceeding northwest through portions of White Rock, Water and Pajarito Canyons, and terminating at TA-69. Construction and operations activities have been determined to be consistent and compatible with all existing land uses along the project's route, and these land uses would likely continue. Several minor impacts are possible, however, including short-term impacts on cattle grazing and recreational use during construction on one segment that is outside of LANL and potentially adverse effects on existing or future high explosives testing within LANL. Additionally, the project could provide a minimal constraint of activities within the Dynamic Testing Area and Twomile Mesa South in areas designated for future experimental use, because development could not occur within the power line right-of-way (DOE 2000a).

Management of construction fill, another activity affecting multiple TAs, would not be expected to have an effect on existing land uses. Construction fill would be stored in existing borrow areas at TA-16 or TA-61.

5.1.1.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide and Technical Area Impacts

Under the Reduced Operations Alternative, the same impacts on land use resulting from actions addressed under the No Action Alternative (see Section 5.1.1.1) would occur. None of the actions proposed under the Reduced Operations Alternative that differ from those proposed under the No Action Alternative would impact land use.

5.1.1.3 Expanded Operations Alternative

The Expanded Operations Alternative reflects proposals that would expand the overall operations levels at LANL beyond those established for the No Action Alternative (which also would take place). As such, the Expanded Operations Alternative includes a number of new projects that potentially could impact land use at LANL. Not all new projects would affect land use; many would involve actions within or modifications to existing structures or construction of new facilities within previously developed areas of LANL. Only those proposed projects that would impact land use are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, two proposed projects could impact land use across a number of TAs at LANL: (1) MDA Remediation and (2) the Security-Driven Transportation Modifications Project. A detailed analysis of each of these two actions is presented in Appendices I and J, respectively.

Action options for remediation of MDAs include capping or removal. Remedies for MDAs subject to the March 2005 Consent Order would be recommended by LANL, but decisions would be made by the New Mexico Environment Department. Decisions on actions would be implemented on an MDA-by-MDA basis and could involve a combination of partial removal and capping (a hybrid action for the purposes of this analysis). Because the Capping Option would stabilize rather than remove existing contaminants, future use of MDAs would remain restricted. At present, most MDAs are open areas that are fenced and excluded from any use other than safely maintaining inventories of waste. In the future, MDAs would have to be surveyed and maintained to protect public health and safety and the environment. Under the Removal Option, there would be fewer restrictions on land use than under the Capping Option. Complete removal of waste and contamination from MDAs could free up to roughly 110 acres (45 hectares) for purposes other than use as an exclusion area for storing radioactive waste. This would not mean, however, that major changes would occur in the designated land use of the TAs containing the MDAs. The extent of removal would depend on information obtained from the program and on regulatory decisions.

The investigation and remediation program for MDA B would remove waste and contamination. Alternative uses of this portion of TA-21 may be possible. Opportunities for different uses of some lands may arise following PRS remediation. This would depend on the corrective measure required by the New Mexico Environment Department and implemented by the LANL

management and operating contractor, as well as the overall mission of the TA containing the PRS. Under a hybrid action, land use generally would be similar to that for the Capping Option.

Security-driven transportation modifications in the Pajarito Corridor West would require construction of two parking lots or structures (in TA-48 and TA-63), a new two-lane road along the east edge of TA-63, new auto and pedestrian crossings connecting TA-63 and TA-35, and a road through the northern edge of TA-35. While this alternative would affect future land use by developing currently undeveloped portions of the Pajarito Corridor West, all construction, except the pedestrian walkway, would take place within areas designated either for Development or for Infill. Thus, this alternative generally would be compatible with the land use plans for the Pajarito Corridor West outlined in the *Comprehensive Site Plan 2001* (LANL 2001c).

Auxiliary Action A for the Security-Driven Transportation Modifications Project involves construction of a two-lane bridge within a 1,000-foot (300-meter)-wide corridor across Mortandad Canyon and a new two-lane road from the north end of the new bridge westward through TA-60 to connect TA-35 with TA-3. These actions are within the scope of the land use plans described in the *Comprehensive Site Plan 2001*. Auxiliary Action B involves construction of a second new two-lane bridge within a 1,000-foot (300-meter)-wide corridor across Sandia Canyon, as well as a new two-lane road from the new bridge to connect with East Jemez Road. Although the terminus of the bridge and the new road to East Jemez Road would be within an area designated as Primary Development in the *Comprehensive Site Plan 2001*, there is no provision in the plan for a bridge corridor over Sandia Canyon, as there is for the bridge over Mortandad Canyon. Thus, construction of a bridge corridor over Sandia Canyon would represent a departure from the current site development plan; however, the *2000 Comprehensive Site Plan* did address the concept of a future road over the canyon (LANL 2000a, 2001c).

Technical Area Impacts

Three projects are proposed that could impact land use within TA-3, TA-21, and TA-72. The impacts described below are from project-specific analyses in Appendices G and H.

Technical Area 3

Construction of the Replacement Office Buildings at TA-3 would require 13 acres (5.3 hectares) of undeveloped land that is presently designated as Reserve. Additional acreage would be required within recently disturbed portions of the TA that are classified as Physical/Technical Support. The future land use proposal calls for the Reserve area to be redesignated as Physical/Technical Support.

Technical Area 21

Following decontamination and demolition of its buildings and structures, a 7.6-acre (3.0-hectare) parcel in the western portion of TA-21 was conveyed to Los Alamos County. In the future, it is likely that this area could be used for commercial or industrial purposes. The eastern portion of TA-21 would remain a part of LANL for the foreseeable future. Portions of the eastern parcel, however, are being considered as brownfield sites for potential reuse. Future land use proposals call for this area to be redesignated from Waste Management, Service/Support, and

Nuclear Materials Research and Development to Reserve; however, redevelopment could negate this change in designation (see Appendix H).

Technical Area 72

Construction of the Remote Warehouse and Truck Inspection Station along the south side of East Jemez Road would require clearing about 4 acres (1.6 hectares) of land. As current and future land use within the site area is designated as Reserve, development of the site would change the land use designation from Reserve to Physical/Technical Support.

Key Facilities Impacts

Five projects that could impact land use at LANL Key Facilities are proposed as part of the Expanded Operations Alternative. The impacts described below are from project-specific analyses in Appendices G and H.

Pajarito Site

Decontamination, decommissioning, and demolition (DD&D) of TA-18 buildings and structures would change the overall land use designation of the TA because the site would not be used for other LANL development purposes. The land use designation of the site would change from Nuclear Material Research and Development to Reserve.

Radiochemistry Facility

Construction of the Radiological Sciences Institute would require about 33.6 acres (13.6 hectares) of land, mainly within TA-48, as well as a small part of TA-55, of which about 12.6 acres (5.1 hectares) are currently undeveloped. Development would require some areas that are currently designated Reserve and Experimental Science to be redesignated as Nuclear Materials Research and Development; however, this is consistent with future land use concepts because TA-48 is within the Pajarito Corridor West Development Area. Construction of the Radiological Sciences Institute would take place in areas designated as Primary Development, Proposed Parking, and Potential Infill.

Radioactive Liquid Waste Treatment Facility

Construction of the new liquid waste management buildings would occur in a developed area of TA-50 and would not change the TA's current or future land use designation as Waste Management. If the evaporation tanks, which could occupy up to 4 acres (1.6 hectares) of land, were constructed near the border of TA-52 and TA-5, the land use designation for the tank areas and a portion of the pipeline route (1.4 acres [0.6 hectares]) would likely change from Reserve to Waste Management.

Solid Radioactive and Chemical Waste Facilities

While activities taking place within TA-54, including some new construction and removal of the domes, would not change the existing land use designation within the TA, construction of the TRU Waste Facility (previously called the Transuranic Waste Consolidation Facility) in an as-yet

identified location in the Pajarito Road corridor could impact land use. The greatest potential impact to land use would occur at a generic site that is presently not developed. With the exception of TA-54 West, all generic sites are undeveloped; thus, up to 7 acres (2.8 hectares) of land would be disturbed. Construction of the TRU Waste Facility would change the present land use category to Waste Management at all generic sites except at TA-63. However, all generic sites have been determined to be suitable for future development because they have been designated in the *Comprehensive Site Plan 2001* (LANL 2001c) as Primary Development, Secondary Development, or Potential Infill.

Biosciences Facilities

Under Option 1, the Northwest TA-62 Site Option, a site located to the west of TA-3 would be used for construction of the Science Complex. Land use within this site area is currently designated as Reserve, and this is not predicted to change in the future (LANL 2003h). Construction of the Science Complex, however, would disturb 5 acres (2 hectares) of undeveloped land and would change the site area's future land use designation from Reserve to Experimental Science. Option 2, the Research Park Option, would also change the site area's future land use designation from Reserve to Experimental Science. Option 3, the South TA-3 Site Option, would locate the facility in an area presently occupied by a parking lot and would result in no change to its land use designation.

5.1.2 Visual Environment Impacts

Visual resources are natural and manmade features that give a particular landscape its character and aesthetic quality. A comparative analysis of the impacts to visual resources was performed, consisting of a qualitative examination of potential changes in the visual environment. Aspects of visual modification examined included site development, building modification, and demolition, as appropriate. Each of these activities could alter the appearance of LANL structures or obscure views of the surrounding landscape, result in changes in surrounding land cover that could make structures more or less visible, and cause light pollution that would alter the night sky. **Table 5–2** summarizes the expected impact on visual resources at LANL.

5.1.2.1 No Action Alternative

The visual environmental impacts of the No Action Alternative are related to the existing visual environment at LANL, including actions that DOE or NNSA has decided upon, but has not fully implemented, as well as the impacts identified by other NEPA compliance reviews issued since the *1999 SWEIS* ROD. Impacts to the visual environment are described in terms of those projects that affect the site as a whole and those that affect specific TAs. Key Facilities are addressed separately. Only those projects that have been evaluated in their respective environmental analyses to have an impact on the visual environment at LANL are addressed below.

Table 5–2 Summary of Environmental Consequences on the Visual Environment

Location	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
Site-Wide	*Land Conveyance and Transfer* – Development could degrade views of presently undeveloped tracts. *Electrical Power System Upgrades* – Short-term visual impacts during construction. – Adverse visual impact in undisturbed areas. – No overall change in view from Bandelier National Monument. *Wildfire Hazard Reduction Program* – Forest would appear more park-like. – Some LANL facilities would be more visible. *Disposition of Flood Retention Structures* – Temporary impacts if staging areas are located near Pajarito Road. – Overall, little impact because most disposition projects are not visible to the public.	Same as No Action Alternative	Same as No Action Alternative plus: *MDA Remediation Project* – Short-term visual impacts during MDA capping or removal and during remediation of other PRSs. – Temporary containment domes used under the MDA Removal Option. – Minor changes in distant views if MDAs are capped; would be maintained as open grassy areas. – Borrow pit in TA-61 would become more visible due to the large quantities of material needed. *Security-Driven Transportation Modifications Project* – Short-term impacts during construction. – Pronounced impacts due to roads, bridges, and parking lots, as well as vehicle and pedestrian bridges under auxiliary actions.
Affected Technical Areas			
TA-3	No change in impacts to visual resources	Same as No Action Alternative	*Physical Science Research Complex* – Short-term impacts during construction. – New structures would be of a unified design. – Demolition of vacated structures would improve the overall appearance of TA-3, TA-35, and TA-53. *Replacement Office Buildings Project* – Short-term impacts during construction. – New buildings and parking lot would be readily visible from West Jemez Road and Pajarito Road. – Impact of the project on distant views would be minimal.
TA-21	No change in impacts to visual resources	Same as No Action Alternative	*TA-21 Structure DD&D* – Enhancement of visual environment from removal of old structures. – Both conveyed and non-conveyed parcels could undergo development, which could change the visible environment.

Location	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
TA-72	No change in impacts to visual resources	Same as No Action Alternative	*Remote Warehouse and Truck Inspection Station* – Short-term impacts during construction. – 4 acres (1.6 hectares) would be cleared making the site readily visible from East Jemez Road. Lighting could be visible from the Tsankawi Unit of Bandelier National Monument.
Key Facilities			
Chemistry and Metallurgy Research Building (TA-3, TA-48, and TA-55)	– Temporary impacts during construction of replacement building. – Minimal visual impact to public from Pajarito Plateau rim and employees from Pajarito Road.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Processing Facilities (TA-16)	– Temporary impacts during construction of replacement or new buildings. – New structures of unified design. – Removal of old buildings would enhance visual environment.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Testing Facilities (TA-6, TA-22, and TA-40)	– Temporary impacts during construction of new buildings. – Minimal long-term impacts. – Removal of old buildings would enhance visual environment.	Same as No Action Alternative	Same as No Action Alternative
Pajarito Site DD&D (TA-18)	No change in impacts to visual resources	Same as No Action Alternative	*TA-18 DD&D* – Short-term impact from demolition. – Long-term positive impact as area is restored to more natural appearance.
Radiochemistry Facility (TA-48)	No change in impacts to visual resources	Same as No Action Alternative	*Radiological Sciences Institute* – Short-term impacts during demolition and construction. – Minimal visual impact to public from Pajarito Plateau rim and employees from Pajarito Road from new construction west of current buildings.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in impacts to visual resources	Same as No Action Alternative	*Radioactive Liquid Waste Treatment Facility Upgrade* – Short-term impact from construction of new treatment building in TA-50. – Permanent change to the visual environment if evaporation tanks are built near the border of TA-52 and TA-5.

Location	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in impacts to visual resources	Same as No Action Alternative	*Waste Management Facilities Transition* – Short-term impacts during construction. – Beneficial impact on near and distant views from removal of domes in TA-54. – Minimal visual impact of new TRU Waste Facility to public from Pajarito Plateau rim and employees from Pajarito Road. – Construction at generic sites within TA-51, TA-52, and TA-54 West would be visible from lands of the Pueblo of San Ildefonso.
Bioscience Facilities	No change in impacts to visual resources	Same as No Action Alternative	*Science Complex Project* – Short-term impacts during construction. – Under Options 1 and 2, the new facility would be readily visible from West Jemez Road and forested buffer between LANL and Los Alamos Canyon would be lost. – Potential impacts to Los Alamos Canyon from night lighting under Options 1 and 2. – Minimal impact under Option 3 because the new facility would be generally located within a developed part of TA-3.

MDA = material disposal area; PRS = potential release site; TA = technical area; DD&D = decontamination, decommissioning, and demolition.

Los Alamos National Laboratory Site-Wide Impacts

Conveyance of land to Los Alamos County, the New Mexico Department of Transportation, and transfer of land to the U.S. Department of the Interior (to be held in trust for the Pueblo of San Ildefonso) have been evaluated with respect to impacts on the visual environment. Most tracts would maintain their current level of visual aesthetic value after conveyance and transfer and any subsequent development, and the visual resources of some tracts could be improved by the removal and replacement of industrial buildings. The evaluation also determined, however, that commercial and residential development of currently undeveloped areas, such as the Rendija Canyon and White Rock Tracts, could degrade the local visual landscape. Overall, the reduction in visual quality was not found to be substantial on a regional scale (DOE 1999d).

The electrical power system upgrades were determined to affect the visual environment near the power line right-of-way both during and after construction. During construction, staging areas and equipment would cause short-term visual effects that would be out of character with the surrounding environment. Revegetation after construction, however, would return disturbed areas to a more natural condition. Analysis determined that, after construction, the power line would have two principal visual effects – selectively cleared corridors in wooded areas and visible pole structures and lines that would contrast with natural landforms. Because the corridors would be cleared selectively, no major swathes of devegetated areas would be visible. The finished power line would be most disruptive in areas where the surrounding land is undeveloped or where the contrast with the natural landscape is marked. The evaluation determined that electrical power system upgrades would not dramatically change the overall character of the view from the Bandelier National Monument Wilderness Area (DOE 2000a).

The Wildfire Hazard Reduction Program was found to have minimal effect on visual resources at LANL and in the surrounding area, given the degraded panoramas of the Pajarito Plateau and Jemez Mountains resulting from the Cerro Grande Fire. The primary aspect of the program that would affect visual resources is vegetation removal, which would occur as a result of selective thinning activities. The forest at LANL would become more natural as the diversity of shrubs, herbs, and grasses in the understory increased. Some facilities currently screened from casual view could become visible to viewers at various vantage points. The overall effect of the Wildfire Hazard Reduction Program would be to enhance the contrast between the background setting and LANL's industrial character (DOE 2000e).

Disposition of flood and sediment retention structures was determined to affect visual resources temporarily if the staging areas for the concrete removal were located near Pajarito Road. Actual demolition of the flood retention structure in Pajarito Canyon and the steel diversion wall upstream from TA-18 would occur in restricted areas that are not visible to the public. The low-head weir, located in Los Alamos Canyon, and the road reinforcements in Twomile Canyon, Pajarito Canyon, and Water Canyon would remain in place, with no change to visual resources (DOE 2002j).

Management of construction fill would not be expected to affect visual resources. Construction fill would be stored in existing borrow areas at TA-16 and TA-61.

Technical Area Impacts

No actions are contemplated under the No Action Alternative that would impact visual resources in terms of the TAs beyond the impacts related to Key Facilities, as discussed below.

Key Facilities Impacts

Since publication of the *1999 SWEIS*, NEPA compliance has been achieved for three currently active projects related to Key Facilities: construction of the Chemistry and Metallurgy Research Replacement Facility at TA-55, consolidation and refurbishment of the Weapons Manufacturing Support Facility at TA-16, and construction at the Dynamic Experimentation Complex at TA-6, TA-22, and TA-40. The impacts of these projects to visual resources are discussed below.

Chemistry and Metallurgy Research Replacement Building

Impacts to visual resources resulting from construction of the Chemistry and Metallurgy Research Replacement Facility at TA-55 were determined to be temporary in nature and include increased levels of dust and human activity. When complete, the general appearance of the new facility, which would include two buildings, would be consistent with other buildings located within TA-55. The Chemistry and Metallurgy Research Replacement Facility would be readily visible to LANL employees from Pajarito Road, and would be visible to the public from the upper reaches of the Pajarito Plateau rim (DOE 2003d). Future DD&D of the Chemistry and Metallurgy Research Building would likely result in a temporary park-like area once the site was revegetated. As infill building probably would occur later, no long-term visual change is likely because new construction would blend in with modern construction.

High Explosives Processing Facilities

Construction and demolition activities at the Weapons Manufacturing Support Facility at TA-16 would have some local short-term adverse effects and long-term beneficial effects on the viewscape. Short-term adverse visual effects would occur during the construction period. As the existing engineering complex is highly industrial in appearance, these effects would be minor. In the long term, the area would experience a beneficial effect because temporary buildings would be removed and newly built structures would be of a similar style. The visual effects of the new facilities would be confined to the immediate area of the current complex because the area generally is not visible from public roads. Demolition activities generally would result in the same local short-term adverse effects identified for the construction phase. Overall, the removal of buildings would enhance the visual characteristics of TA-3, TA-8, and TA-16 (DOE 2002l).

High Explosives Testing Facilities

Dynamic Experimentation Complex construction activities at TA-6, TA-22, and TA-40 would have some local short-term adverse effects on visual resources; long-term effects from construction and demolition are expected to be minimal. The project, which would involve constructing 15 to 25 new one- to two-story buildings, as well as new roads and parking lots, generally is not visible from public roads, and new buildings would be similar in height to existing structures. The visual effects of construction would be confined to the immediate area. In the long term, the area would experience minimal effects because its industrial park

appearance would continue, but on an expanded scale with similar architecture. Demolition activities generally would result in the same local short-term adverse effects identified for the construction phase. Overall, the removal of buildings would enhance visual characteristics as some areas return to more natural conditions (DOE 2003e).

5.1.2.2 Reduced Operations Alternative

Under the Reduced Operations Alternative, the same impacts on the visual environment as those addressed under the No Action Alternative (see Section 5.1.2.1) would occur.

5.1.2.3 Expanded Operations Alternative

The Expanded Operations Alternative reflects proposals that would expand the overall operations levels at LANL beyond those established for the No Action Alternative. Additionally, the Expanded Operations Alternative includes a number of new projects that could impact the visual environment at LANL. Not all new projects would affect the visual environment because many would involve actions within or modifications to existing structures. Only those projects that impact the visual environment are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

Two proposed projects could impact visual resources across a number of TAs at LANL: the MDA Remediation Project and the Security-Driven Transportation Modifications Project. A detailed analysis of each is presented in Appendices I and J, respectively.

Action options for remediation of MDAs include capping, removal, or a combination of both. Remedies for MDAs subject to the Consent Order would be recommended by the LANL management and operating contractor on an MDA-by-MDA basis, and the decision would be made by the New Mexico Environment Department. Each option would have some temporary short-term visual impacts resulting from activities such as stripping or disrupting the existing vegetative cover over the MDAs, removing waste, placing cover materials in compacted lifts, and providing revegetation. Not all land would be affected at the same time. Many of the affected sites would not be in areas that are routinely visible to the public; however, a number of MDAs are located on DP Mesa in TA-21 and are visible from the Los Alamos townsite. Remediating the MDAs would have a relatively minor impact on visual resources from higher elevations to the west and, in a few cases, from the townsite. Once capped, the views generally would be similar to those in existence prior to implementation of corrective measures. One difference between the Capping and Removal options is that, under the Removal Option, MDAs would be covered by enclosures as needed while waste is being removed. (The investigation and remediation program at MDA B also would be conducted under enclosures.) These domed structures would be visible from greater distances than the MDAs themselves under the Removal Option; however, their presence would be temporary. After waste removal was completed, the enclosures would be removed and the site would be revegetated. Under both the Capping and Removal Options, the need to obtain fill may require removal of a small hill that currently screens the TA-61 borrow pit from observation from East Jemez Road. Thus, the borrow pit, which is a cleared area several acres in size, might become visible from East Jemez Road and

would remain visible until the area ultimately is reclaimed and revegetated. Remediating PRSs other than MDAs would result in few additional long-term visual impacts.

The Security-Driven Transportation Modifications Project would take place within Pajarito Corridor West, which is a highly developed area that is readily visible from both nearby and higher elevations to the west. While many actions associated with implementing the Security-Driven Transportation Modifications Project would have few or no visual impacts, construction of the two parking lots, new roads across TA-63 and TA-35, and highway and pedestrian bridges over Ten Site Canyon would noticeably add to the built-up appearance of the area. Visual impacts of constructing the parking lots and the highway and pedestrian bridges would be especially pronounced because they would involve removal of existing forest and span a forested canyon that has an otherwise natural appearance. The bridges would be readily visible from the canyon where little development is presently apparent; they would also be visible from more distant areas.

Auxiliary Action A for the Security-Driven Transportation Modifications Project involves construction of a two-lane bridge within a 1,000-foot (300-meter)-wide corridor across Mortandad Canyon and a new two-lane road from the north end of the new bridge westward through TA-60 to connect TA-35 with TA-3. Although the roadway would have minimal impact on visual resources because it would follow an existing unpaved road, the proposed bridge would represent a highly visible change in the appearance of the local environment and would stand out in contrast to the forested setting of the canyon, altering its natural appearance when viewed from both nearby locations and higher elevations to the west.

Auxiliary Action B involves construction of a second, new two-lane bridge within a 1,000-foot (300-meter)-wide corridor across Sandia Canyon and a new two-lane road from the new bridge to connect with East Jemez Road. Because Auxiliary Action B would not proceed independently of Auxiliary Action A, the impacts on visual resources would be similar to those addressed for Auxiliary Action A, but would involve bridges across two canyons.

Technical Area Impacts

Three projects are planned that could impact visual resources at TA-3 and TA-21. These projects are addressed below.

Technical Area 3

Construction of the Physical Science Research Complex (formerly the Center for Weapons Physics Research) would result in short-term impacts to the visual environment, including construction activities and increased dust generation. Once complete, the facility would be visually compatible with nearby office and computing structures and would enhance the overall architectural character of the Core Development Area. Distant views of TA-3 would not change appreciably due to the highly developed nature of the area. DD&D of buildings vacated as a result of the project would cause temporary construction-related impacts, but in the long term would improve the general appearance of TA-35 and TA-53.

Construction of the Replacement Office Buildings would require clearing and grading of 13 acres (5.3 hectares), which would result in short-term impacts to the visual environment such as

construction activities and increased dust generation. The forested area along West Jemez Road would be replaced with buildings and a parking lot that would be readily visible from West Jemez Road, Pajarito Road, and nearby areas. Views from Pajarito Road, however, only would be apparent to employees because the road is closed to the public (see Appendix G). Due to the highly developed nature of TA-3, distant views would not change appreciably.

Technical Area 21

DD&D activities at TA-21 would have short-term adverse impacts on visual resources due to the presence of heavy equipment and an increase in dust. Following removal of buildings and structures, the area would be contoured and revegetated, as appropriate. These efforts, however, would be aimed primarily at soil stabilization, not recreating a more natural environment, because both the western part of the site, which has been transferred to Los Alamos County, and the eastern section could be developed in the future. With redevelopment likely, future views of the TA from NM 502 and from higher elevations to the west would remain commercial or industrial in nature. Nevertheless, with proper planning, the view would be of modern architecturally compatible buildings rather than the current mix of 50-year-old structures (see Appendix H).

Key Facilities

Five projects related to Key Facilities at LANL are proposed under the Expanded Operations Alternative. The impacts described below are from project-specific analyses in Appendices G and H.

Pajarito Site

The use of heavy equipment for DD&D of buildings at TA-18 and the resultant increase in dust would have short-term impacts on visual resources; however, long-term impacts would be positive. Once the buildings and structures were removed and the site restored, including grading and planting of native species, the canyon bottom would present a natural appearance and, given time, would blend with previously undisturbed portions of the TA (see Appendix H).

Radiochemistry Facility

Construction of the Radiological Sciences Institute would result in changes in both near and distant views of TA-48. Short-term impacts would include the construction activity itself, as well as increased dust generation. Upon completion, the new buildings and parking lots would be more visible from the road than current facilities due to their increased number and size. Most of the changes to area views would be visible only to LANL workers. Construction of the Radiological Sciences Institute also would change distant views of TA-48 because the size of the developed area would increase along with the numbers of buildings and parking lots. The overall broad viewshed effect would be minimal due to the extensive nature of existing development on the mesa.

Demolition of buildings and structures at TA-48 prior to constructing the Radiological Sciences Institute would have short-term and long-term impacts on visual resources. In the short term, dust and demolition activity would adversely affect these resources; however, in the long term,

the new facility would be more aesthetically pleasing in terms of architectural style than the mix of existing structures. These changes would be observed primarily by LANL employees. Distant views from higher elevations to the west would not change appreciably (see Appendix G).

Radioactive Liquid Waste Treatment Facility

One or more treatment buildings and a separate utilities structure would be constructed, or the existing building could be renovated. Regardless of the construction option, visual impacts would be temporary and localized. Any new buildings would be no more than two stories high with established color schemes for the building exteriors. If evaporation tanks were constructed, it would permanently change the visual environment because the area near TA-52 and TA-5 where the tanks would be constructed currently is undeveloped and wooded. Views of this natural setting from higher areas to the west of LANL would be disrupted by a noticeable break in the forest cover.

Solid Radioactive and Chemical Waste Facilities

Waste Management Facilities Transition activities primarily would involve work within TA-54 and a generic site. Actions taking place within TA-54, including some new construction and removal of the domes and other facilities, would occur within previously disturbed areas. While most activities taking place within TA-54 would have minimal impacts on visual resources due to the developed nature of the area, removal of the domes at MDA G would have a beneficial impact on both near and distant views because these structures can be seen many miles away from areas in the Nambe and Española area and in western and southern Santa Fe. The domes also are visible from the lands of the Pueblo of San Ildefonso. Generic sites for the TRU Waste Facility, with the exception of TA-54 West, are located within undeveloped areas. Thus, while construction of the new facility would have minimal visual impact within TA-54 West, it would create a change in the visual environment of the other generic sites. However, construction would generally not be visible to the public since Pajarito Road is open only to LANL personnel. Construction at generic locations within TA-51, TA-52, and TA-54 West would be visible from lands of the Pueblo of San Ildefonso. Regardless of where the TRU Waste Facility would be built, when viewed from higher elevations to the west it would add somewhat to the developed nature of LANL along Pajarito Road.

A second option related to the Waste Management Facilities Transition would require additional storage space for remote-handled and contact-handled transuranic waste that could be collocated with the TRU Waste Facility or be separated from it. This option also involves upgrading satellite storage areas around LANL for mixed low-level radioactive waste and hazardous or chemical waste. While impacts on visual resources from construction of the TRU Waste Facility would be similar to those described above, construction of new transuranic waste storage buildings would increase the visual impact under this option. DOE would mitigate these impacts by following the design principles provided in the LANL architectural guide (LANL 2002a).

Biosciences Facilities

The Science Complex would consist of two four-story buildings and a six-story parking structure, as well as related supporting structures and utilities. Construction of the complex would result in temporary visual impacts related to the presence of heavy equipment and dust.

Once complete, the addition of the Science Complex at the Northwest TA-62 Site or Research Park Site would impact visual resources in this area because views from TA-3 or from West Jemez Road to the west, north, and east would be obstructed. In addition, after construction of the Science Complex on the north side of the road, the natural forested buffer area between LANL and Los Alamos Canyon would be lost. These options would add somewhat to the overall "built-up" appearance of LANL when viewed from higher elevations to the west. Under the South TA-3 Site option, there would be little overall impact to visual resources because the Science Complex would be located within a highly developed part of LANL.

Under the Northwest TA-62 Site or Research Park Site options, it is possible that the security lighting associated with the Science Complex may illuminate some portion of the south and north walls of Los Alamos Canyon; however, the project would conform to the New Mexico Night Sky Protection Act per architectural and design guidelines and LANL engineering standards. Impacts from night lighting under the South TA-3 option would not be expected.

Remote Warehouse and Truck Inspection Station

Construction of the Warehouse and Truck Inspection Station would result in temporary visual impacts related to clearing activities, the presence of heavy equipment, and dust. Once complete the facility would be readily visible from East Jemez Road. Nighttime lighting would be required in a location that previously was unlighted. Although the Remote Warehouse and Truck Inspection Station would not be visible from the trails or parking lot at the Tsankawi Unit of Bandelier National Monument, the nighttime sky glow from lighting at the facility could be visible from Tsankawi under normal conditions. The trails at Tsankawi, however, are closed to the public after dusk. The lighting that would be installed would comply with the New Mexico Night Sky Protection Act to the extent it does not compromise security.

5.2 Geology and Soils

This section discusses the projected impact on LANL geology and soils under the three alternatives evaluated in this SWEIS. In general, present LANL operations have limited impact on geology and soils, except in specific circumstances. This is because most of LANL is not industrialized, so the majority of the soil column is not disturbed, and few LANL processes involve subsurface work, so there is limited interaction with geological materials. Although LANL activities do not impact geology and soils, there is a geological impact that applies to LANL facilities. An updated seismic hazard analysis completed in 2007 (LANL 2007a) presents an increased estimated probabilistic seismic hazard for LANL. As a result, the hazard assessments for existing and planned facilities will be evaluated and updated as necessary to meet DOE facility design criteria. This may impact LANL facilities under all of the three alternatives (see Section 5.12).

The information for the geology and soils sections feeds into several other sections within this new SWEIS, including human health, accidents, and ecological risk. The following section addresses each of the subject areas previously described in Chapter 4, Affected Environment.

Table 5–3 summarizes the impacts of each of the proposed alternatives on geology and soils.

Table 5–3 Summary of Environmental Consequences for Geology and Soils

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Volcanism & Seismic Activity – No activities that could increase the probability of seismic events. *Slope Stability, Subsidence, & Soil Liquefaction* – No impact. *Soil Monitoring* – No increase in the level of legacy contaminants. – Overall decrease in soil contamination occurring over time. *Soil Erosion* – No impact. *Mineral Resources* – No impact.	Same as No Action Alternative, except: *Soil Monitoring* – Potential for soil contamination would decrease due to the 20 percent reduction in high explosives testing activities.	Same as No Action Alternative, except: *Soil Monitoring* – Facility DD&D and MDA and PRS remediation would have a positive impact by removing or containing legacy contamination. *Soil Erosion* – Combined activities could impact up to 3.2 million cubic yards (2.5 million cubic meters) of soil and rock. – Standard best management practices would serve to minimize soil erosion and loss. *Mineral Resources* – MDA remediation would have a significant impact on geological resources -- up to 2.5 million cubic yards (1.9 million cubic meters) of crushed tuff and other materials would be required under the Capping Option. – Up to 2.2 million cubic yards (1.7 million cubic meters) of crushed tuff and other materials would be required under the Removal Option. – Materials would be available at LANL or from nearby offsite sources. – TA-61 borrow pit would be expanded. *Security-Driven Transportation Modifications Project* – Would disturb up to 240,000 cubic yards (183,000 cubic meters) of soil and rock for construction. – Construction of bridges as part of the auxiliary actions could disturb up to 28,000 cubic yards (21,000 cubic meters) of soil and rock. – Excavated materials would be managed to minimize erosion and losses.
Affected Technical Areas			
TA-3	No impacts to geology and soils.	Same as No Action Alternative	Same as No Action Alternative except: – Construction of Replacement Office Buildings and Physical Science Research Complex would impact approximately 868,000 cubic yards (664,000 cubic meters) of soil and rock for building excavation. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Legacy contamination would be reduced due to removal of contaminated soils during DD&D.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
TA-21	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative except: – No impact to native soils because all areas were disturbed previously by site activities. – Positive impact due to removal or improved containment of contaminated soils as a result of MDA remediation and DD&D of existing structures.
TA-61	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – If all MDA Capping Option tuff requirements came from TA-61, 25 acres (10 hectares) would have to be excavated an average of 50 feet (15 meters). – If all MDA Removal Option tuff requirements came from TA-61, up to 24 acres (9.7 hectares) would have to be excavated an average of 50 feet (15 meters).
TA-72	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction of Remote Warehouse and Truck Inspection Station would impact about 90,000 cubic yards (69,000 cubic meters) of soil and rock for building excavation. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Negative impact in the areas where construction would occur in areas with previously undisturbed soils.
Key Facilities			
Pajarito Site DD&D (TA-18)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – No impact to native soils because all areas were disturbed previously. – Positive impact due to removal of contaminated soils and reduction of legacy soil contamination at LANL.
Radiochemistry Facility (TA-48)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – DD&D of existing facilities would reduce legacy contamination and potential soil erosion. – Construction of Radiological Sciences Institute would impact approximately 802,000 cubic yards (613,000 cubic meters) of soil and rock for building excavation, some up to 45 feet (14 meters) below grade. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Negative impact in the areas where construction would occur in areas with previously undisturbed soils.
Radioactive Liquid Waste Treatment Facility (TA-50 and TA-54)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction would impact up to 95,000 cubic yards (73,000 cubic meters) of soil and rock for building excavation. – Construction of evaporation tanks and pipeline would impact approximately 69,000 cubic yards (53,000 cubic meters) of soil and rock. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – DD&D of North or South Annexes would reduce legacy contamination and potential soil erosion.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
			– Negative impact in the areas where construction would occur in areas with previously undisturbed soils.
Bioscience Facilities	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction of Science Complex would impact about 840,000 cubic yards (640,000 cubic meters) of soil and rock for building excavation. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Negative impact in the areas where construction would occur in areas with previously undisturbed soils.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Waste Management Facilities transition would impact up to 169,000 cubic yards (129,000 cubic meters) of soil and rock for building excavation and construction. Option 1 (Accelerated Actions) would impact approximately 80,000 cubic yards (61,000 cubic meters) and Option 2 (Interim Actions) would impact up to 89,000 cubic yards (68,000 cubic meters), depending on whether Option 2a, 2b, or 2c were selected. – No impact to native soils because all areas were disturbed previously. – Positive impact due to removal of wastes, contaminated soils and reduction of legacy soil contamination at LANL. – Excavated materials would be managed to minimize erosion and losses; backfill would be obtained at LANL or from nearby offsite sources.
Radiography Facility (TA-55)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction of the New Radiography Building would impact up to 8,000 cubic yards (6,100 cubic meters) of soil and rock for building excavation. – No impact to native soils because all areas were disturbed previously. – Positive impact due to removal of contaminated soils and reduction of legacy soil contamination at LANL. – Excavated materials would be managed to minimize erosion and losses; backfill would be obtained at LANL or from nearby offsite sources.

DD&D = decontamination, decommissioning, and demolition; MDA = material disposal area; PRS = potential release site; TA = technical area.

5.2.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

Volcanism and Seismic Activity

LANL operations under the No Action Alternative do not include activities that could modify the movement of magma, trigger volcanic activity, or increase the probability of seismic events (such as underground nuclear tests or operation of injection wells). This is unchanged from the *1999 SWEIS* impact analysis (DOE 1999a). The estimated potential for seismic impact to LANL facilities was updated in 2007 (LANL 2007a). The result is an increase in the probabilistic hazard that will require a review and update to the existing seismic hazard assessment for existing facilities.

Slope Stability, Subsidence, and Soil Liquefaction

The No Action Alternative does not include any new activities that would result in additional slope stability impacts. This is unchanged from the *1999 SWEIS* impact analysis (DOE 1999a). The potential for slope failure under this alternative is related primarily to increased stream downcutting, which may result from greater streamflow. The No Action Alternative does not include activities that would significantly increase streamflow, such as startup of new facilities or use of new industrial processes that discharge large volumes of water. Similarly, this alternative does not include any activities that would increase surface subsidence or the potential for soil liquefaction.

Soil Monitoring

The No Action Alternative does not include any activities that would appreciably increase the level of legacy contaminants (both chemical and radiological) in soils at the site. As discussed in Chapter 4, Section 4.2.3.1, the levels of legacy contaminants generally are decreasing over time as a result of contaminant decay, soil losses, improvements in LANL work practices, and environmental remediation.

Soil Erosion

The No Action Alternative does not include any activities that would significantly impact the potential for soil erosion. Construction activities yet to be undertaken under the No Action Alternative would continue using standard mitigation measures to minimize the effect of surface runoff and erosion.

Mineral Resources

The No Action Alternative would not affect the mineral resources in use at LANL. As discussed in Chapter 4, Section 4.2.4, the potential mineral resources at LANL are sand, gravel, tuff, and pumice deposits. These materials can be used for backfill or construction of evapotranspiration covers for environmental remediation projects. Under the No Action Alternative, the areas for proposed new construction activities are relatively small and would not impede the availability of borrow material. The only area being used for mineral resources, the East Jemez Road Borrow

Pit in TA-61 (Stephens and Associates 2005) would continue to be available under the No Action Alternative. At present, however, the pit is used to stockpile and manage materials from other areas; no quarrying is being conducted.

Technical Area Impacts

No activities planned under the No Action Alternative are expected to contribute additional impacts on geology and soils at any of the TAs.

Key Facilities

No activities planned under the No Action Alternative and related to construction or operations at any of the site's Key Facilities are expected to additionally impact geology and soils.

5.2.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Geology and soils impacts under the Reduced Operations Alternative would be similar to those under the No Action Alternative.

Technical Area Impacts

Geology and soils impacts under the Reduced Operations Alternative with respect to the TAs would be similar to those under the No Action Alternative.

Key Facilities

High Explosives Testing Facilities

Compared to the No Action Alternative, the potential impact of LANL operations on soil contamination could decrease under the Reduced Operations Alternative due to a 20 percent reduction in activities at the High Explosives Testing Facilities.

5.2.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Similar to the impacts expected under the No Action Alternative, LANL operations under the Expanded Operations Alternative would not be expected to impact the site with respect to volcanism, seismic activity, slope stability, subsidence, or soil liquefaction. Proposed activities (including facility construction and DD&D) would not significantly alter overall LANL subsurface conditions.

Volcanism and Seismic Activity

All proposed new facilities would be designed, constructed, and operated in compliance with the applicable DOE Orders, requirements, and governing standards established to protect public and worker health and the environment. DOE Order 420.1B (DOE 2005f) 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. The criteria specifically reflect adoption of the seismic design and construction provisions of the International Building Code for DOE Performance Category 1 and 2 facilities. The updated seismic hazard analysis completed in 2007 (LANL 2007a) presents increased estimated probabilistic seismic hazard for LANL. As a result, the hazard assessment for existing and planned facilities will be reviewed and updated so that these data can be used in facility design to meet DOE Orders, requirements, and governing standards.

Slope Stability, Subsidence, and Soil Liquefaction

Similar to the No Action Alternative, the Expanded Operations Alternative does not include any new activities that would result in additional slope stability impacts. This alternative also does not include activities that would significantly increase streamflow, such as startup of new facilities or use of new industrial processes that discharge large volumes of water. Similarly, this alternative does not include any activities that would increase surface subsidence or the potential for soil liquefaction. All new facilities built under this alternative would be located a sufficient distance away from steep slopes (such as canyon walls) and would use standard construction practices, as detailed in a text box in Appendix G, "Construction Work Elements," to minimize the potential for slope failure.

Soil Monitoring

This alternative would decrease the level of legacy contamination at facility construction, DD&D, and MDA and PRS remediation sites, where excavated soil and rock would be monitored for contamination. Any contaminated materials would be managed according to the LANL environmental restoration and waste management programs. The overall effect would be to remove contaminated soil from LANL, thereby reducing the levels of legacy contamination onsite. The impact of removal would be much greater under the Expanded Operations Alternative than the No Action or Reduced Operations Alternatives due to the greater volume of soil to be excavated, monitored, and potentially removed as contaminated media.

At sites involving excavation or other soil disturbances, potential impacts on PRSs and PRS-affected areas could result. Prior to commencing any ground disturbance, potentially affected contaminated areas would be surveyed to determine the extent and nature of any contamination and required remediation in accordance with procedures established under the LANL Risk Reduction and Environmental Stewardship Remediation Program.

Soil Erosion

Under the Expanded Operations Alternative, facility construction and DD&D would impact geological materials. A total of approximately 3.2 million cubic yards (2.5 million cubic meters) of soil and rock would be impacted; however, over 90 percent of the material would be from areas already disturbed by present or past activities. This would minimize the impact to native soils (soils formed by natural processes and that are not impacted by construction or other anthropogenic activities). The impacts would include both facility footprints and support areas such as soil staging areas and construction equipment laydown yards.

Surface soils and unconsolidated sediments exposed in excavations would be subject to wind and water erosion if left exposed over time. In all instances, adherence to standard best management practices for soil erosion and sediment control, including watering during construction, would minimize soil erosion and loss. See Appendix G text box "Construction Work Elements" for description of additional examples. After construction, disturbed areas that have not been paved would be stabilized and/or revegetated and would not be subject to long-term soil erosion.

Mineral Resources

Projects and activities proposed under the Expanded Operations Alternative would significantly impact mineral resources at LANL due to the proposed closures of MDAs under the Consent Order[2] (NMED 2005) through either waste containment (via construction of evapotranspiration covers) or waste removal (via excavation and offsite disposal). If final covers were constructed at the MDAs and contaminated areas in TA-49 under the Capping Option, 750,000 to 2,000,000 cubic yards (570,000 to 1,500,000 cubic meters) of crushed tuff would be needed through 2016 depending on the required thickness of the covers. Up to 460,000 cubic yards (350,000 cubic meters) of additional rock, gravel, topsoil, and other bulk materials would be required for the final surface and erosion control. The total amount of geologic materials needed would be up to 2.5 million cubic yards (1.9 million cubic meters). Total impacts to soil and rock from possible construction of vertical and subsurface horizontal containment walls would be minor.

If the waste were removed under the Removal Option, approximately 1,300,000 cubic yards (1,000,000 cubic meters) of backfill would be needed to replace the excavated waste and contamination, as well as 61,000 cubic yards (47,000 cubic meters) of rock, gravel, topsoil, and other bulk materials used for erosion control and site restoration. An additional 220,000 to 600,000 cubic yards (170,000 to 460,000 cubic meters) of crushed tuff could be needed to cap remaining disposal units in Area G and contaminated areas in TA-49, as well as about 160,000 cubic yards (120,000 cubic meters) of additional bulk materials. The total amount of geologic materials needed would be up to 2.2 million cubic yards (1.7 million cubic meters). Total impacts to soil and rock from possible construction of vertical and subsurface containment walls would be minor.

[2] *NNSA is including impacts associated with Consent Order implementation in the SWEIS in order to more fully analyze the impacts resulting from Consent Order compliance. NNSA intends to implement actions necessary to comply with the Consent Order regardless of decisions it makes on other actions analyzed in the SWEIS.*

For economic and feasibility reasons, these materials would need to be produced from borrow pits and quarries in the LANL area (Stephens and Associates 2005). The only borrow pit now in use at LANL is the East Jemez Road Borrow Pit in TA-61. There would be sufficient tuff available for quarrying at the pit to provide the needed volumes of crushed tuff. Other sources available in the area would be required to provide other materials (such as soil and coarse material for erosion control) needed to complete MDA remediation. Borrow materials also could be collected from areas of opportunity on the site, such as facility construction or DD&D areas where excess uncontaminated excavated soils may meet backfill or capping criteria. The use of excavated soils as fill or cap material would minimize the need for additional borrow pits and the impacts to LANL soils and surface water, as well as the potential impact to groundwater from enhanced infiltration.

Security-Driven Transportation Modifications

The proposed Security-Driven Transportation Modifications Project would disturb up to 240,000 cubic yards (183,000 cubic meters) of soil and rock during construction. In addition, construction of both optional bridges under this proposal could disturb up to 28,000 cubic yards (21,000 cubic meters) of soil and rock.

Technical Area Impacts

Technical Area 3

Construction of the Replacement Office Buildings and the Physical Science Research Complex would impact about 868,000 cubic yards (664,000 cubic meters) of soil and rock due to building excavation. DD&D of existing facilities would reduce legacy contamination and potential soil erosion. Excavated materials would be managed to minimize erosion and losses, and backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. There would be negative impacts on areas where construction would affect undisturbed native soils.

Technical Area 21

Remediation of the MDAs in TA-21, as well as DD&D of structures, would occur in areas that are already disturbed by site activities so there would be no impacts on native soils. Additional fill materials would be obtained onsite or from nearby offsite sources. Completion of DD&D and MDA remediation would have a positive impact due to the removal of contaminated soils from the site and a reduction of legacy soil contamination at LANL.

Technical Area 61

As discussed above, the only borrow pit now in use at LANL is the East Jemez Road Borrow Pit in TA-61. The site containing the borrow pit currently covers approximately 43 acres (17 hectares). If all of the tuff materials required to support the MDA Capping Option at maximum thickness were taken from this borrow pit, 25 acres (10 hectares) of the pit would have to be excavated an average of 50 feet (15 meters). Under the MDA Removal Option, there would be a comparable maximum tuff requirement. The TA-61 borrow pit would need to be excavated an average of 50 feet (15 meters) over 24 acres (9.7 hectares).

Technical Area 72

Construction of the Remote Warehouse and Truck Inspection Station would require excavation of approximately 90,000 cubic yards (69,000 cubic meters) of soil and some of the underlying rock. The facility would be constructed in previously undisturbed areas, resulting in a negative impact due to the loss of native LANL soils. During construction, the excavated soil and rock would be managed to minimize erosion and losses. If necessary, backfill material would be obtained from LANL sources.

Key Facilities

Pajarito Site

DD&D and shutdown activities would have no impact to native soils because all areas were previously disturbed. After DD&D and shutdown were complete, there would be a positive impact due to the removal of contaminated soils from the site and a reduction of legacy soil contamination at LANL.

Bioscience Facilities

Construction of the Science Complex would impact about 840,000 cubic yards (640,000 cubic meters) of soil and rock due to building excavation. Although a similar volume of earthwork would be required under each of the three options for building this facility, the impact to native (undisturbed) LANL soils would depend on the option selected. Option 1 (Northwest TA-62 Site) and Option 2 (Research Park Site) would have the greater impact on LANL soils because the complex would be built in a relatively undeveloped area, resulting in excavation and disruption of the native soil material. Option 3 (South TA-3 Site) would have less impact on native LANL soils because the facility would be placed on an area presently occupied by a parking lot and on fill material previously placed at the site. There would be some impact to native LANL soils along the margins of facility construction under Option 3.

Materials excavated for facility construction would be managed to minimize erosion and losses. Backfill for facility construction would be obtained from LANL sources.

Radiochemistry Facility

Construction of the Radiological Sciences Institute would impact about 802,000 cubic yards (613,000 cubic meters) of soil and rock for building excavation. DD&D of existing facilities would reduce legacy contamination and potential soil erosion. Excavated materials would be managed to minimize erosion and losses and backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. There would be a negative impact on areas where construction would affect undisturbed native soils.

Radioactive Liquid Waste Treatment Facility

Construction of a Radioactive Liquid Waste Treatment Facility would impact up to 95,000 cubic yards (73,000 cubic meters) of soil and rock for building excavation. Another 69,000 cubic yards (53,000 cubic meters) of soil and rock would be impacted by construction of evaporation tanks

and a pipeline. DD&D of the North or South Annexes would reduce legacy contamination and potential soil erosion. Excavated materials would be managed to minimize erosion and losses, and any additional backfill required would be obtained at LANL or from nearby offsite sources. There would be a negative impact on areas where construction would affect undisturbed native soils.

Solid Radioactive and Chemical Waste Facilities

Waste Management Facilities Transition activities primarily would involve work within TA-54, TA-50, and TA-63. Earthmoving operations would impact 80,000 to 169,000 cubic yards (61,000 to 129,000 cubic meters) of soil and rock; the total volume impacted would depend on the combination of Option 1 and Option 2a, 2b, or 2c. Option 1 (accelerated removal and disposition of wastes with supporting removal, relocation, and replacement of applicable facilities) would impact approximately 80,000 cubic yards (61,000 cubic meters) of rock and soil. The impacts of Option 2 (interim actions necessary for meeting Consent Order and other options) impacts would be additional to those under Option 1. Option 2a would impact approximately 89,000 cubic yards (68,000 cubic meters) of additional soil and rock for facility construction. Option 2b would impact approximately 82,000 cubic yards (63,000 cubic meters), and Option 2c would have a negligible impact on soil and rock because an additional facility would not be constructed.

There would be minimal loss of native LANL soils because the activities would occur in areas previously disturbed by LANL activities. During construction, excavated soil and rock would be managed to minimize erosion and losses. If necessary, backfill material would be obtained from LANL sources. The necessary backfill volume would not significantly deplete geological resources at LANL. There also would be a positive impact from the removal of wastes and contaminated soil from LANL, as well as a reduction in legacy soil contamination.

TA-55 Radiography Facility

Relocation of high-energy x-ray radiography into a TA-55 Radiography Facility would impact up to 8,000 cubic yards (6,100 cubic meters) of soil and rock. The construction would be at the site of the former Building TA-55-41, so there would be no impact to native LANL soils. During construction, best management practices would be implemented to prevent erosion and migration of disturbed materials from the site caused by stormwater, other water discharges, or wind. Uncontaminated backfill would be stockpiled at an approved material management area at LANL for future use.

5.3 Water Resources

Water resource impacts considered in this section include changes in surface water quality and quantity, sediments, floodplains, and groundwater quality and quantity.

5.3.1 Surface Water

Surface water quality is measured using sampling data from National Pollutant Discharge Elimination System (NPDES) outfalls, stormwater flows, and watershed monitoring stations. As it is difficult to predict future sampling results, a qualitative analysis of actions that could affect

those results was performed based on patterns observed from previous actions. For example, one of the effects expected from installing a new treatment system at the Radioactive Liquid Waste Treatment Facility would be a reduction in the number of downstream surface water samples containing detectable levels of the treated constituents. The effect may not be immediate if effluents are diluted by perennial or stormwater flows, but the long-term effect would be improved surface water quality in that canyon, a significant beneficial impact.

A potential source of surface water contamination is the sediment located in certain canyon bottoms. Sampling results following the Cerro Grande Fire showed that unusually large volumes of stormwater could mobilize contaminants in sediment and transport them for long distances downstream. Actions that could increase surface water volumes would likely mobilize contaminated sediment, which would have potentially adverse effects on surface water quality.

Surface disturbance from construction activities could remove protective vegetative or other earth cover, loosen soil particles, and generate accelerated erosion that could result in sediment entering the waterways. For this analysis, it was assumed that accelerated erosion from surface disturbance during construction would be minimized by installation and maintenance of erosion and sediment controls specified in Stormwater Pollution Prevention Plans, in compliance with state and Federal regulations under the Clean Water Act, including the NPDES Construction General Permit and Section 404 and Section 401 permits.

Stormwater volumes could be directly affected by LANL construction due to changes in the size of impervious areas that affect runoff flow rates and volumes. Changes in LANL effluent discharges from the NPDES outfalls can affect the quantity of flow in sections of the canyons. The surface water flows in various canyons could be affected if some of the flood structures from the Cerro Grande Fire were removed.

To calculate the changes in runoff volume under each alternative, it is first necessary to estimate the acreage of the impervious area in each watershed located near the LANL facilities to be constructed; however, the proposed facility designs are not developed to the point where the footprint sizes of the facilities are usable for that purpose. Stormwater management controls, including mitigation measures for increased stormwater flows and sediment loads, are required as part of LANL's construction specifications (LANL 2004b). For this analysis, it was assumed that new construction would include installing construction site stormwater controls, so there would be only minor increases in sediment-laden runoff reaching the canyons.

The environmental consequences of LANL actions under the different alternatives could impact surface water quality, surface water quantity, floodplains and wetlands, and sediments. Impacts on wetlands are discussed in Section 5.5 because wetlands are an important habitat for diverse flora and fauna. **Table 5–4** summarizes the expected surface water impacts for each of the three alternatives.

Table 5–4 Summary of Environmental Consequences on Surface Water

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Transfer − Negligible impact on surface water quality and floodplains (White Rock Y and Rendija Canyon).	Same as No Action Alternative	Same as No Action Alternative
	Wildfire Hazard Reduction Program − Minor impact on surface water quality, quantity, and floodplains. Beneficial long-term effects due to wildfire risk reduction.		Same as No Action Alternative
	Flood Structures Removal − Minor beneficial impact on surface water quality and quantity. − Temporary adverse impact on Pajarito floodplains due to removal of structures that retained flow and sediment. Restoration of normal flow would cause sediments to alter channel and readjust floodplains.		Same as No Action Alternative
	Security Perimeter Project − Minor impact on surface water quality if soil contaminants mobilized.		Same as No Action Alternative
	MDA Remediation LANL's environmental restoration program continues, but no significant remediation of MDAs occurs.		Actions taken in compliance with the Consent Order with respect to MDA remediation would ensure water quality is protected (long-term) by removal or stabilization of potential contamination sources.
TAs			
TA-21	No impact on surface water quality.	Same as No Action Alternative	DD&D of the Steam Plant and the Tritium Science and Fabrication Facility would result in removal of two NPDES-permitted outfalls. Minor impact on surface water quantity in Los Alamos Canyon, but little to no impact on surface water quality.
TA-46	Significant beneficial impact on surface water quality and quantity in Sandia Canyon from recycling Sanitary Wastewater Systems Plant outfall volume for use in cooling towers.	Same as No Action Alternative	Same as No Action Alternative

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Key Facilities			
High Explosives Testing Facilities – Dynamic Operations Complex	Minor beneficial impact on surface water quality due to shot containment.	Minor impact on surface water quantity in Water Canyon due to reduction of operations. Minor beneficial impact on surface water quality by discharge reduction.	Same as No Action Alternative.
Radioactive Liquid Waste Treatment Facility (TA-50)	No impact on surface water quality.	Same as No Action Alternative	Although increased pit production would increase the Radioactive Liquid Waste Treatment Facility outfall volumes by 25 percent, this would have a negligible effect on surface water volumes in Mortandad Canyon because other facilities contribute 90 percent of the outfall flow in that canyon. Implementing the zero discharge option at the Radioactive Liquid Waste Treatment Facility would have a minor effect on surface water volume, but would improve surface water quality by reducing the movement of historical contaminants in the sediments downstream of that outfall.
LANSCE (TA-53)	No impact on surface water quality.	Effects may be temporary or permanent, if shut down. Significant beneficial impacts in Los Alamos Canyon due to shutdown of operations and removal of two NPDES – permitted outfalls.	Same as No Action Alternative.
Pajarito Site (TA-18)	No impact on surface water quality.	Same as No Action Alternative.	DD&D would have minor beneficial impact on surface water quality by removing potential contaminant sources. Minor impact to Pajarito Canyon floodplains by removing TA-18-184 building obstruction.

MDA = material disposal area; TA = technical area; DD&D = decontamination, decommissioning, and demolition; NPDES = National Pollutant Discharge Elimination System; LANSCE = Los Alamos Neutron Science Center.

LANL NPDES outfall volumes affect surface water quantities and could be altered by the proposed LANL activities. Although direct impacts from changes to effluent discharges are usually localized to a short section within a canyon, such changes could affect the entire downstream drainage system. Changes to effluent discharges under each alternative were compared to the baseline for NPDES outfall volumes in each canyon, as calculated from the totalized or estimated average flows from 2002 through 2005. **Table 5–5** summarizes the estimated outfall volumes for the three alternatives evaluated. The assumptions used to calculate the projected changes in outfall volumes for each alternative are listed at the end of Table 5–5.

Changes in outfall volume within a canyon of less than 5 percent of current flows are considered negligible, and changes of greater than 40 percent are considered significant. The greater-than-40-percent threshold for significance was selected specifically for this SWEIS to provide a measure of change that was based on past changes that made a difference to water quality and quantity. In those canyons where flows are typically relatively low, outfall changes are predicted to affect both water quality and quantity downstream.

5.3.1.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

To reduce the potential impacts of LANL activities on water resources, LANL has several programs that monitor and protect surface water quality and quantity. Under the No Action Alternative, the NPDES industrial permit was modified (EPA 2007b) to reduce the total number of outfalls from 21 to 17. The four outfalls that were removed from the permit (03A024, 05A097, 03A047, and 03A049) have not discharged effluent in recent years, so no direct impacts to water quality or flow volumes in the canyons would result.

When NNSA determines that site conditions have returned to pre-Cerro Grande Fire conditions, the aboveground portion of the flood retention structure and the entire steel diversion wall upgradient of TA-18 would be removed via the Flood Structures Removal Project (DOE 2002j). Best management practices would be implemented during the controlled demolition and removal of the flood control structures to control disturbed sediment that might enter the watercourse during construction. No excavation or demolition debris would be placed in or near drainages or in the Pajarito Canyon floodplain, so the potential for surface water contamination after construction would be minimal (DOE 2002j). After removal of the flood control structures in Pajarito Canyon is completed, the potential for sediment transport would increase in the short term as the channel adjusts to the change (LANL 2002c).

Continued maintenance of the low-head weir and detention basin in Los Alamos Canyon and the road reinforcements above Pajarito, Twomile, Los Alamos, and Water Canyons would minimize adverse impacts to surface water quality and the floodplains in those canyons even if the Flood Structures Removal Project were implemented. Long-term stabilization at the sites of the removed structures using recontouring and reseeding would protect surface water quality in Pajarito Canyon. Sediment and water sampling in the canyons would monitor potential contamination and trigger remedial actions, if needed (DOE 2002j).

Table 5–5 Estimated National Pollutant Discharge Elimination System Permitted Discharges by Facility and Canyon (million gallons per year)

Facility	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Los Alamos Canyon			
Tritium Facilities – 2 outfalls	17.4	17.4	0.0 [a]
LANSCE – 3 outfalls	28.2	0.0 [b]	28.2
Canyon Total	45.6	17.4	28.2
Sandia Canyon			
Sigma Complex – 1 outfall	0.0 [c]	0.0 [c]	0.0 [c]
LANSCE – 1 outfall	1.3	0.0 [b]	1.3
Nicholas C. Metropolis Center for Modeling and Simulation (Metropolis Center) – 1 outfall	13.6	13.6	17.7 [d]
Non-Key Facilities – 3 outfalls	172.4	172.4	172.4
Canyon Total	187.3	186.0	191.4
Mortandad Canyon			
Chemistry and Metallurgy Research Building –1 outfall	1.9	1.9	1.9
Sigma Complex – 1 outfall	5.8	5.8	5.8
Plutonium Complex– 1 outfall	4.1	4.1	4.1
Radioactive Liquid Waste Treatment Facility– 1 outfall	4.0	4.0	5.0 [e]
Non-Key Facilities – 1 outfall	28.5	28.5	28.5
Canyon Total	44.3	44.3	45.3
Water Canyon (including Cañon de Valle)			
High Explosives Processing – 3 outfalls	0.06	0.05 [f]	0.06
High Explosives Testing – 2 outfalls	2.2	1.8 [g]	2.2
Canyon Total	2.26	1.81	2.26
Subtotal Key Facilities (including the Metropolis Center)	78.6	48.6	66.2
Non-Key Facilities	200.9	200.9	200.9
Totals	279.5	249.5	267.1

LANSCE = Los Alamos Neutron Science Center.

Assumptions used to predict outfall volumes:

[a] Zero discharge based upon removal of TA-21 buildings including the Steam Plant Outfall and the Tritium Science and Fabrication Facility Outfall.

[b] Zero discharge based upon safe shutdown of LANSCE.

[c] This outfall has not discharged any effluents in recent years and has been proposed for removal from the National Pollutant Discharge Elimination System permit.

[d] 30 percent increase in cooling water based upon operation of a third cooling tower.

[e] 25 percent increase based upon increased activity of facilities that generate radioactive liquid waste.

[f] 20 percent decrease based upon 20 percent reduction in high explosives processing.

[g] 20 percent decrease based upon 20 percent reduction in high explosives testing.

Note: To convert gallons to liters, multiply by 3.78533. Totals may not add due to rounding.

Sources: EPA 2007b, LANL 2006a, 2006h.

The removal of fuels through the Wildfire Hazard Reduction Program would improve forest health, stabilize the watersheds, and reduce the long-term potential for wildfires. This would beneficially impact surface water quality because wildfires destroy the vegetation that stabilizes the soil and promotes stormwater infiltration. Fewer wildfires would reduce the potential for stormwater runoff eroding soil and mobilizing contaminants (DOE 2000e), and thus the potential

for surface water contamination from high sediment loads in stormwater. Reducing the potential for wildfire also would limit other adverse impacts to surface water quality such as scoured stream channels that alter the extent of floodplains. Potentially adverse impacts resulting from tree cutting, chipping, and slash pile burning in the floodplains (performed as part of the Wildfire Hazard Reduction Program) would be mitigated through required environmental protection measures (DOE 2000e).

Construction activities associated with the Security Perimeter Project (DOE 2003a; NNSA 2004a, 2005a) could require compliance with Section 404 and Section 401 permits, thereby requiring provisions to protect the watercourse from potential increased runoff and sediments during bridge construction (although previously analyzed, a bridge is not included in current plans). Adverse impacts on surface water quality due to construction on the canyon walls, as well as access control and traffic improvements near the watercourse, would be minimized through implementation of a Stormwater Pollution Prevention Plan to control soil erosion in accordance with the NPDES Construction General Permit. Such best management practices could include the use of silt fences, straw bales, and check dams.

The Security Perimeter Project would have a minor beneficial effect on surface water quality if the PRSs at solid waste management units located in the proposed bypass road corridors were remediated, which would include removing contaminants found in the drainage pathway from a chemical (polychlorinated biphenyls) storage area. There would be a negligible adverse effect from increased stormwater runoff over the new impervious road surfaces that would allow additional flows containing potential contaminants.

Continuing the LANL environmental restoration program in existence before the 2005 Consent Order would cause the removal of contaminated soil and sediment, and thus have a positive impact on surface water quality.

Management of construction fill would have no effect on surface water quality. Construction fill would be stored at existing borrow areas at TA-16 and TA-61. Best management practices would be employed to protect surface waters.

Technical Area Impacts

NPDES-permitted outfalls would be maintained at four non-Key Facilities: the TA-3 Power Plant (001); the TA-3 Laboratory Data Computing Center cooling tower outfall (03A199); the Sanitary Wastewater Systems Plant at TA-46 (13S), which routes its effluent through storage tanks at TA-3 for recycling or discharge; and a cooling tower outfall at TA-35 (03A160). Total effluent discharges from these outfalls would continue to be lower than the 1999 actual volumes, although individual facilities could have higher volumes. If the Sanitary Effluent Recycling Facility for supplying water to cooling towers at the Metropolis Center becomes effective, reduced NPDES-outfall volumes and associated contaminants from the TA-46 Sanitary Wastewater System Plant would have a significant beneficial impact on surface water quality and quantity in Sandia Canyon (LANL 2006a).

Key Facilities Impacts

Sigma Complex

At the Sigma Complex, one cooling tower NPDES outfall (03A024) has been removed. There has been no flow from this outfall in recent years, so flow volumes in Mortandad Canyon, where this effluent discharged, would not be affected. The Sigma Complex would retain a separate cooling water outfall into Sandia Canyon (03A022) (LANL 2006a).

High Explosives Processing Facilities

At the High Explosives Processing Facilities, one NPDES outfall (05A097) has been removed. There has been no flow from this outfall in recent years, so flow volumes in Water Canyon, where this effluent discharged in the past, would not be affected. The high explosives outfall from the High Explosives Wastewater Treatment Facilities (05A055) at TA-16 and the cooling water outfall (03A130) at TA-11 would continue discharging treated effluent into Water Canyon (LANL 2006a).

High Explosives Testing Facilities

At the High Explosives Testing Facilities, use of foam at the Dual Axis Radiographic Hydrodynamic Test site has reduced impacts to surface water quality from depleted uranium contamination by containing 75 percent of experimental material from shots (LANL 2001d). Enhanced containment of shot debris and augmented cleanup of debris from uncontained shots would have a minor long-term beneficial effect on water quality because it would reduce the potential contaminants that could be mobilized by stormwater.

Los Alamos Neutron Science Center

At the Los Alamos Neutron Science Center (LANSCE), a project to upgrade the cooling towers would reduce the number of cooling tower outfalls at the facility from four to two. Outfalls 03A047 and 03A049 have been removed from the NPDES permit. There has been no flow from the older cooling towers in recent years, so flow volumes in Los Alamos Canyon would not be affected.

5.3.1.2 Reduced Operations Alternative

Most of the same impacts on surface water quality and quantity resulting from actions discussed under the No Action Alternative also would occur under the Reduced Operations Alternative, except those explicitly associated with the reduced ordnance operations.

Key Facility Impacts

Under the Reduced Operations Alternative, impacts to surface water quality would be the same as those described under the No Action Alternative, with the exception of the impacts described below. There would be little or no effect on floodplains from changes to Key Facilities.

High Explosives Processing Facilities

Reduced operations at the High Explosives Processing Facility would have little or no effect on surface water quality or quantity. Effluent volumes from the High Explosives Wastewater Treatment Facility (05A055) and the cooling water (03A130) NPDES outfalls would be reduced by about 20 percent, but their expected flows (less than 0.05 million gallons per year [0.2 million liters] or less than 3 percent of the total effluent discharged in Water Canyon) are not large enough to produce significant beneficial impacts to surface water.

High Explosives Testing Facilities

Reduced operations at the High Explosives Testing Facilities would result in minor beneficial effects on local surface water quality and quantity. Expected effluent flows from the cooling water NPDES outfalls (03A028 and 03A185) into Water Canyon would be reduced about 20 percent from 2.2 million gallons (8.3 million liters) per year to about 1.8 million gallons (6.7 million liters) per year. The percentage change in flow volumes from these reduced operations would not exceed the significance threshold for surface water quantity in Water Canyon.

Los Alamos Neutron Science Center

Surface water impacts from shutting down operations at LANSCE may be short-term or permanent. Shutdown of LANSCE would significantly reduce the surface water quantity in Los Alamos Canyon compared to the No Action Alternative. Cooling water NPDES outfalls from LANSCE contribute about 60 percent of the effluent flowing into Los Alamos Canyon. Shutdown of LANSCE would have a negligible effect on Sandia Canyon, resulting in approximately 1 percent less effluent flow than under the No Action Alternative. This would beneficially impact surface water quantity in both canyons because reduced flows could mobilize fewer contaminated sediments.

5.3.1.3 Expanded Operations Alternative

The same surface water quality and quantity impacts resulting from actions discussed under the No Action Alternative also would occur under the Expanded Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Beneficial impacts to surface water quality would follow remediation of MDAs and other PRSs. Construction of MDA final covers under the Capping Option or removal operations under the Removal Option would disturb soils and remove stabilizing vegetation temporarily. In compliance with the terms of the NPDES Construction General Permit, installation of erosion control measures described in Stormwater Pollution Prevention Plans would minimize erosion and offsite sedimentation during construction.

Following closure of the MDAs, surface water quality would gradually improve as corrective measures remove or stabilize potential sources of contamination from release sites (see Appendix I). The Capping Option and the Removal Option would decrease the risk of surface

water contamination more than the No Action Alternative because additional potential contamination sources at MDAs and PRSs would be avoided or eliminated.

Technical Area Impacts

DD&D of buildings at TA-21 would eliminate both the Tritium Science and Fabrication Facility and the Steam Plant, which both discharge industrial effluent into Los Alamos Canyon. As these are the only TA-21 outfalls, discharges from this TA would be eliminated in the Expanded Operations Alternative. The impact on surface water quantity in Los Alamos Canyon would be minor, as these effluents are less than 40 percent of the discharges into that canyon. Removal of these sources would have little to no impact on surface water quality, because the majority of the effluent comes from boiler blowdown and cooling water, which does not contain many contaminants.

Key Facilities Impacts

Under the Expanded Operations Alternative, impacts to surface water quality would be the same as described under the No Action Alternative, except as described below. Construction of a new Radioactive Liquid Waste Treatment Facility, two bridges, other building construction, and demolition of the existing annexes would have little or no adverse impact on surface water quality due to installation of stormwater management and erosion and sediment controls based on compliance with site-specific Stormwater Pollution Prevention Plans and LANL's construction specifications.

Radioactive Liquid Waste Treatment Facility

Proposed increased discharges from the Radioactive Liquid Waste Treatment Facility outfall resulting from increased activity at facilities that generate radioactive liquid waste (see Table 5–5) would result in about a 25 percent higher effluent discharge rate into Mortandad Canyon from that facility, compared to the No Action Alternative. This increase would have a negligible effect on Mortandad Canyon, as the Radioactive Liquid Waste Treatment Facility effluent currently accounts for about 9 percent of LANL's discharges into that canyon. This percentage of overall flow contribution would only increase to 11 percent at the higher discharge rate. Contaminant transport through sediment mobilization could be enhanced due to the increased outfall discharge rate. Cooling water discharges are the only other LANL effluents introduced into Mortandad Canyon.

Operation of a new Radioactive Liquid Waste Treatment Facility would have a beneficial impact on surface water quality because the improved low-level radioactive waste and transuranic waste processes would reduce the contaminant concentrations in the effluent discharged into Mortandad Canyon to levels that could meet potentially more stringent future water quality standards. An auxiliary action, which could be applied to any of the options for the new Radioactive Liquid Waste Treatment Facility, is to construct evaporation tanks and eliminate discharges into Mortandad Canyon. If the facility thus becomes a zero discharge facility, surface water quality would be positively affected. Elimination of effluent flows into the canyon at the Radioactive Liquid Waste Treatment Facility outfall would minimize the potential for contaminated sediments to become mobilized in streams, resulting in a beneficial impact to

downstream surface water quality. There would be a minor reduction in surface water quantity in Mortandad Canyon if the Radioactive Liquid Waste Treatment Facility outfall were eliminated. Floodplain size would not be affected by this project.

Pajarito Site

Under the Expanded Operations Alternative, unneeded structures at TA-18 would be removed, thereby removing potential contamination sources from an area where they could be flooded. Parts of TA-18 lie within the 100-year floodplain for Pajarito Canyon. For example, the building that houses the Solution High-Energy Burst Assembly (SHEBA) is partially within the floodplain boundary. Although the possibility of floodwater mobilizing contaminants from the buildings is remote, complete removal of potential contaminant sources would protect surface water quality.

5.3.2 Groundwater Resources

Alternatives evaluated in the SWEIS have the potential to impact the quality of groundwater and the quantity of water available in aquifers. Groundwater quality can be affected by radionuclides and chemicals in liquid and solid waste that infiltrate into the ground. The quantity of groundwater available can be affected by changes in recharge rates and water supply well withdrawal rates. This section addresses potential impacts to groundwater from liquid effluent releases to the canyons and from solid radioactive waste disposal on the mesa tops. In addition, the effects of changes in recharge rates and water supply well withdrawal rates on water levels in the aquifer are discussed.

Impacts to the regional aquifer in the LANL area are generally measured over many years, primarily due to the long time necessary for contaminants to flow through the rock into the regional groundwater and the relatively small volume of water transported through the vadose zone in this arid climate. For the *1999 SWEIS*, significant adverse impacts to the regional aquifer were defined as changes to groundwater that alter the contaminant levels in concentrations above the drinking water standards in a way that can affect human health and safety. This could occur if any of the activities under consideration in the three SWEIS alternatives increase the flow rate of contaminants entering the deep groundwater.

Impacts to the alluvial groundwater are likely to occur more rapidly and could be affected either beneficially or adversely by changes to outfall flows from LANL. Some of the surface water carrying contaminants enters the alluvial groundwater system through canyon bottoms. Although surface-to-subsurface infiltration is fairly rapid in the canyons, any contaminants carried by the surface water are diluted by the large volume of water already stored in the ground; conversely, uncontaminated surface water infiltrating into already contaminated groundwater would cause its dilution over time.

Impacts to the alluvial aquifer may be considered significant if the concentrations of contaminants are altered in relation to the New Mexico and U.S. Environmental Protection Agency (EPA) groundwater standards for irrigation and other non-drinking-water uses. An adverse impact to the alluvial aquifer would be significant if, as a result of any of the activities proposed in the alternatives, contaminant levels increase so that the perched groundwater no

longer meets state and Federal standards. A significant beneficial impact could occur if contaminant levels were reduced below these standards.

There are still uncertainties about how waterborne contaminants interact with and move through rock fractures and the rock matrix into the regional aquifer below LANL. There also are uncertainties about the chemistry, volumes, and infiltration rates of liquid wastes from past releases into the canyon bottoms and onto disturbed ground at the MDAs. LANL will be conducting future data collection activities, along with further analysis of existing data, to better define the interaction between groundwater and the rock matrix. It is expected that the new data, coupled with improvements in numerical flow and transport models and calculation techniques, will enable better prediction of flow and transport of groundwater in the LANL region and more accurate definition of the ultimate impacts on the regional groundwater resources below LANL. This new information is being used to update the performance assessment and composite analysis for the Area G low-level radioactive waste disposal facility. Flow and transport of contaminants to the regional aquifer are discussed in more detail in the surface water and groundwater sections in Chapter 4 and in the hydrogeologic and numerical modeling sections in Appendix E. **Table 5–6** summarizes the expected groundwater impacts for each of the three alternatives.

Table 5–6 Summary of Environmental Consequences on Groundwater

	No Action Alternative	***Reduced Operations Alternative***	***Expanded Operations Alternative***
LANL Site			
	Construction and DD&D activities are unlikely to affect groundwater resources due to their short duration and the small quantity of contaminants that could be released and ultimately infiltrate to groundwater. Operations-related activities, including the planned reduction of LANL outfalls, would slightly reduce the transport of contaminants into the groundwater. No significant impacts to groundwater are expected to result in the short term. Long-term impacts to groundwater are not likely to be significant.	Similar to the No Action Alternative in terms of construction and DD&D activities. The long-term impacts of operations might be reduced by eliminating additional outfalls in the canyons.	Similar to the No Action Alternative plus: *MDA Remediation* – The effects of capping or removal of waste from MDAs would not appreciably change the rate of transport of contaminants presently in the vadose zone in the short term, but would likely reduce long-term contaminant migration and impacts on the environment.

DD&D = decontamination, decommissioning, and demolition; MDA = material disposal area.

5.3.2.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

The No Action Alternative would continue current operations. Therefore, there would be little change in the flow of contaminants to the alluvial or regional groundwater as a result of the No Action Alternative. Proposed construction and demolition activities are unlikely to affect the groundwater resource due to their short duration and the small quantity of contaminants that could be released and ultimately infiltrate to underground water resources. As described in Section 5.8.2.1, under the No Action Alternative, 388 million gallons (1,469 million liters) per year of groundwater would be used, which is within the range of LANL's water use over the last 7 years (see Section 4.8.2.3), and within the LANL annual water use ceiling quantity of

542 million gallons (2,050 million liters). Therefore, additional impacts to water levels in the regional aquifer are not expected.

Groundwater is unlikely to be adversely affected in the short term by the No Action Alternative because discharges of liquid effluent have been curtailed substantially compared to past operations, and solid radioactive waste disposal on the mesa tops takes many years to affect the regional aquifer. As discussed in Section 5.3.1, discharges resulting from LANL operations are monitored to ensure that effluents to surface waters are kept below regulatory limits. In addition, as discussed in Section 4.3.2, groundwater is monitored to ensure that instances of contamination are investigated, understood, and mitigated, and that existing contamination does not impact drinking water sources.

Long-term impacts to groundwater are complex and require modeling to predict potential contaminant migration thousands of years in the future. At the waste disposal locations on the mesa tops, dry conditions coupled with porous flow and transport result in slow, unsaturated flow and contaminant transport. Annual net natural infiltration rates for dry mesas are estimated to be less than 0.4 inches per year (10 millimeters per year), and more often are estimated to be closer to 0.04 inches per year (1 millimeter per year) or less. Under these conditions, travel times for contaminants percolating downward beneath the plateau to the regional aquifer are expected to be several hundred to thousands of years. Site disturbance, however, can alter the speed of water moving through the vadose zone (Birdsell et al. 2005).

Although a sitewide groundwater model is still under development, groundwater modeling was performed for a performance assessment and composite analysis prepared for radioactive waste disposal at Area G (LANL 1997a). The impacts analysis assumed the continued existence of the interim covers currently covering the waste disposal units. The groundwater protection analysis analyzed performance over a period of 10,000 years to provide reasonable assurance that the groundwater protection performance objective could be met. The model predicted that there would be no offsite doses from the groundwater pathway during the institutional control period because no radionuclides were transported beyond the current LANL boundary within 100 years. Groundwater ingestion doses projected in the performance assessment were small, with only three contributing radionuclides (carbon-14, technetium-99, and iodine-129). The peak annual dose at 330 feet (100 meters) downgradient from Area G was 1.4×10^{-5} millirem at 4,000 years. The peak annual dose at the Pajarito Canyon location was 4.5×10^{-5} millirem at 700 years. These peak annual doses are well below the 4 millirem per year standard for groundwater protection (LANL 1997a).

Under the No Action Alternative, MDA H would be closed. The DOE-preferred closure option was to close MDA H in place and cover it with an engineered evapotranspiration cover that would be designed, constructed, and maintained to limit infiltration and slow contaminant migration from the MDA. The environmental assessment (EA) for the proposed corrective measures at MDA H concluded that neither surface nor groundwater quality would be adversely affected over the next 1,000 years (DOE 2004e). In its selection of a corrective remedy, the New Mexico Environment Department acknowledged that an evapotranspiration cover would be effective in reducing or limiting the amount of water that would percolate into the shafts under design conditions, but had concerns about the potential for intrusion into the waste by deep-rooted plants and burrowing animals, and for groundwater contamination from volatile organic

compounds and tritium in soil pore gas. The selected remedy therefore requires complete encapsulation of the disposal shafts, installation of an engineered evapotranspiration cover, and installation of a soil vapor extraction system (NMED 2007b).

5.3.2.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Most impacts to groundwater resources occurring under the No Action Alternative would also occur under the Reduced Operations Alternative. Impacts might be reduced by elimination of some outfalls to the canyons and reduction of water supply well withdrawals, but no quantitative estimate of the impact of these reductions can be made.

5.3.2.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Impacts to groundwater resources occurring under the No Action Alternative would be similar to those under the Expanded Operations Alternative. Direct and indirect impacts to groundwater resulting from the proposed construction and operations under the Expanded Operations Alternative also would be similar, but greater than those described for the No Action Alternative. As described in Section 5.8.2.3, under the Expanded Operations Alternative 522 million gallons (1,980 million liters) per year of groundwater would be used, which would be greater than the range of LANL's water use over the last 7 years (Section 4.8.2.3), but within the range of LANL's water use over the last 14 years (LANL 2003h). Water use under the Expanded Operations Alternative would be within the LANL annual water use ceiling quantity of 542 million gallons (2,050 million liters). Therefore, impacts to water levels in the regional aquifer would be within historical levels.

Increased pit production under the Expanded Operations Alternative would have little to no impact on groundwater resources. Although increased pit production would generate larger volumes of waste liquids than those projected for the No Action Alternative, for either alternative the waste liquids would be processed at the Liquid Radioactive Waste Treatment Facility in TA-50. Treated liquid effluent from the Liquid Radioactive Waste Treatment Facility would be discharged from an NPDES-permitted outfall. Alternatively, under a proposed auxiliary action, discharge of liquid effluents from the Radioactive Liquid Waste Treatment Facility would be eliminated by the construction and use of evaporation tanks (see Appendix G, Section G.4).

Possible impacts to groundwater resources will be addressed as part of any required corrective measure evaluation performed for MDAs and other PRSs in accordance with the Consent Order. A corrective measure evaluation for an MDA would consider both capping and removal, two bounding options for MDA remediation that were considered in Appendix I. LANL management would recommend remedies for each MDA (or other PRSs subject to the Consent Order), and the New Mexico Environment Department would determine the remedy to be applied. A corrective measure evaluation performed for MDA G in TA-54 would be coordinated with an update to the performance assessment and composite analysis that is currently being prepared. In addition to providing more recent information about the site and the contents of the disposal units, this

update would consider the application of a final cover over the disposal units. Once the new performance assessment and composite analysis becomes available, the results will be reviewed in accordance with the NEPA process, and the SWEIS impact analyses will be reviewed and supplemented as necessary.

The effects of either the Capping or the Removal Option would not appreciably affect the rate of transport of contaminants presently in the vadose zone in the near term, but would likely reduce long-term migration of contaminants and corresponding impacts on the environment from wastes present in the MDAs. Under the MDA Capping Option, where engineered barriers are used to cap MDAs, the covers would be designed, constructed, and maintained to limit infiltration. Over the long term, the covers, by limiting infiltration, would slow contaminant migration from the MDAs. Under the MDA Removal Option, excavation and removal of the waste and contaminated soil and rock would eliminate nearly all of the source term. The filled, compacted excavation, however, may still experience larger infiltration rates than undisturbed areas, which might further drive migration of deeper contaminants that are beyond the reach of conventional excavation. Under either MDA remediation option, impacts to the regional aquifer would likely be small, as described under the No Action Alternative.

5.4 Air Quality and Noise

5.4.1 Nonradiological Impacts

Air pollution refers to the direct or indirect introduction of any substance into the air that could:

- endanger human health,
- harm living resources and ecosystems,
- damage material property, or
- impair or interfere with the comfortable enjoyment of life and other legitimate uses of the environment.

For the purpose of this SWEIS, only outdoor air pollutants were addressed. These may be in the form of solid particles, liquid droplets, gases, or a combination of forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants or by reaction with normal atmospheric constituents that may be influenced by sunlight). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Thus, air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location can be described by comparing the concentrations of various pollutants in the atmosphere with the appropriate standards. Ambient air quality standards have been established by Federal and state agencies to ensure an adequate margin of safety for the protection of public health and welfare from the adverse effects of pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy; those below such standards are generally considered acceptable.

The pollutants of concern are primarily those for which Federal and state ambient air quality standards have been established, including criteria air pollutants, hazardous air pollutants, and other toxic air pollutants. Criteria air pollutants are those listed in National Primary and Secondary Ambient Air Quality Standards (40 *Code of Federal Regulations* [CFR] Part 50). Hazardous air pollutants are those listed in Title I of the Clean Air Act, as amended (Title 40 of the *United States Code*, Section 7401 *et seq.* [40 U.S.C. 7401 *et seq.*]) and those regulated by the National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61). Toxic air pollutants are considered to be those that have been proposed or adopted for regulation by the applicable state or are listed in state guidelines or permit regulations for toxic air pollutants. States may set ambient standards that are more stringent than the National Ambient Air Quality Standards. The more stringent of the state or Federal standards are shown in this document.

Potential air quality impacts of criteria pollutant emissions from construction, normal operations, and DD&D activities were evaluated for each alternative. This assessment included a comparison of pollutant concentrations under each alternative with applicable Federal and state ambient air quality standards. Operational air pollutant impacts were evaluated for combustion sources using the facility-wide analysis prepared for the LANL operating permit, as described in Appendix B. The analysis is based on the potential emissions from each source, and the results bound the potential impacts associated with the alternatives addressed in this SWEIS. Potential differences among these results are discussed for each alternative. The analysis included the following emission sources: air curtain destructors; TA-60 asphalt plant; four TA-16 boilers; three TA-48 boilers; two TA-53 boilers; two TA-55 boilers; two TA-59 boilers; TA-50 boiler; carpenter shops at TA-15 and TA-3; TA-33 generator; TA-52 paper shredder; TA-3 power plant; rock crusher; TA-21 steam plant; TA-9 boiler; and TA-35 boiler. The analysis was based on allowable facility-wide emission limits proposed in the permit application. Emissions were presented in the application for individual sources or for source groups. The emissions used in the analysis are conservative. For example, for the TA-3 boilers, the fuel with the highest emissions was assumed and all three boilers were assumed to operate simultaneously; normally only two boilers are operated at the same time (Jacobson, Johnson, and Rishel 2003). Also, air curtain destructors have been removed from operation at LANL. The impacts of criteria pollutant emissions from construction activities for various projects were evaluated using engineering estimates of emissions from site preparation and building erection activities and modeled using the Industrial Source Complex Short Term (ISCST3) dispersion model, as discussed in Appendix B.

The approach used to evaluate chemical air pollutants in the *1999 SWEIS* is based on the use of screening level emission values to identify chemicals that would be evaluated in more detail. Screening level emission values are conservatively estimated hypothetical emission rates for each of the toxic air pollutants that could be emitted from each of LANL's TAs and would not result in air quality levels that are harmful to human health under current or future conditions. These screening level emission values were compared with conservatively estimated pollutant emission rates on a TA-by-TA basis to determine the potential air quality impacts of toxic air pollutants from LANL operations. Any pollutant that could contravene a guideline value was subject to evaluation in the health and ecological risk assessment process. This approach is described in more detail in Appendix B. **Table 5–7** summarizes the expected nonradiological air quality impacts for each of the three alternatives.

Table 5–7 Summary of Environmental Consequences on Nonradiological Air Quality

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	General – Minor impacts from construction-type activities would occur primarily in the form of fugitive dust. *Land Conveyance and Transfer* – Very minor increases in air pollutant emissions could result from increases in commute distances. *Electrical Power System Upgrades and Security Perimeter Project* – Minor air quality impacts would result from construction. *Wildfire Hazard Reduction Program* – Minor emissions would result from activities. *Disposition of Flood and Sediment Retention Structures* – Minor emission would result from activities. *Trails Management Program* – Minor air quality impacts.	Same as No Action Alternative	Same as No Action Alternative, plus: – Minor air quality impacts would result from road, bridge, and walkway construction under the Security-Driven Transportation Modifications Project. – Minor increases in vehicle emissions could result from use of the new roads and would occur in new locations. – Minor to moderate air quality impacts would result from remediating MDAs and other PRSs. – Minor increase in air pollutant emissions from increased commuter vehicles and waste and materials shipments.
Affected Technical Areas			
TA-3	– Minor change in air quality impacts from operation of new turbine generators. – Minor air quality impacts from constructing three new office buildings. – Minor operation air quality impacts from new office buildings.	Same as No Action Alternative	Same as No Action Alternative, plus: – Minor construction air quality impacts from constructing additional office buildings and the Physical Science Research Complex.
TA-21	No change in air quality impacts.	Same as No Action Alternative	Minor construction-type air quality impacts from DD&D of structures.
TA-54	Minor air quality impacts would result from MDA closure activities. Some reductions in emissions could result from closure.	Same as No Action Alternative	Minor construction-type air quality impacts from construction of new buildings and DD&D of old structures.
TA-72	No change in air quality impacts.	Same as No Action Alternative	– Minor construction-type air quality impacts from constructing the Remote Warehouse and Truck Inspection Station. – Potential decrease in emissions from reduced delivery trips.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Key Facilities			
Chemistry and Metallurgy Research Building (TA-3, TA-48, and TA-55)	Minor air quality impacts from construction of new facility at TA-55.	Smaller air quality impacts from reduced construction scope.	Same as No Action Alternative
High Explosives Processing Facilities	Minor construction-type impacts from TA-16 Engineering Complex and demolition of structures. No change in operations air quality impacts.	Same as No Action Alternative for construction. Minor reduction in operations air quality impacts from 20 percent reduction in activities.	Same as No Action Alternative for construction. Minor increase in operations air quality impacts may be indicated by increased mock explosives use.
High Explosives Testing Facilities	No change in operation air quality impacts. Minor construction impacts from construction of 15 to 25 new structures (new offices, laboratories, and shops) within the TA-22 to replace about 59 structures currently used for dynamic experimentation operations and removal or demolition of vacated structures.	Reduction in operation air quality impacts from 20 percent reduction in activities. Same as No Action Alternative for construction.	Same as No Action Alternative
Tritium Facilities (TA-21)	No change in air quality impacts.	Same as No Action Alternative	– Minor construction-type air quality impacts from DD&D of all TA-21 tritium buildings as part of the project to decommission all of TA-21. – Minor reduction in operational emissions from shutdown of boilers under the complete DD&D option.
Pajarito Site (TA-18)	No change in air quality impacts.	Minor reduction in operation air quality impacts from shutdown of activities.	– Minor reduction in operation air quality impacts from shutdown of activities. – Minor construction-type air quality impacts from DD&D of TA-18 buildings.
Bioscience Facilities	No change in air quality impacts.	Same as No Action Alternative	– Minor change in operation impacts with transfer of the Bioscience Facilities operations to the new Science Complex location. – Minor construction air quality impacts from construction of the new Science Complex and associated DD&D actions.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Radiochemistry Facility (TA-48)	No change in air quality impacts.	Same as No Action Alternative	Same as No Action Alternative for operation. – Minor construction air quality impacts from construction of the new Radiological Sciences Institute with construction of the Institute for Nuclear Nonproliferation Science and Technology (see Appendix G) and associated DD&D actions.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in air quality impacts.	Same as No Action Alternative	Same as No Action Alternative for operation. – Minor construction air quality impacts from construction of a replacement for the existing Radioactive Liquid Waste Treatment Facility at TA-50 (see Appendix G) and DD&D of the existing Radioactive Liquid Waste Treatment Facility.
LANSCE (TA-53)	No change in air quality impacts.	Reduction in air quality impacts from shutdown of LANSCE operations.	Negligible to minor air quality impacts from refurbishment.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in air quality impacts.	Same as No Action Alternative	Minor air quality impacts from retrieving transuranic waste from below ground storage. – Minor air quality impacts from construction of a new TRU Waste Facility and new access control station, low-level radioactive waste compactor building, low-level radioactive waste certification building, and associated DD&D actions.
Plutonium Facility Complex (TA-55)	No change in air quality impacts.	Same as No Action Alternative	Same as No Action Alternative for operation. – Minor air quality impact from facility modifications in support of increased pit production rate and the Plutonium Facility Complex Refurbishment Project, and constructing radiography capabilities (see Appendix G). – Positive air quality impact from chiller replacement and steam system subproject; improved regulatory compliance with stack replacement.

MDA = material disposal area; PRS = potential release site; TA = technical area; DD&D = decontamination, decommissioning, and demolition; LANSCE = Los Alamos Neutron Science Center.

The National Emission Standard for Hazardous Air Pollutants for Asbestos, 40 CFR Part 61, Subpart M, requires that LANL provide advance notice to the New Mexico Environment Department for large renovation jobs that involve asbestos and for all demolition projects. The asbestos National Emission Standard for Hazardous Air Pollutants further requires that all activities involving asbestos be conducted in a manner that mitigates visible airborne emissions and that all asbestos-containing wastes be packaged and disposed of properly. LANL would be required to meet these requirements for all demolition and renovation projects as applicable to minimize the risk of asbestos exposure to the public and employees. For example, the contractor performing the demolition or renovation would employ techniques such as wetting of asbestos or the use of plastic tents to contain and capture asbestos and other airborne particulates during removal.

5.4.1.1 No Action Alternative

This section describes the estimated nonradiological air quality impacts from LANL operations under the No Action Alternative. Radiological air emissions and their impacts on human health are discussed in Sections 5.4.2 and 5.6.1, respectively.

Los Alamos National Laboratory Site-Wide Impacts

Minor impacts on nonradiological air quality would occur from construction-type activities related to previously approved projects, including construction of the electrical power system upgrades, Wildfire Hazard Reduction Program activities, disposition of flood and sediment retention structures, activities related to the Trails Management Program, mechanical and manual Wildfire Hazard Reduction Program activities, and construction related to the Security Perimeter Project. These projects would result in temporarily elevated concentrations of criteria air pollutants, especially fugitive dust from heavy equipment activity.

Analysis of criteria pollutant emissions from facilities at LANL was performed to obtain the LANL Title V operating permit. The results of this analysis were used to bound the potential impacts associated with the alternatives addressed in this SWEIS. The modeling results demonstrate that the simultaneous operation of LANL's air emission sources at maximum capacity, as described in the Title V permit application, would not exceed any state or Federal ambient air quality standards (Jacobson, Johnson, and Rishel 2003). These results are presented in **Table 5–8**. All of the equipment at the TA-3 Co-Generation Complex (TA-3 Power Plant), including the three existing boilers, the new combustion turbine generator, and an additional combustion turbine generator that would be constructed in the 2007 to 2013 timeframe, would operate within the nitrogen oxides and carbon monoxide emissions analyzed (Jacobsen, Johnson, and Rishel 2003; DOE 2002l). The air quality permit limits co-generation complex emissions to (93.4 tons [84.7 metric tons] per year for nitrogen oxides and 61.1 tons [55.4 metric tons] per year for carbon monoxide (NMED 2006a).

For criteria pollutants, the concentrations from No Action Alternative operations would be smaller than those shown in the operating permit and well below the ambient standards established to protect human health with an adequate margin of safety. Criteria pollutant emissions under the No Action Alternative are expected to continue to have minor impacts on human health.

Table 5–8 Facility-Wide Criteria Pollutant Impacts

Pollutant	*Time Period*	*Maximum Estimated Concentrations (micrograms per cubic meter)*	*New Mexico Controlling Ambient Air Quality Standards* [a] *(micrograms per cubic meter)*
Carbon monoxide	8 hours 1 hour	192.4 1,071	7,900 11,900
Nitrogen dioxide	Annual 24 hours	7.0 40.2	75 150
Sulfur dioxide	Annual 24-hours 3-hours	10.2 83.5 397.3	42 209 1,050
Total suspended particulates	Annual 24-hours	5.7 135.0	60 150
PM_{10}	Annual 24-hours	5.24 101.6	50 150

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

[a] New Mexico Ambient Air Quality standards for pollutants other than particulate matter are stated in parts per million. These values were converted to micrograms per cubic meter, with appropriate corrections for temperature and pressure (elevation) following New Mexico Dispersion Modeling Guidelines (NMAQB 2003). PM_{10} standards are the National Ambient Air Quality Standards (40 CFR Part 50). The annual PM_{10} standard has recently been revoked (71 *Federal Register* [FR] 61143).

Source: Jacobson, Johnson, and Rishel 2003.

Similarly, for toxic and hazardous air pollutants, the bounding analyses (based on the emission rates evaluated in the *1999 SWEIS*) indicate that the pollutant emissions that could exceed the guideline values used in the analysis to screen emission rates were:

- Emissions from High Explosives Firing Site operations at TA-14, TA-15, TA-36, TA-39, and TA-40 (DOE 1999a). The estimated concentration of a pollutant would be greater than its guideline value for the following releases:
  - Depleted uranium, beryllium, lead, aluminum, copper, tantalum, tungsten, and iron from TA-15;
  - Depleted uranium, beryllium, lead, copper, and iron from TA-36;
  - Beryllium, lead, aluminum, and copper from TA-39;
  - Depleted uranium and lead from TA-14; and
  - Copper from TA-40.
- Additive emissions from all of the pollutants from all TAs on receptor sites located near the Los Alamos Medical Center (DOE 1999a).

In the *1999 SWEIS*, emissions from High Explosives Testing Facilities operations under the No Action Alternative were projected to be the same as the emissions projected under the Expanded Operations Alternative; this projection is similar to anticipated emissions from High Explosives Testing Facilities operations under the No Action Alternative in this SWEIS. Emissions from High Explosives Testing Facilities operations are shown in **Table 5–9**.

Table 5–9 Estimated Emission Rates of the Pollutants that Could Be Released from High Explosives Testing Facilities

TAs with High Explosives Testing Operations [a]	*Pollutants that Could Be Released During Testing Operations*	*Estimated Maximum Amount of Material that Would Be Used During Testing Operations* [b]	*Estimated Respirable Fraction Release Rate*		
			Annual Rate [b]	*8-Hour Respirable Release Rate* [c]	
		(kilograms per year)	*(kilograms per year)*	*(kilograms)*	*(grams)* [d]
TA-14	Depleted Uranium	31.4	3.1	0.267	267
	Lead	31.4	3.1	0.267	267
TA-15	Depleted Uranium	2,700	270.0	23.0	23,000
	Beryllium	30	3.0	0.256	256
	Lead	150	15.0	1.28	1,280
	Aluminum	450	45.0	3.83	3,830
	Copper	300	30.0	2.56	2,560
	Tantalum	300	30.0	2.56	2,560
	Tungsten	300	30.0	2.56	2,560
	Iron	150	15.0	1.28	1,280
TA-36	Depleted Uranium	1,200	120.0	10.2	10,200
	Beryllium	30	3.0	0.256	256
	Lead	30	3.0	0.256	256
	Aluminum	30	3.0	0.256	256
	Copper	30	3.0	0.256	256
	Tantalum	30	3.0	0.256	256
	Tungsten	30	3.0	0.256	256
	Iron	150	15.0	1.28	1,280
TA-39	Beryllium	30	3.0	0.256	256
	Lead	30	3.0	0.256	256
	Aluminum [e]	45,000	4,500.0	383	383,000
	Copper [e]	45,000	4,500.0	383	383,000
	Tantalum	30	3.0	0.256	256
	Tungsten	30	3.0	0.256	256
	Iron [e]	30,000	3,000.0	256	256,000

TAs with High Explosives Testing Operations [a]	*Pollutants that Could Be Released During Testing Operations*	*Estimated Maximum Amount of Material that Would Be Used During Testing Operations* [b]	*Estimated Respirable Fraction Release Rate*		
			Annual Rate [b]	*8-Hour Respirable Release Rate* [c]	
		(kilograms per year)	*(kilograms per year)*	*(kilograms)*	*(grams)* [d]
TA-40	Aluminum	240	24.0	2.04	2,040
	Copper	300	30.0	2.56	2,560
	Tantalum	90	9.0	0.767	767
	Tungsten	30	3.0	0.256	256
	Iron	60	6.0	0.511	511

TA = technical area.

[a] High explosives testing operations involve detonations of explosives at TA-14, TA-15, TA-36, TA-39, and TA-40. Particulate emissions released into the atmosphere due to detonation of high explosives contain bonded metal emissions in respirable form.

[b] Respirable release rates were estimated based on the assumption that this fraction is 10 percent of the amount of material exploded.

[c] The total 8-hour respirable release rates (in kilograms), as a result of these operations, were estimated using the scale factor of 0.085.

[d] The total amount of material released, in grams, was used in dispersion analysis to estimate 1-hour average concentrations at specified receptor locations.

[e] These quantities are dominated by the support structures constructed for tests. These structures in actuality are not expended in explosive tests and do not contribute to test air emissions.

Note: To convert kilograms to pounds, multiply by 2.2046; grams to ounces, multiply by 0.035274.

Source: DOE 1999a.

These emissions were estimated to result in air pollutant concentrations that are larger than guidance values, indicating that a human health analysis should be performed. The human health analysis (Section 5.6.2) showed that the nonradiological pollutants released from LANL High Explosives Testing Facilities operations under the No Action Alternative are not expected to cause air quality impacts that would affect human health. Although not considered in the analysis, recent use of foam to suppress emissions from high explosives tests involving beryllium has reduced emissions from these shots by 50 to 95 percent. This reduction meets the requirements of Phase I of the Phased Containment Option outlined in the *Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement* (DOE 1995a). Increased use of foam and vessels for explosives testing is expected to reduce these emissions further (LANL 2006a).

A minor increase in vehicle emissions could result from development that occurs as a result of conveyance and transfer of land. This increase is not expected to produce concentrations of pollutants that would threaten human health.

An increase in truck traffic from management of construction fill could increase vehicle emissions. This increase is not expected to produce concentrations of pollutants that would affect human health.

Emissions from beryllium sources at TA-3 and TA-55 are controlled by high-efficiency particulate air (HEPA) filtration with a removal efficiency of 99.95 percent. These emissions were analyzed in the *1999 SWEIS* using the annual emission rates shown in **Table 5–10**, which were estimated based on the existing permit applications. The results of the analysis with regard to public health are discussed in Section 5.6.2.

Table 5–10 Beryllium Annual Emission Rates Associated with Technical Area 3 and Technical Area 55 Facilities

Emission Source	*Annual Permitted Emission Rate*	
	Pounds per Year	*Grams per Second*
TA-3 Building 141 (Beryllium Technology Facility)	0.11	1.58×10^{-6}
TA-55 FE-15	0.003	4.32×10^{-8}
TA-55 FE-16	0.0042	6.05×10^{-8}

TA = technical area.
Source: DOE 1999a.

Technical Area Impacts

Minor construction-related nonradiological air quality impacts would occur from construction of new office buildings at TA-3 and MDA H closure activities at TA-54. The new turbine generator at TA-3 would operate within the emission combustion limits specified in the air quality permit for the TA-3 Co-Generation Complex (DOE 2002l) and analyzed in the facility-wide air quality impact analysis; minor operations-related air quality impacts would be expected.

Key Facilities Impacts

Minor nonradiological air quality impacts would occur from construction of the Chemistry and Metallurgy Research Replacement Facility at TA-55, completion of the TA-16 Engineering Complex, demolition of structures at TA-16, construction of new buildings at the consolidated Twomile Mesa Complex within TA-22, and demolition of unneeded structures nearby, as described below.

Operation of new buildings including the Chemistry and Metallurgy Research Replacement Facility, TA-16 Engineering Complex, various new structures for dynamic experiment operations, and a new dynamic experimentation structure at TA-15 would not be expected to increase emissions of criteria pollutants because a comparable amount of space would be removed through DD&D, resulting in a comparable reduction in emissions. Emissions related to these facilities primarily are associated with heating facilities and providing electric power.

Chemistry and Metallurgy Research Building

Operation of the Chemistry and Metallurgy Research Replacement Facility at TA-55 would result in additional periodic testing of emergency generators at that location instead of at TA-3. This change in operations would likely result in minor impacts on air pollutant concentrations at the site boundary. Criteria pollutant concentrations at the site boundary estimated for generator testing are shown in **Table 5–11**.

Table 5–11 Air Quality Concentrations from Chemistry and Metallurgy Research Replacement Facility Generator Testing at Technical Area 55 [a]

Pollutant	*Averaging Period*	*Maximum Incremental Concentration (micrograms per cubic meter)*
Carbon monoxide	8 hours 1 hour	53.2 239
Nitrogen dioxide	Annual 24 hours	0.0182 45.1
Sulfur dioxide	Annual 24 hours 3 hours	0.0113 28.1 207
Total suspended particulates	Annual 24 hours	0.001 2.43
PM_{10}	Annual 24 hours	0.001 1.39

PM_{10} = particulate matter less than or equal to 10 microns in diameter.
[a] The annual concentrations were analyzed at locations to which the public has access – the site boundary and nearby sensitive areas. Short-term (24 hours or less) concentrations were analyzed at the site boundary and at the fence line of the technical area where the public has temporary access. As access to the TA-55 fenceline has been restricted since the EIS for this facility was prepared, the short-term concentrations in public areas would be less.
Source: DOE 2003d.

Plutonium Facility Complex

Operations at TA-55 to produce 20 pits per year would represent about 25 percent of the 80-pits-per-year production rate analyzed in the *1999 SWEIS* for the Expanded Operations Alternative. Emission estimates for the Plutonium Facility Complex for 2005 included about 0.12 tons

(0.11 metric tons) per year of air pollutants from chemical use, about 1 percent of the 14.6 tons (13.2 metric tons) per year evaluated in the *1999 SWEIS* (DOE 1999a, LANL 2006g). Most of the estimated emissions are hydrochloric and nitric acids from plutonium recovery operations for the complex and are not directly associated with the level of pit production; the impacts of chemical air pollutant emissions under the No Action Alternative would be less than analyzed.

5.4.1.2 Reduced Operations Alternative

The same nonradiological air quality impacts anticipated to result from activities associated with the No Action Alternative also would occur under the Reduced Operations Alternative, except for those actions specific to the Reduced Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Minor impacts on air quality would occur from construction-related activities on previously approved projects, as discussed for the No Action Alternative. No new construction impacts on air quality would result from implementing the Reduced Operations Alternative.

For criteria pollutants, overall emission rates for the Reduced Operations Alternative would likely be lower than those for the No Action Alternative due to cessation of operations at TA-18 and shutdown of LANSCE. The boilers at TA-53 represent emissions of less than 1 percent of the emissions from facilities at LANL. Although it is unlikely that these boilers would be completely shut down if LANSCE were shut down, use of these boilers would be reduced and would result in a small reduction in pollutant emissions. Criteria pollutant emissions under the Reduced Operations Alternative are expected to result in concentrations below the ambient standards and to have minor impacts on human health.

There would be fewer high explosives experiments each year under the Reduced Operations Alternative than under the No Action Alternative, which would reduce overall emissions. As discussed in the No Action Alternative (Sections 5.4.1.1 and 5.6.2.1), reducing emissions from these activities would result in toxic air pollutant concentrations that would not be expected to cause air quality impacts that would affect human health.

Under the Reduced Operations Alternative, chloroform use would be similar to the usage level projected under the No Action Alternative. As discussed for the No Action Alternative, this usage level would result in emissions of chloroform that would not be expected to cause air quality impacts that would affect human health.

Based on the information discussed above, release of air pollutants as projected under the Reduced Operations Alternative would not be expected to cause air quality impacts that would affect human health and the environment.

Technical Area Impacts

Construction- and operations-related air quality impacts from the TAs under the Reduced Operations Alternative would be the same as those under the No Action Alternative, except as described below in relation to Key Facilities.

Key Facilities Impacts

Under the Reduced Operations Alternative, construction-related nonradiological air quality impacts from Key Facilities generally would be the same as those under the No Action Alternative; however, there would be slightly reduced construction-related nonradiological air quality impacts because of the reduced scope of construction for the Chemistry and Metallurgy Research Replacement Facility.

Chemistry and Metallurgy Research Building

Emissions of criteria and toxic air pollutants would continue at TA-3 from operation of boilers, emergency diesel generators, and other activities at TA-3, including operation of the Chemistry and Metallurgy Research Building for a period of time. Emissions would be smaller than those estimated for the Expanded Operations Alternative in the *1999 LANL SWEIS*, which were projected to remain within Federal and State standards for ambient air concentrations.

High Explosives Processing and High Explosives Testing Facilities

A minor decrease in operational impacts would be expected from reducing high explosives testing and processing activities by 20 percent. This could result in a reduction of about 0.01 tons (0.015 metric tons) per year of air pollutant emissions from high explosives testing and 0.05 tons (0.05 metric tons) per year from high explosives processing.

Los Alamos Neutron Science Center

Implementing the Reduced Operations Alternative for LANSCE at TA-53 would shut down that facility, reducing emissions from the TA-53 boilers.

Pajarito Site

Shutdown of operations at the Pajarito Site (TA-18) also would reduce emissions, which would have a minor positive affect on overall air quality.

5.4.1.3 Expanded Operations Alternative

The same nonradiological air quality impacts that would result from activities associated with the No Action Alternative also would occur under the Expanded Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Under the Expanded Operations Alternative, there would be emissions of criteria, toxic, and hazardous air pollutants, including fugitive dust, from construction activities at LANL. These emissions would be short-term for any particular project, but could be ongoing for a longer term as various facilities are constructed, demolished, and closed. In addition to emissions resulting from the construction activities described for the No Action Alternative, there would be temporary increases in air pollutant concentrations at the site boundary and along roads to which the public has access due to construction of new buildings in various TAs; DD&D of buildings; road, bridge, and walkway construction under the Security-Driven Transportation Modifications Project; and MDA remediation (as described in Appendix I). These impacts, apart from

MDA activities, would be similar to the impacts of other recent construction-related activities at LANL. Emissions of fugitive dust from these activities would be controlled with water sprays, application of soil stabilizers, and other controls as appropriate. The maximum ground-level concentrations offsite and along roads to which the public has regular access would be below the ambient air quality standards, except for possible short-term concentrations of nitrogen oxides and carbon monoxide for certain projects that could occur near the site boundary. Appropriate management controls and scheduling would be used to minimize impacts on the public and to meet regulatory requirements. The impact on the public would likely be minor.

The MDA Capping and Removal Options would require the use of heavy equipment that would result in additional air pollutant emissions, including criteria and hazardous pollutants. At some locations, these activities would be of longer duration than typical construction activities at LANL and would involve extensive movement of materials. Estimated emissions from these activities are presented in Appendix I. Particulate matter would be dispersed into the air from grading, earthmoving, and compaction at the MDA sites and at the borrow pit from which capping material or fill is excavated. These emissions have been estimated to be considerable and could result in minor to moderate increases in short-term concentrations of criteria pollutants near the MDA activities. In some cases, these estimated concentrations would occur near the site boundary and nearby residences and businesses. For example, based on the schedule and remediation methods assumed in Appendix I for the Removal Option at TA-21 (MDAs A, B, T, and U), estimated concentrations at the site boundary near the Los Alamos townsite would be above the 1-hour ambient standard for carbon monoxide and the 24-hour standard for nitrogen dioxide. In addition, for the Removal Option at TA-54 (MDA G), the estimated concentrations at the site boundary near White Rock would be above the 1-hour and 8-hour ambient standards for carbon monoxide and the 24-hour and annual standards for nitrogen dioxide. The contribution to concentrations of particulate matter less than or equal to 10 microns in diameter (PM_{10}) from the Removal Option at MDA G could result in concentrations greater than 80 percent of the ambient standard. Concentrations under the Capping Option at MDA G would be about 8 percent of those under the Removal Option. Overall emissions from heavy equipment for the Removal Option were estimated to be more than 10 times those for the Capping Option. The Removal Option would greatly reduce or eliminate long-term release of volatile organic compounds from the MDAs. Particulate emissions would be controlled using standard dust control measures such as water sprays or through use of an enclosure. Other emissions would be reduced by management controls and scheduling to minimize impacts on the public and to meet regulatory requirements.

Changes in LANL operations proposed under the Expanded Operations Alternative, including relocation of existing operations, reinvestment in and refurbishment of existing facilities, and new operations or levels of operations, would not result in emissions beyond the level evaluated for the facility-wide air quality impact analysis (see Section 5.4.1.1). The results of the analysis bound the impacts of the Expanded Operations Alternative, and the highest estimated concentration of each pollutant would be below the ambient air quality standards and would likely have minor impacts on human health.

The impacts of toxic and hazardous air pollutants were assessed for this SWEIS based on analysis of the *1999 SWEIS* Expanded Operation Alternative. In all but two cases, the estimated pollutant concentrations would be below the corresponding guideline values established for the

analysis in the *1999 SWEIS*. Guideline values are the levels established to identify chemicals for further analysis. The two cases where estimated emission rates would be above guideline values (which were referred to the human health and ecological risk assessment processes for further analysis) were High Explosive Testing Facilities operations and additive emissions from all pollutants from all TAs on receptor sites located at or near the Los Alamos Medical Center.

Operational nonradioactive air pollutants released under the Expanded Operations Alternative in this SWEIS would not be expected to cause air quality impacts that would affect human health and the environment (see Sections 5.4.1.1 and 5.6.2). In addition, if activities from the Bioscience Facilities were moved to the new Science Complex, the impacts resulting from LANL operations on receptor sites located near the Los Alamos Medical Center would likely be reduced.

Minor changes in vehicle emissions could result from activities under the Security-Driven Transportation Modifications Project. A small increase from shuttle bus emissions could be partially offset by a decrease from less use of personally owned vehicles.

Increased employment under the Expanded Operations Alternative of 2.2 percent per year could result in similar increases in LANL commuter vehicle emissions from additional employee vehicles commuting from Santa Fe and Rio Arriba County and other locations. The increase in employee vehicles and the increase in other vehicles resulting from the population increase that the state projects will occur would result in increases in vehicle emissions along the routes used to access the site. Along NM 30 the estimated increase in traffic levels during the 2007 through 2011 time period from increased operation and construction employee traffic would be about five percent over current traffic levels. Along NM 502 the estimated increase in traffic levels during the 2007 through 2011 time period from increased operation and construction employee traffic and shipments would be about six percent over current traffic levels. Similar increases in air pollutants emissions from traffic along these routes would be expected. The primary pollutants from commuter vehicles are hydrocarbons, carbon monoxide and nitrogen oxides. Elevated levels of carbon monoxide inhibit the blood's capacity to carry oxygen. Nitrogen oxides and hydrocarbons are contributors to the formation of ozone. Ozone damages lung tissue, aggravates respiratory disease, and makes people more susceptible to respiratory infections. As discussed in Section 4.4.2.1 the area around Los Alamos and most of New Mexico is designated as attaining for the National Ambient Air Quality Standards for carbon monoxide, nitrogen oxides, ozone, and the other criteria pollutants (40 CFR 81.332). Even with the continuing growth in population there has been a decreasing or steady trend in concentrations in the region of carbon monoxide, nitrogen oxides, and ozone. Carbon monoxide and nitrogen oxides concentrations are well below the ambient standards (EPA 2006a). The ambient standards are set to protect the public health and welfare.

Technical Area Impacts

Construction-related nonradiological air quality impacts would be the same as those for the No Action Alternative for specific TAs (TA-3, TA-21, and TA-54), except for additional temporary construction impacts from new office buildings and the Physical Science Research Complex at TA-3, minor construction impacts from DD&D of TA-18 buildings, and temporary construction-related impacts at the Science Complex and the Remote Warehouse and Truck

Inspection Station. Construction-related impacts would occur during daytime hours from construction equipment operations and fugitive dust generation.

Operational nonradiological air quality impacts from specific TAs (TA-3, TA-21, and TA-54) would be similar to those under the No Action Alternative. There would be potential decreases in emissions from reduced intrafacility vehicle trips related to the Science Complex and from reduced delivery trips resulting from construction of the new Remote Warehouse and Truck Inspection Station.

Key Facilities Impacts

Construction-related nonradiological air quality impacts from Key Facilities would be similar to those of the No Action Alternative. Minor temporary construction impacts would occur from DD&D of TA-21 buildings, DD&D of TA-18 buildings, construction of the new Science Complex, construction of the new Radiological Sciences Institute and the Institute for Nuclear Nonproliferation Science and Technology, construction of a replacement for the Radioactive Liquid Waste Treatment Facility at TA-50, DD&D of the existing Radioactive Liquid Waste Treatment Facility, retrieval of transuranic waste from belowground storage at the Solid Radioactive and Chemical Waste Facilities, construction of a new TRU Waste Facility and other buildings, and minor facility modifications and construction at TA-55.

Operation of new buildings, including those discussed under the No Action Alternative, the new Science Complex, the Radiological Sciences Institute, the Institute for Nuclear Nonproliferation Science and Technology, the replacement Radioactive Liquid Waste Treatment Facility, the new TRU Waste Facility, new office buildings at TA-3, and a new radiography facility at TA-55, would not be expected to increase emissions of criteria pollutants because a comparable amount of space would be removed through DD&D of the old buildings. These emissions primarily would be associated with heating of facilities and providing electric power. Plutonium Facility Complex Refurbishment activities such as stack upgrades, steam system upgrades, and chiller replacement would have positive impacts on air quality and regulatory compliance. Operational nonradiological air quality impacts from other Key Facilities would be the same under the Expanded Operations Alternative as those under the No Action Alternative.

High Explosives Processing Facilities

There could be a minor increase in operational impacts corresponding to the 2.5 percent increase in High Explosives Processing Facilities activity indicated by the increased use of mock explosives. This could result in an increase of about 0.03 tons (0.027 metric tons) per year of hazardous air pollutant emissions from increased safety and mechanical testing. These chemicals could include various chemicals listed under the New Mexico permit regulations on toxic air pollutants and emission (NMAC 20.2.72.502) such as dicyclopentadienyl iron, ethyl ether, iodine, isopropyl alcohol, nitric acid, dimethyl acetamide, potassium hydroxide, sulfuric acid, and VM&P Naphtha. Hazardous air pollutant emissions such as chloroform, hydrazine, and nitrobenzene are subject to the limits on hazardous air pollutant emissions in the LANL Title V permit.

Tritium Facilities

Operations-related emissions from three boilers at TA-21 would be eliminated, which would reduce Tritium Facilities emissions by as much as 1.6 tons (1.5 metric tons) per year of nitrogen oxides (about 3.1 percent of nitrogen oxides emissions at LANL); 0.12 tons (0.11 metric tons) of particulates, (about 2.4 percent of the LANL total); and 1.3 tons (1.2 metric tons) of carbon monoxide (about 3.8 percent of carbon monoxide emissions at LANL).

5.4.2 Radiological Air Quality Impacts

Impacts of the emission of radioactive constituents to the air from continued operations at LANL were evaluated in terms of the increased dose (above the dose from background radiation) and corresponding risk of a latent cancer fatality (LCF) to the population in the vicinity of LANL and to a nearby maximally exposed individual (MEI). This impacts assessment is presented in Section 5.6. The following assessment of radiological air quality impacts represents an intermediate step in developing the dose estimates. The impacts are presented here as the projected quantities of radionuclides emitted under each alternative.

Radioactive air emissions from LANL come from point sources, such as stacks and vents, as well as diffuse or nonpoint (area) sources. Although there are other minor contributors of radioactive emissions, the Key Facilities represent essentially all of the site emissions that are relevant to the calculation of doses to the population and an MEI. Specifically, a few Key Facilities and certain radionuclides dominate the human health effects. Therefore, this analysis focuses on radioactive air emissions from those facilities, including gaseous mixed activation products associated with LANSCE operations and tritium, plutonium, americium, and uranium emissions associated with other Key Facilities.

Table 5–12 summarizes the expected radiological air emissions for each of the three alternatives. Air emissions are summarized as total emissions for the site. A detailed presentation of the radionuclides emitted from each of the Key Facilities is included in Appendix C.

5.4.2.1 No Action Alternative

Key Facility Impacts

Under the No Action Alternative, radioactive air quality impacts at the LANL site-wide and TA levels are not discussed separately because they are accounted for in the following discussion of emissions from the Key Facilities. Radiological air emissions for the No Action Alternative generally are projected to remain at levels similar to those projected in the *1999 SWEIS* Expanded Operations Alternative.

Chemistry and Metallurgy Research Building

The Chemistry and Metallurgy Research Replacement Facility at TA-55 would be completed and become operational. With the exception of the Wing 9 hot cell, activities in the current Chemistry and Metallurgy Research Building in TA-3 would be moved into the new facility. As a result of a decision not to move certain capabilities to the Chemistry and Metallurgy Research Replacement Building, tritium is no longer projected to be a significant emission from this building.

Table 5–12 Summary of Annual Projected Radiological Air Emissions (curies per year)

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site [a]			
Tritium [b]	2,400	2,400	2,400 [c]
Americium-241	4.2×10^{-6}	4.2×10^{-6}	4.2×10^{-6} [d]
Plutonium [e]	0.00082	0.000092	0.00084 [d]
Uranium [f]	0.15	0.12	0.15
Particulate and Vapor Activation Products	30	0.014	30
Gaseous Mixed Activation Products	30,600	100 [g]	30,600 [g]
Mixed Fission Products [h]	1,650	1,650	1,650
Affected Technical Areas			
TA-21, TA-49, TA-50, TA-54 for major MDAs	Not applicable	Not applicable	Variable [i]

TA = technical area; MDA = material disposal area.

[a] These LANL site data include emissions from all Key Facilities. Radiological air emission data by Key Facility are presented in Appendix C.

[b] Includes both gaseous and oxide forms of tritium.

[c] Tritium emissions include 550 curies of tritium for TA-21 stacks. Emissions from TA-21 stacks were stopped in September 2006 as part of TA-21 shutdown activities. Decontamination, decommissioning, and demolition of TA-21 under the Expanded Operations Alternative would permanently eliminate this potential source of tritium release.

[d] Americium-241 emissions could increase to 1.1×10^{-5} curies per year and plutonium emissions to 0.00089 curies per year if the Decontamination and Volume Reduction System, the new TRU (Transuranic) Waste Facility (formerly the Transuranic Waste Consolidation Facility), and remote-handled transuranic waste retrieval and processing activities operated simultaneously (estimated to occur from 2012 through 2015).

[e] Includes plutonium-238, plutonium-239, and plutonium-240.

[f] Includes uranium-234, uranium-235, and uranium-238.

[g] Gaseous mixed activation product emissions would decrease by 100 curies per year after about 2009 due to the shutdown of TA-18 thereafter, resulting in zero emissions of gaseous mixed activation product for the Reduced Operations Alternative and 30,500 curies per year in the Expanded Operations Alternative.

[h] Mixed fission products include krypton-85, xenon-131m, xenon-133, and strontium-90.

[i] There would be additional emissions from the remediation of the larger MDAs. These emissions would depend on radionuclides present, whether an MDA is being capped or removed, the number of MDAs being remediated at one time, and whether exhumation occurs under an enclosure (see Appendix I).

Radiochemistry Facility

Based on actual emissions from 1999 to 2005, the projected level of emissions from the Radiochemistry Facility has been increased by 10 percent.

Los Alamos Neutron Science Center

Projected emissions from LANSCE are determined by multiplying the microamp-hours of LANSCE operations by an emissions factor derived from stack monitoring results. Based on LANSCE emissions over recent years, the emissions factor used to estimate releases of gaseous mixed activation products has increased by a factor of about 7 from about 0.003 to 0.02 curies per microamp-hour. Therefore, the projected emissions from LANSCE are higher than previously estimated.

5.4.2.2 Reduced Operations Alternative

Key Facility Impacts

Under the Reduced Operations Alternative, radioactive air quality impacts at the LANL site-wide and TA level are not discussed separately because they are accounted for in the following discussion of Key Facility emissions. Activities at selected Key Facilities would be reduced or eliminated from those identified in the No Action Alternative, resulting in lower emissions of radiological constituents. The lower radiological emissions would result in lower radiological doses and risks under the Reduced Operations Alternative compared to the No Action Alternative (see Section 5.6).

Chemistry and Metallurgy Research Building

Based on information in the *CMRR EIS* (DOE 2003d), continued operation of the Chemistry and Metallurgy Research Building in TA-3 is projected to result in reduced airborne emissions of actinides compared to the assumed operation of the Chemistry and Metallurgy Research Replacement Building in TA-55 for the No Action Alternative; that is, from 0.00076 to 0.00003 plutonium curies per year.

High Explosives Processing and High Explosives Testing Facilities

A lower level of operations at both the High Explosives Processing and High Explosives Testing Facilities would result in a 20 percent reduction in their emissions. This reduction is shown in Table 5–12 as a reduction in emissions of uranium isotopes from 0.15 to 0.12 curies per year.

Los Alamos Neutron Science Center

The largest impacts on emissions would be due to cessation of LANSCE operations. Emissions of particulate and vapor activation products would be reduced by about 30 curies per year; the remaining 0.014 curies per year shown in Table 5–12 would be from the Radiochemistry Facility. Shutdown of LANSCE would also eliminate emissions of about 30,500 curies per year of gaseous mixed activation products.

Pajarito Site

Cessation of operations at TA-18, particularly shutdown of SHEBA, would reduce the remaining gaseous mixed activation product emissions by 100 curies per year. Complete cessation of TA-18 operations is assumed to occur in about 2009.

5.4.2.3 Expanded Operations Alternative

Implementation of the Expanded Operations Alternative would decrease some emissions of radiological constituents due to closure and DD&D of certain facilities; however, there would be both long-term and short-term increases in other emissions. The long-term increases would be associated with higher levels of operational activities at certain facilities. The short-term increases could occur during construction or DD&D activities, as well as from actions related to the implementation of the Consent Order.

Los Alamos National Laboratory Site-Wide Impacts

Major MDA remediation, canyon cleanups, and other Consent Order actions could result in temporary increases of radiological air emissions. The highest level of emissions would be from remediation of the large MDAs, which is the focus of the analysis in Appendix I. Remediation of other PRSs is expected to produce lower emissions. Emissions of radiological contaminants from remediation activities would depend on a number of factors. (Emissions from each MDA would be greatly affected by the remediation option selected; removal would result in larger emissions than capping.) Under the Removal Option, various radiological air emissions would be expected depending on the inventory of the MDA being remediated and whether or not exhumation would occur inside an enclosure equipped with a filtered exhaust system. Under the Capping Option, improving the covers on the MDAs would reduce the potential for radiological air emissions. Remediation of an MDA would occur over a few months to several years depending on the size of the MDA and the remediation option implemented. All of these factors would affect the quantity and timing of releases of radiological constituents, resulting in variable releases over time. Although the amount of these releases would vary over time and depend on the remediation option selected, Section 5.6 presents an estimated dose based on the assumptions that the Removal Option would be selected for all of the MDAs and that some of the removal actions would occur within an enclosure with a filtered exhaust.

Technical Area Impacts

A number of the projects analyzed in Appendices G, H, and J involve construction activities related to either excavation or DD&D of buildings, or both. These activities could cause minor short-term increases in emissions of radiological contaminants. The potential for these emissions would be minimized by conducting radiation surveys before the activities begin, as well as the use of a range of contamination control techniques such as decontamination, application of dust suppressants, and use of enclosures. Consequently, these activities generally would not be expected to increase emissions appreciably. Effects on radiological emissions associated with the TA-21 Structure DD&D are discussed as part of the Tritium Facilities section under the Key Facilities Impacts.

Key Facility Impacts

The Expanded Operations Alternative would result in both increases and decreases in projected emissions from Key Facilities. In addition, the location of some emission sources would change. As discussed above under Technical Area Impacts above, construction and DD&D activities may result in minor, short-term increases in radioactive emissions. Similar minor short-term increases in emissions also may occur in connection with projects at Key Facilities.

Chemistry and Metallurgy Research Building

The Chemistry and Metallurgy Research Replacement Facility at TA-55 would be completed and become operational. With the exception of the Wing 9 hot cell, activities in the current Chemistry and Metallurgy Research Building in TA-3 would be moved into the new facility. As discussed in Appendix G, the Wing 9 hot cell capabilities would be moved to the Radiological Sciences Institute when it is available. Therefore, although the emissions location would change,

there would be no net change in the projected level of radioactive emissions from Chemistry and Metallurgy Research activities.

Pajarito Site

Closure of the TA-18 Pajarito Site would eliminate SHEBA, the primary source of emissions from that site. Therefore, after permanent shutdown of SHEBA in about 2009, site-wide emissions would be reduced by 100 curies per year (of argon-41), resulting in total site-wide emissions of 30,500 curies per year of gaseous mixed activation products.

Tritium Facilities

TA-21 Structure DD&D would include buildings that are part of the Tritium Facilities. DD&D of structures at TA-21 would permanently eliminate these buildings as emissions sources, which would reduce projected tritium emissions by 550 curies per year to 1,850 curies per year after about 2009.

Los Alamos Neutron Science Center

Under the Expanded Operations Alternative, LANSCE emissions would remain the same as for the No Action Alternative. If the LANSCE Refurbishment Project were implemented, the facility and its operating systems and equipment would be refurbished, allowing for its continued use. This restoration of the facility could result in more operational time and therefore increase the emissions from normal operations. As described in the human health impacts of the No Action Alternative (see Section 5.6.1.1), the dose to the MEI from emissions at LANSCE would be limited by operational controls to 7.5 millirem per year.

Plutonium Facility Complex

Addition of capabilities and increased levels of operations under the Expanded Operations Alternative would not appreciably affect emissions from most Key Facilities. Increases in the level of activities at the Plutonium Facility Complex, however, including production of up to 80 pits per year, would cause a small increase in plutonium emissions. The higher level of activity would result in the annual emission of an additional 0.000019 curies per year of plutonium from the Plutonium Facility Complex, as shown in Appendix C, Table C–14.

Solid Radioactive and Chemical Waste Facilities

Implementing the Waste Management Facilities Transition Project (see Appendix H) could increase emissions temporarily. Implementation of the project may result in the simultaneous operation of the temporary remote-handled transuranic waste retrieval facility, the new TRU Waste Facility, and the existing Decontamination and Volume Reduction System Facility. If all three facilities operated at the same time, americium-241 emissions would increase to 1.1×10^{-5} curies per year and plutonium emissions would increase to 0.00089 curies per year. This increase could occur in the 2012 through 2015 timeframe until remote-handled transuranic waste retrieval is completed and the Decontamination and Volume Reduction System Facility is shut down in support of remediation of MDA G.

5.4.3 Noise Impacts

Noise (sound) results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Sound requires a source of energy and a medium for transmitting the sound wave. Propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is undesirable sound that interferes or interacts negatively with the human or natural environment. Noise can disrupt normal activities (for example, concentration or sleep), damage hearing, or diminish the quality of the environment.

Noise-level measurements used to evaluate the effects of nonimpulsive sound on humans are compensated by an A-weighting scale that accounts for the hearing response characteristics (frequency) of the human ear. Noise levels are expressed in decibels (dB); or in the case of A-weighted measurements, decibels A-weighted (dBA). The C-weighted scale is used in describing large amplitude impulsive sounds of short duration, and is expressed in decibels C-weighted (dBC). EPA has developed noise-level guidelines for different land use classifications (EPA 1974). The EPA guidelines identify a 24-hour exposure level of 70 dB as the level of environmental noise that will prevent any measurable hearing loss over a lifetime. Likewise, levels of 55 dB outdoors and 45 dB indoors are identified as the levels that prevent activity interference and annoyance.

Los Alamos County has promulgated a local noise ordinance that establishes noise level limits for residential land uses. Noise levels that affect residential receptors are limited to a maximum of 65 dBA during daytime hours and 53 dBA during nighttime hours between 9 p.m. and 7 a.m. Between 7 a.m. and 9 p.m., 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 (LANL 2004c).

Noise standards related to protecting worker hearing are contained in LANL's *Noise and Temperature Stresses – Laboratory Implementation Requirements* (LANL 2003g). The occupational exposure limit for steady-state noise, defined in terms of accumulated daily (8-hour) noise exposure that allows for both exposure level and duration, is 85 dBA (LANL 2003g). When a worker is exposed for a shorter duration, the permitted noise level is increased. LANL administrative requirements also limit worker impulse/impact noise exposures that consist of a sharp rise in sound pressure level (high peak) followed by a rapid decay of less than 1 second in duration and greater than 1 second apart. No exposure of an unprotected ear in excess of a peak of 140 dBC is permitted (LANL 2004c).

Noise from facility construction or operations and associated traffic could affect human and animal populations. The region of influence for each facility includes the site and surrounding areas, as well as transportation corridors, where proposed activities might increase noise levels. Transportation corridors most likely to experience increased noise levels are those roads within a few miles of the site boundary that are expected to carry most of the site's employee and shipping traffic.

Noise impacts associated with the alternatives could result from construction and operations activities, including increased traffic. The impacts of proposed activities under each alternative were assessed according to the types of noise sources and the location of the facility site locations relative to the site boundary and noise-sensitive receptors. Assessments of potential traffic-related noise impacts were based on the likely increase in traffic volume. Evaluations of the possible impacts on wildlife were based on the possibility of sudden loud noises occurring during site activities under each alternative.

Table 5–13 summarizes the expected noise impacts for each of the three alternatives.

5.4.3.1 No Action Alternative

Common to all three alternatives is LANL's continued contribution to background noise generation within the Los Alamos County area. The background noise levels are expected to remain at or near current levels for most of the foreseeable future regardless of the alternative implemented. There is no single representative measurement of ambient noise available for the LANL site. For a description of existing noise levels, see Chapter 4, Section 4.4.5.

Background noise levels associated with LANL activities under any of the three alternatives would be unlikely to approach the upper limit for sound levels in the community based on the site operation activities associated with each alternative relative to the existing environment.

Los Alamos National Laboratory Site-Wide Impacts

The levels of noise and short-range ground vibrations generated by environmental restoration activities are consistent with those produced by most construction activities. Heavy equipment use (bulldozers, loaders, backhoes, and portable generators) typically produces noise with mean levels ranging from 81 to 85 dBA at 50 feet (15 meters). In comparison with these noise levels, normal conversation is usually conducted at a sound level of about 60 dBA (FICN 1992). If heavy machinery were operated over an 8-hour period, producing noise at levels above 85 dBA constantly, it would be considered unsafe for workers; however, such noise generally is produced for short or sporadic periods. While occasional short spurts of site activities could result in noise levels in excess of 85 dBA, these are expected to be well within the levels of noise considered safe for likely exposure time durations of less than 1 hour. Hearing protection is provided and worn by workers, as appropriate, according to their standard operating procedures. Additionally, some minor interior and outdoor construction activities are common across all alternatives. Noise produced by these activities would be noticed most by LANL workers at the site where these activities are being performed, and these workers would be provided with hearing protection as part of their standard operating procedures.

Table 5–13 Summary of Environmental Consequences for Noise at LANL

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Normal Operations – Noise levels from operations would continue to have little impact on the public, with the exception of sporadic noise from explosives detonation and traffic noise. *Construction* – Noise impacts from construction-type activities would occur from construction, demolition, and remediation activities, and would likely have little impact on the public, except for traffic noise impacts. *Land Conveyance and Transfer* – Minor increases in traffic noise could result from development. – Minor noise impacts could result from development. *Electrical Power System Upgrades* – Minor noise impacts would result from construction. *Wildfire Hazard Reduction Program* – Minor noise impacts would result from activities and disposition of flood and sediment retention structures. – Minor noise impacts would result from the Trails Management Project and the Security Perimeter Project.	Same as No Action Alternative.	Same as No Action Alternative, plus: *Security-Driven Transportation Modifications Project* – Minor noise impacts would result from road, bridge, and walkway construction. – Minor increases in traffic noise could result from use of the new roads, especially at the Royal Crest Mobile Home Park under one of the auxiliary actions. *MDA Remediation* – Minor noise impacts from remediation activities near the LANL boundary could cause some public annoyance. – Minor to moderate increase in truck and personnel vehicle traffic noise could result along East Jemez Road and at White Rock under the various remediation options.
Affected Technical Areas			
TA-3	– Minor changes in noise impacts would result from operation of new turbine generator. – Minor construction noise impacts would result from construction of three new office buildings. – Negligible operation noise impacts are expected from new office buildings.	Same as No Action Alternative.	Same as No Action Alternative, plus: – Minor construction equipment and traffic noise impacts would result from construction of the Physical Science Research Complex and the Replacement Office Buildings. – Negligible operational noise impacts would result from use of equipment at the Physical Science Research Complex and the Replacement Office Buildings.
TA-21	No change in noise impacts.	Same as No Action Alternative.	Minor construction equipment noise impacts would result from DD&D of structures. Some increase in traffic noise would result from waste shipments.
TA-54	Minor noise impacts would result from MDA H closure activities.	Same as No Action Alternative.	Same as No Action Alternative.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
TA-61	No change in noise impacts.	Same as No Action Alternative.	*Borrow Pit* – Noise impacts from operation of construction-type equipment to withdraw crushed tuff for MDA remediation and from increased truck traffic.
TA-72	No change in noise impacts.	Same as No Action Alternative.	– Minor construction equipment and traffic noise would result from construction of the Remote Warehouse and Truck Inspection Station. – Noise could be noticeable to the public along East Jemez Road from operation of the Remote Warehouse and Truck Inspection Station.
Key Facilities			
Chemistry and Metallurgy Research Building (TA-3, TA-48, and TA-55)	– Little or no change in impacts would result from operation of the CMRR Facility and relocation of CMR activities to TA-55. – Minor construction equipment and traffic noise impacts would result from DD&D of the old facility at TA-3 and construction of the new facility at TA-55.	Minor reduction in noise impacts if the nuclear facility portion of the CMRR Facility is not constructed.	Same as No Action Alternative.
High Explosives Processing Facilities	– No change in operation noise impacts. – Minor construction equipment and traffic noise impacts would result from construction of the TA-16 Engineering Complex and demolition of structures.	Same as No Action Alternative.	Same as No Action Alternative.
High Explosives Testing Facilities	– No change in operation noise impacts. – Minor construction equipment and traffic noise impacts would result from construction of 15 to 25 new structures (new offices, laboratories, and shops) to replace about 59 structures currently used for dynamic experimentation operations and removal or demolition of vacated structures.	Minor reduction in operation noise impacts would result from 20 percent reduction in activities. Same as No Action Alternative for construction.	Same as No Action Alternative.
Tritium Facilities (TA-21)	No change in noise impacts.	Same as No Action Alternative.	– Minor construction equipment and traffic noise impacts would result from DD&D of all TA-21 tritium buildings as part of the project to decommission all of TA-21.
Pajarito Site (TA-18)	No change in noise impacts.	Minor reduction in operation noise impacts would result from shutdown of activities.	– Minor reduction in operation noise impacts would result from shutdown of activities. – Minor construction equipment and traffic noise impacts would result from DD&D of TA-18 buildings.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Target Fabrication Facility	No change in noise impacts.	Same as No Action Alternative.	Same as No Action Alternative.
Bioscience Facilities	No change in noise impacts.	Same as No Action Alternative.	– Negligible change in operation impacts would result from transfer of Bioscience Facilities operations to the new Science Complex. – Minor construction noise impacts from construction of the new Science Complex.
Radiochemistry Facility (TA-48)	No change in noise impacts.	Same as No Action Alternative.	– Minor construction equipment and traffic noise impacts from construction of the new Radiological Sciences Institute.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in noise impacts.	Same as No Action Alternative.	– Minor construction equipment and traffic noise impacts from construction of a replacement for the existing Radioactive Liquid Waste Treatment Facility at TA-50 and DD&D of the existing Radioactive Liquid Waste Treatment Facility.
LANSCE (TA-53)	No change in noise impacts.	Minor reduction in noise impacts from shutdown.	Negligible to minor noise impacts from refurbishment.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in noise impacts.	Same as No Action Alternative.	– Minor noise impacts from retrieving transuranic waste from below ground storage. – Minor construction and traffic noise impacts from construction of a new TRU Waste Facility and new access control station, low-level radioactive waste compactor building, and low-level radioactive waste certification building.
Plutonium Facility Complex (TA-55)	No change in noise impacts.	Minor reduction in noise impacts if the nuclear facility portion of the CMRR Facility is not constructed.	– Minor construction equipment and traffic noise impact from minor facility modifications in support of increased pit production and the Plutonium Complex Refurbishment Project, as well as construction of radiography capabilities.

MDA = material disposal area; TA = technical area; DD&D = decontamination, decommissioning, and demolition; LANSCE = Los Alamos Neutron Science Center; CMRR = Chemistry and Metallurgy Research Replacement; CMR = Chemistry and Metallurgy Research Building.

Noise from LANL construction activities may be somewhat noticeable to nearby members of the public. Environmental restoration activities that occur near the Los Alamos townsite may be noticeable to the public but would be limited in duration. Because these activities are conducted during the daytime hours for short continuous durations, the noise levels and ground vibrations produced are unlikely to adversely impact the public or sensitive wildlife receptors and their habitats. If certain sensitive wildlife species are found to occupy habitat areas near locations where these types of activities need to occur, or if the occupancy status of these habitat areas is unknown, either these activities would need to be scheduled outside of the species' breeding season or other special protective measures would need to be planned and implemented (such as hand digging).

Specifically for the No Action Alternative, minor noise impacts would occur from construction activities, including construction related to previously approved projects such as the Electric Power System Upgrades, Wildfire Hazard Reduction Program, disposition of flood and sediment retention structures, Trails Management Program, and Security Perimeter Project. Management of construction fill would increase truck traffic. All of these construction projects would produce temporary increases in equipment and traffic noise.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by explosives testing, which is common to some degree among all of the three alternatives. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control their entry into explosives firing site detonation points. The public is not allowed within the fenced TAs that have firing sites, and noise levels produced by explosives tests are sufficiently reduced at locations where the public would be present to preclude hearing damage. Such tests would not be expected to adversely affect offsite sensitive receptors (such as those at Bandelier National Monument or at White Rock). Noises heard at that distance would be similar to thunder in their intensity, and air blast and ground vibrations are not expected to be present outside LANL at intensities great enough to adversely affect real properties. Sensitive wildlife species are unlikely to be adversely affected by "thunder-like" explosives testing events, given their continued presence in areas of the country that are known to be within higher-than-average lightning event areas and their continued presence on the LANL site over the past 10 years. In fact, the continued thriving of resident and long-term migratory populations of these sensitive species on the LANL site indicates that the level of noise generated by explosives testing under the No Action Alternative is at least tolerable to these particular species.

Implementing the No Action Alternative would likely result in the previously discussed operations-related effects that are common to all alternatives. Specifically for the No Action Alternative, a minor increase in vehicle noise could result from development that occurs under conveyance and transfer of land.

Technical Area Impacts

Minor and temporary construction-related noise impacts would occur from construction of three new office buildings at TA-3 and MDA H closure activities at TA-54. Workers in the vicinity of MDA H waste encapsulation equipment may require hearing protection. Minor operations-

related noise impacts would result from operation of new office buildings at TA-3 and operation of the new turbine generator at TA-3.

Key Facilities Impacts

Minor construction-related noise impacts would occur from construction of the Chemistry and Metallurgy Research Replacement Facility at TA-55, demolition of facilities at TA-3, completion of the TA-16 Engineering Complex, demolition of structures at TA-16, construction of buildings at the new Twomile Mesa Complex site, and demolition of unneeded structures.

Minor operations-related noise impacts would occur from moving Chemistry and Metallurgy Research operations from TA-3 to TA-55 due to operation of heating, ventilation, and cooling systems and other equipment at new facilities, including new structures for dynamic explosion operations. Minor operations-related noise impacts also would occur from operation of a new dynamic explosion structure at TA-15 for high explosives testing.

5.4.3.2 Reduced Operations Alternative

Noise impacts resulting from activities associated with the No Action Alternative would still occur, except for those associated with reductions to operations considered part of the Reduced Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Construction-related noise impacts under the Reduced Operations Alternative would be similar to those under the No Action Alternative. Construction projects would result in temporary increases in noise from equipment and traffic.

The operations-related noise impacts of the Reduced Operations Alternative would be similar to those of the No Action Alternative. The primary noise, air blast waves, and ground vibration impacts from implementation of this alternative would be generated by the high explosives tests. There would be fewer of these explosions under the Reduced Operations Alternative, and the resulting noise would still result from occasional (rather than continuous) events. Noises associated with LANSCE and TA-18 operations would be eliminated by the shutdown of those facilities.

Technical Area Impacts

Construction- and operations-related noise impacts would be the same as those under the No Action Alternative.

Key Facilities Impacts

Noise impacts from construction equipment and traffic from Key Facilities would be the same as those under the No Action Alternative except in TA-55, where the nuclear facility portion of the Chemistry and Metallurgy Research Replacement Facility would not be constructed, and in TA-3 where the Chemistry and Metallurgy Research Building DD&D would be postponed. A minor reduction in operational noise impacts would occur from the reduction in high explosives testing and the shutdown of activities at TA-18 (Pajarito Site) and LANSCE at TA-53.

5.4.3.3 Expanded Operations Alternative

The same noise impacts associated with activities considered under the No Action Alternative would occur under the Expanded Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Under the Expanded Operations Alternative, interior and outdoor construction activities at LANL would increase. Individual activities would remain within the level of effects described for the No Action Alternative, but could be ongoing for a longer period. In addition to the construction activities discussed for the No Action Alternative, activities such as construction of new buildings in various TAs; DD&D of buildings; road, bridge, and walkway construction as part of the Security-Driven Transportation Modifications Project; and MDA remediation (described and discussed in Appendix I) would likely result in levels of noise and short-range ground vibrations similar to those associated with current construction and demolition activities. Workers would be primarily affected by these noises, although motorists could occasionally hear low levels of equipment noises along Pajarito Road under certain climatic conditions. The roadway, walkway, and bridge construction under the Security-Driven Transportation Modifications Project (Appendix J) would be short-term and similar to other roadway construction at LANL. Noise from increased activities at MDAs close to the site boundary, such as at TA-21, could increase public annoyance at nearby residences or businesses.

There would be no change in noise impacts to the public outside of LANL as a result of construction activities, except for a small increase in traffic noise levels from construction employees' vehicles, materials shipments, and a minor-to-moderate increase in truck traffic noise from MDA remediation, especially along East Jemez Road near the Royal Crest Mobile Home Park. Other proposed construction activities under this alternative include small-scale outdoor activities, interior work on existing buildings, construction of an addition to an existing building, construction of a new building in close proximity to others, and construction at specific TAs and Key Facilities, as described below. The effects of these construction activities would be primarily limited to involved workers and would not likely result in any adverse effects on sensitive wildlife species or their habitats.

The largest increases in traffic noise from construction activities would be associated with remediation of the MDAs. Estimated increases in traffic along Pajarito Road could be substantial during the years when remediation of MDA G occurs. A similar increase in traffic along NM 4 at White Rock could be expected. The associated increase in traffic noise may be noticeable to some residents at White Rock due to the increase in truck trips. As most of the truck trips are expected to occur during non-peak-traffic daytime hours, the truck noise levels would be higher during these hours. As most of the increase in traffic would be from personnel vehicles, much of the increased traffic and associated traffic noise would occur during peak traffic hours. Increases in traffic along East Jemez Road near the Royal Crest Mobile Home Park also could be substantial during the years when remediation of MDA G (under either the Capping or the Removal Option) occurs. The associated increased traffic noise due to the higher volume of truck and personnel vehicle trips may be noticeable to residents at the Royal Crest Mobile Home Park.

As discussed for the No Action Alternative, the primary noise from implementation of these alternatives would be generated by air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to involved workers. They would not likely result in any adverse effect on sensitive wildlife species or their habitats, and would be similar to the effects discussed under the No Action Alternative.

A minor increase in vehicle noise could result from use of the new roads constructed under the Security-Driven Transportation Modifications Project, especially at the Royal Crest Mobile Home Park under one of the auxiliary actions being considered that would include a bridge across Sandia Canyon.

Technical Area Impacts

There would be no change in noise impacts to the public outside of LANL as a result of construction activities at specific TAs (TA-3, TA-18, TA-21, and TA-54), except for minor increases in traffic noise levels from construction employees' vehicles and materials shipments and in noise levels at nearby businesses from DD&D at TA-21. Construction noise impacts would result from the same activities as those under the No Action Alternative, plus construction of additional office buildings and the Physical Science Research Complex at TA-3, DD&D of TA-18 buildings, DD&D at TA-21, construction of the Science Complex, and construction of the Remote Warehouse and Truck Inspection Station. The effects of these construction activities would be primarily limited to involved workers and would not likely result in any adverse effects on sensitive wildlife species or their habitats.

Operational noise impacts would result from the same type of activities as those under the No Action Alternative, with minor changes to impacts from relocated and consolidated activities across the various TAs. Noise potentially noticeable to the public along East Jemez Road could occur from operations of the Remote Warehouse and Truck Inspection Station.

Key Facilities Impacts

There would be no changes in noise impacts to the public outside of LANL as a result of construction-type activities at Key Facilities, except for a small increase in traffic noise levels from construction employees' vehicles and materials shipments. Construction noise impacts from Key Facilities would be the same as those under the No Action Alternative, with minor impacts resulting from DD&D of TA-21 and TA-18 buildings; construction of the new Science Complex, new Radiological Sciences Institute, and Institute for Nuclear Nonproliferation Science and Technology; replacement of portions of the Radioactive Liquid Waste Treatment Facility at TA-50; DD&D of the existing Radioactive Liquid Waste Treatment Facility; refurbishment at LANSCE; retrieval of transuranic waste from below ground storage at the Solid Radioactive and Chemical Waste Facilities; construction of a new TRU Waste Facility and associated buildings; and construction of a radiography facility and minor facility modifications at TA-55. The effects of these activities would be primarily limited to involved workers and would not likely result in any adverse effect on the public or on sensitive wildlife species or their

habitats. Some of these activities such as the Radiological Sciences Institute construction could include blasting noise. Traffic noise would increase in the area around LANL from increased numbers of employee vehicles and shipments of materials and wastes, as discussed in the site-wide section above.

Operational noise impacts for Key Facilities would result from the same activities as those under the No Action Alternative, except for a minor reduction in operational impacts from the removal of activities from TA-18 and minor changes in impacts due to the transfer of the Bioscience Facilities operations to the new Science Complex and changes related to the operations of the Radiological Sciences Institute, the replacement Radioactive Liquid Waste Treatment Facility, the new TRU Waste Facility, and new radiography facility at TA-55. Noise impacts from Key Facilities operations associated with the Expanded Operations Alternative, therefore, would likely be about the same as those under the No Action Alternative.

5.5 Ecological Resources

Ecological resources include terrestrial resources, wetlands, aquatic resources, and protected and sensitive species. Biological data from the *1999 SWEIS* and other environmental documents, wetlands surveys, and plant and animal inventories of LANL were reviewed to identify the locations of plant and animal species and wetlands. Lists of protected and sensitive species potentially present on LANL were developed from sources at the Federal, state, and site levels.

Impacts to ecological resources could result from land disturbance, water use and discharge, human activity, and noise associated with project implementation. Each of these factors was considered when evaluating the potential impacts of proposed projects and activities. For those alternatives involving construction of new facilities, direct impacts to ecological resources were based on the acreage of land disturbed by construction. Indirect impacts from factors such as human disturbance and noise were evaluated qualitatively. Indirect impacts to ecological resources from erosion due to construction were evaluated qualitatively, recognizing that standard erosion and sediment control practices would be followed.

In evaluating the potential impacts on protected and sensitive species, it is important to consider both direct effects and effects that a proposed project could have on the species' habitat. Accordingly, LANL has established Areas of Environmental Interest for three species: Mexican spotted owl (*Strix occidentalis lucida*) (federally listed as threatened and state-listed as sensitive), bald eagle (*Haliaeetus leucocephalus*) (federally and state-listed as threatened), and the southwestern willow flycatcher (E*mpidonax traillii extimus*) (federally and state-listed as endangered) (LANL 2000b). Areas of Environmental Interest for these species include both core and buffer zones, each of which has certain restrictions aimed at protecting the species and their habitats. DOE has prepared a biological assessment for the continued operation of LANL (LANL 2006b) that evaluates potential impacts to the Mexican spotted owl, bald eagle, and southwestern willow flycatcher in terms of potential effects to the species and their designated Areas of Environmental Interest.[3] The results of the biological assessment, as well as the

[3] *The biological assessment uses the phrases "reasonable and prudent measures" and "reasonable and prudent alternatives." In this SWEIS, the term reasonable and prudent measures includes both phrases used in the biological assessment.*

U.S. Fish and Wildlife Service (USFWS) responses to the assessment (see Chapter 6), have been incorporated into this Final LANL SWEIS.

This section addresses the impacts of the No Action, Reduced Operations, and Expanded Operations Alternatives on Ecological Resources. A summary of these impacts is presented in **Table 5–14**.

5.5.1 No Action Alternative

The No Action Alternative was analyzed in terms of its impacts on the existing environment and on ecological resources (see Sections 4.4.5 [for effects of explosives-related noise on wildlife] and 4.5), including the actions that will be implemented, based on other NEPA compliance reviews issued since the *1999 SWEIS*. The impacts to ecological resources are described in terms of those projects that would impact the site as a whole and those that would affect specific TAs. Key Facilities are addressed separately. Only those projects that were determined to impact ecological resources are addressed below. Continuing the LANL environmental restoration program is not expected to adversely affect ecological resources.

Los Alamos National Laboratory Site-Wide Impacts

Five projects that have been approved, and for which NEPA documentation has been prepared since publication of the *1999 SWEIS*, have potential impacts across a number of TAs. These projects are addressed separately below.

Conveyance and transfer of land from DOE began in 2002; by the end of 2005, 2,259 acres (914 hectares) had been conveyed or transferred (see Chapter 4, Section 4.1.1). Additional acreage may be turned over by 2012. The land that has been or is to be conveyed or transferred falls within the pinyon-juniper woodland and ponderosa pine forest zones. One of the direct impacts of the conveyance and transfer is a change in responsibility for resource protection. An indirect impact, as determined by the analysis, is potential future development within the conveyed and transferred parcels. Approximately 770 acres (312 hectares) of relatively undisturbed habitat within the ponderosa pine forest and pinyon-juniper woodland zones could be developed, which could affect potential habitats for several federally listed threatened and endangered species, including the Mexican spotted owl. In some tracts, wetlands could be reduced or possibly lost, potentially increasing downstream and offsite sedimentation. Another indirect impact of the land conveyance and transfer could be a much less rigorous environmental review and protection process for future activities because neither the County of Los Alamos nor the Pueblo of San Ildefonso have regulations matching the Federal review and protection process. Cumulatively, development could impact biodiversity due to fragmentation of habitat and disruption of wildlife migration corridors (DOE 1999d).

Table 5–14 Summary of Environmental Consequences of Ecological Resource Changes at Los Alamos National Laboratory

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Conveyance and Transfer – 2,259 acres (914 hectares) of land within the pinyon-juniper woodland and ponderosa pine forest zones have been conveyed or transferred. – 770 acres (312 hectares) of habitat could be developed. – Transfer of resource protection responsibility could result in a less rigorous environmental and protection review process. *Electrical Power System Upgrades* – Minimal effects on vegetation. – Temporary impacts such as disturbance from construction activities, on wildlife. – Potentially positive impact from providing perching sites for larger birds. *Wildfire Hazard Reduction Program* – Short-term disturbance of wildlife due to forest thinning activities. – Recreate more natural historic forest conditions. – Increased forest health could benefit the Mexican spotted owl and other species. *Disposition of Flood Retention Structures* – Short-term disturbance of wildlife due to construction activities. – Potentially minor impacts on downstream wetlands. *Trails Management Program* – Short-term disturbance of wildlife due to implementation activities. – Where trails are closed, some increase in diversity of wildlife.	Same as No Action Alternative	Same as No Action Alternative, plus: *MDA Remediation Project* – Minimal temporary impact on wildlife during capping or waste removal. – Capping would reduce biointrusion and complete removal would eliminate it. – Capping would limit revegetation efforts, while there would be no restrictions under the Removal Option. – Possible loss of habitat at borrow pit in TA-61, including undeveloped buffer and core habitat for the Mexican spotted owl. Extension of the borrow pit would require consultation with the USFWS. – In a few cases remediation activities may affect, but are not likely to adversely affect, the Mexican spotted owl, bald eagle, and southwestern willow flycatcher. *Security-Driven Transportation Modifications Project* – Parking lot construction and placement of pedestrian and vehicle bridges would remove about 30 acres (12 hectares) of natural vegetation. – Auxiliary Action A would disturb up to 25.4 acres (10.6 hectares) of undeveloped core and buffer Mexican spotted owl habitat. – Auxiliary Action B would disturb up to 65.8 acres (26.6 hectares) of undeveloped core and buffer; a new section of road would remove 1.3 acres (0.6 hectares) of additional natural habitat. – Construction may affect, but is not likely to adversely affect, the bald eagle. – Bridges and traffic over the core zone of the Sandia-Mortandad Canyon Mexican spotted owl Areas of Environmental Interest could cause long-term impacts. Section 7 consultation with the USFWS would be needed.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Affected Technical Areas			
TA-3	No change in impacts to ecological resources.	Same as No Action Alternative.	*Replacement Office Buildings* – Clear 13 acres (5.3 hectares) of mixed conifer forest. – Short-term construction impacts on wildlife. – Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle.
TA-21	No change in impacts to ecological resources.	Same as No Action Alternative.	*TA-21 Structure DD&D* – Short-term construction impacts on wildlife in adjacent areas. – DD&D activities may affect, but is not likely to adversely affect, the Mexican spotted owl.
TA-61	No change in impacts to ecological resources.	Same as No Action Alternative.	*Borrow Pit* – Loss of wildlife habitat from expanding operations to process tuff for MDA remediation. Consultation with the USFWS would be required.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in impacts to ecological resources.	Same as No Action Alternative.	*Remote Warehouse and Truck Inspection Station Project* − 4 acres (1.6 hectares) of ponderosa pine forest and pinyon-juniper woodland would be cleared. − Short-term construction impacts on wildlife. − Construction may affect, but is not likely to adversely affect, the bald eagle.
Key Facilities			
Chemistry and Metallurgy Research Building (TA-3, TA-48, and TA-55)	Limited acreage of ponderosa pine forest cleared with loss and displacement of wildlife.	Same as No Action Alternative.	Same as No Action Alternative.
High Explosives Testing Facilities (TA-6, TA-22, and TA-40)	Short-term impacts on wildlife from construction of new facilities and demolition of old structures.	Same as No Action Alternative, plus: – Reduction in the number of times animals would be subjected to stress resulting from explosives testing.	Same as No Action Alternative.
Pajarito Site (TA-18)	No change in impacts to ecological resources.	Same as No Action Alternative	– Minor impact to wildlife during demolition. – DD&D activities may affect, but are not likely to adversely affect, the Mexican spotted owl and southwestern willow flycatcher. – Restoration of site could create a more natural habitat and benefit wildlife, potentially including the Mexican spotted owl.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Radiochemistry Facility (TA-48)	No change in impacts to ecological resources.	Same as No Action Alternative.	*Radiological Sciences Institute* – Minor impact to wildlife during construction and demolition. – 12.6 acres (5 hectares) of ponderosa pine forest cleared. – Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. – DD&D activities may affect, but are not likely to adversely affect, the Mexican spotted owl.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in impacts to ecological resources.	Same as No Action Alternative.	– Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle. – Implementation of the evaporation tank option would reduce wetlands and riparian habitat in Mortandad Canyon and the abundance and diversity of Mexican spotted owl prey species, requiring Section 7 consultation with the USFWS.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in impacts to ecological resources.	Same as No Action Alternative.	*Waste Management Facilities Transition Project* − Short-term impacts on wildlife from new construction and demolition in TA-54 under both options. − Construction at TA-54 may affect, but is not likely to adversely affect, the southwestern willow flycatcher. − Construction of a TRU Waste Facility at a generic site could impact portions of Mexican spotted owl Areas of Environmental Interest and would require Section 7 consultation with the USFWS. − TRU Waste Facility construction could result in the loss of 2.5 to 7 acres (1.0 to 2.8 hectares) of ponderosa pine forest or open field.
LANSCE (TA-53)	No change in impacts to ecological resources.	Wetland reduction possible due to shut down.	Same as No Action Alternative.
Bioscience Facilities	No change in impacts to ecological resources.	Same as No Action Alternative.	*Science Complex Project* − Options 1 and 2 would remove 5 acres (2 hectares) of ponderosa pine forest. − Under Option 3 less than 5 acres (2 hectares) of grassland and forest would be cleared. − Short-term construction impacts on wildlife. − Construction may affect, but is not likely to adversely affect, the Mexican spotted owl and bald eagle.

MDA = material disposal area; TA = technical area; DD&D = decontamination, decommissioning, and demolition; LANSCE = Los Alamos Neutron Science Center; USFWS = U.S. Fish and Wildlife Service.

Electric power line upgrades were determined to have minimal effects on vegetation along the power line right-of-way. Construction-related impacts on wildlife would include displacement due to increased noise and human activity; however, some species would likely return to the new habitat within the proposed corridor, including deer and elk. Further, the power line may provide additional perching sites for larger birds that occupy or use the area through which it passes. Adverse effects on habitats for bald eagles, southwestern willow flycatchers, and Mexican spotted owls due to the proposed placement of structures, roads, and laydown areas in existing roadways or disturbed areas would not be expected. Timing of construction and maintenance actions to avoid adverse effects on sensitive species or their habitats would ensure that these species were not impacted (DOE 2000a).

In the long term, the Wildfire Hazard Reduction Program would create conditions at LANL that are consistent with a more natural historic ecological process accompanied by improved health and vigor and increased biological diversity for wildlife. In the short term, treatment measures would temporarily displace local wildlife such as deer, elk, birds, and small mammals; however, wildlife would return to treated forests and their numbers would likely increase over the long term. Sensitive species also would be expected to benefit from a general improvement in forest health. For example, reducing the risk of severe, high-intensity wildfires supports the recovery goals for the Mexican spotted owl (DOE 2000e).

The future disposition of certain flood and sediment retention structures built after the Cerro Grande Fire could have minor short-term effects on ecological resources. The demolition of the flood retention structure in Pajarito Canyon would disturb vegetation and could result in sedimentation of downstream wetlands. In addition, noise and other effects of demolition activities could temporarily disperse animals that use the area. Revegetation and implementation of best management practices would minimize impacts to terrestrial resources and wetlands. Constraints on the timing of activities and noise levels may be required if Mexican spotted owls were found in the area. Removal of the steel diversion wall upstream of TA-18 could cause short-term effects on plants and animals. Noise and activity constraints during the breeding season of the Mexican spotted owl would prevent adverse effects on the nearby Area of Environmental Interest if the area were to become occupied by that species. Activities taking place at the low-head weir, located in Los Alamos Canyon, as well as the road reinforcements in Twomile Canyon, Pajarito Canyon, and Water Canyon were not found to affect ecological resources (DOE 2002j).

No long-term or permanent changes to ecological resources would be expected from implementing the LANL Trails Management Program. Short-term effects on animals that live along trail reaches, however, could result from trail construction, maintenance, or closure activities. In areas where trails would be closed, some increase in animal diversity might occur. Sensitive species, including the Mexican spotted owl, and their critical habitats are unlikely to be adversely affected by activities associated with the Trails Management Program (DOE 2003b).

Management of construction fill would not be expected to affect ecological resources. Construction fill would be stored in previously existing borrow areas in TA-16 and TA-61.

Technical Area Impacts

TA impacts on ecological resources would be essentially unchanged from current conditions under the No Action Alternative.

Key Facilities Impacts

Since publication of the *1999 SWEIS*, NEPA compliance has been completed for two currently active projects related to Key Facilities that could affect ecological resources: the Chemistry and Metallurgy Research Replacement Facility construction at TA-55 and the Twomile Mesa Complex Consolidation at TA-22.

Chemistry and Metallurgy Research Building

The Chemistry and Metallurgy Research Replacement Facility would be built within TA-55 on both previously disturbed land and within a small area of ponderosa pine forest. A total of about 28 acres (11 hectares) of natural vegetation would be removed, some from previously disturbed land. Where construction would occur on previously disturbed land, there would be little or no impact to terrestrial resources. Construction also would remove some previously undisturbed ponderosa pine forest, causing the loss of less mobile wildlife such as reptiles and small mammals and temporarily displacing more mobile species such as birds and large mammals. Indirect impacts from construction, such as noise or human disturbance, could also affect wildlife living adjacent to the construction zone. The project would have no impact on wetlands or aquatic resources at LANL. Although TA-55 includes a portion of the buffer zone of the Pajarito Canyon Mexican spotted owl Area of Environmental Interest, construction of the Chemistry and Metallurgy Research Replacement Facility would not be expected to adversely affect it. Operational impacts were determined to be minimal (DOE 2003d). DD&D of the existing Chemistry and Metallurgy Research Building would allow revegetation of that site; however, as the site is within TA-3, infill building at a later date would likely occur.

High Explosives Testing Facilities

Construction of new facilities associated with the consolidation of activities at the Two-Mile Mesa Complex within TA-22 and the associated demolition of numerous structures within a number of TAs across LANL were determined to impact ecological resources only minimally. Small mammals and birds would be temporarily displaced by construction activities, but they would likely return to the area after construction was completed. Movement of large mammals is not likely to be altered. There would be no impacts to wetlands or sensitive species (DOE 2003e).

5.5.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under the Reduced Operations Alternative, impacts on ecological resources would be the same as those for the No Action Alternative (see Section 5.5.1).

Key Facilities Impacts

Activity levels at certain Key Facilities would change. High explosives processing and testing would be reduced by 20 percent. LANSCE would cease operation and be placed into a safe shutdown mode. Operations would cease at the Pajarito Site (TA-18), and that facility would be shut down. As there would be no change in impacts on ecological resources associated with the closure of LANSCE or TA-18 facilities, this action is not addressed further.

High Explosives Testing Facilities

Under the Reduced Operations Alternative, high explosives testing at LANL would be reduced by 20 percent. Although animals may adjust to constant noise levels, they do not readily adjust to intermittently high noise levels. Startle or fright is the immediate behavioral reaction to transient, unexpected, or unpleasant noise such as explosives testing (EPA 1980). Thus, although testing would be reduced, animals residing near test sites would still experience stress with the occurrence of each test. The overall number of times per year that this stress would be experienced, however, would be lessened.

5.5.3 Expanded Operations Alternative

The Expanded Operations Alternative reflects proposals that would expand the overall operations level at LANL above those established for the No Action Alternative. Thus, this alternative includes the ecological resource impacts for those actions addressed under that alternative (see Section 5.5.1), as well as the potential impacts of a number of new projects. Not all new projects or activities would affect these resources because many would involve actions within or modifications to existing structures, or the construction of new facilities within previously developed areas of LANL. For example, an increase in pit production would not require new construction and hence would not affect ecological resources. Only those projects that would likely impact ecological resources are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

There are two options (capping and removal) related to remediation of MDAs at LANL. Under the Capping Option, terrestrial resources would be disrupted as the MDAs are cleared of existing vegetation and then capped. Provision of material for the caps could result in the loss of some habitat adjacent to the active portion of the borrow pit in TA-61 due to the need to enlarge the existing borrow area. At most sites, however, capping would have minimal biota impact because the MDAs are grassy areas enclosed within a fence that excludes most wildlife species except birds and very small animals. Noise and human presence during remediation could disturb wildlife in adjacent areas, but proper equipment maintenance and restrictions preventing workers from entering adjacent undisturbed areas would lessen these impacts. The caps would be designed to prevent or reduce biointrusion, which would reduce the ecological risks associated with reintroduction of contaminants into the environment. Once capped and revegetated, the MDAs would provide habitat similar to that existing prior to remediation. This option would not directly impact any wetlands or aquatic resources at LANL.

Impacts of MDA and PRS remediation activities to the Mexican spotted owl, bald eagle, and southwestern willow flycatcher were evaluated in a biological assessment prepared by DOE. This

assessment determined that, provided reasonable and prudent measures are implemented, remediation activities may affect, but are not likely to adversely affect, the Mexican spotted owl (within MDAs N, Z, A, and AB), bald eagle (within MDA D), and southwestern willow flycatcher (within MDAs G and L). Activities at other MDAs and PRSs at LANL should not impact these species (LANL 2006b). The USFWS has concurred with the findings of the biological assessment (see Chapter 6, Section 6.5.2). Since expansion of the borrow pit could result in the removal of undeveloped buffer and core habitat for the Mexican spotted owl, consultation with the USFWS would be required prior to this activity.

Impacts to ecological resources under the MDA Removal Option would be similar to those described for the Capping Option. While remedial actions would create a disruptive environment for local wildlife in the short term, long-term impacts would likely be beneficial in terms of ecological risk because wastes would be removed. In addition, there would be no restrictions on the types of plants that could be introduced, which would permit reestablishment of more natural conditions that would, in turn, provide habitat for area wildlife (see Appendix I).

Most actions associated with implementing the Security-Driven Transportation Modifications Project would have little or no impact on ecological resources; however, the construction of the two parking lots, a portion of the new road across TA-63, and the highway and pedestrian bridges over the Ten Site branch of Mortandad Canyon would affect undeveloped ponderosa pine forest, open land, and wildlife. Other project elements would largely take place in currently developed areas. As no wetlands exist within Pajarito Corridor West and aquatic resources are not present on the mesa, impacts to these resources would not occur.

The parking lot in TA-63, the road across the eastern edge of TA-63, and the pedestrian and highway bridges fall within buffer habitat of the Mexican spotted owl Areas of Environmental Interest; a portion of the parking lot is within core habitat. A biological assessment performed by DOE determined that up to 18.8 acres (7.6 hectares) of buffer and 1 acre (0.4 hectares) of core Mexican spotted owl habitat could be lost and that the project would generate excess noise or light. The biological assessment concluded that even if reasonable and prudent measures are implemented to mitigate impacts, project activities may affect, and are likely to adversely affect, the Mexican spotted owl (LANL 2006b). However, following review of the biological assessment, the USFWS concluded that impacts to the spotted owl from construction activities associated with the Security-Driven Transportation Modifications Project would be insignificant and discountable, and would not result in adverse effects (see Chapter 6, Section 6.5.2). Additional USFWS consultation would be needed, however, if a land bridge, rather than a span bridge, were constructed.

Land disturbed by the Security-Driven Transportation Modifications Project does not fall within Areas of Environmental Interest for either the bald eagle or southwestern willow flycatcher. However, because the bald eagle forages over all of LANL and some habitat degradation is associated with the project, the biological assessment concluded that provided appropriate reasonable and prudent measures are implemented, the project may affect, but is not likely to adversely affect, the bald eagle. Because the southwestern willow flycatcher Area of Environmental Interest is more than 2 miles (3.3 kilometers) from the project site, the biological assessment concluded that the proposed project would have no effect on this species

(LANL 2006b). The USFWS has concurred with the biological assessment as it relates to the bald eagle and southeastern willow flycatcher (see Chapter 6, Section 6.5.2).

Auxiliary Action A for the Security-Driven Transportation Modifications Project involves construction of a two-lane bridge within a 1,000-foot (300-meter)-wide corridor across Mortandad Canyon and a new two-lane road from the north end of the new bridge westward through TA-60 to connect TA-35 with TA-3. Auxiliary Action B involves construction of a new two-lane bridge that would be constructed within a 1,000-foot (300-meter)-wide corridor across Sandia Canyon and a new two-lane road from the new bridge to connect with East Jemez Road. Construction of the roadways would have minimal impacts on habitat because they generally would follow the existing rights-of-way that have already been disturbed. The road that would be constructed under the second action, however, would require clearing and grading approximately 1.3 acres (0.5 hectares) of ponderosa pine forest. No wetlands or aquatic resources would be directly affected by roadway construction.

Under both auxiliary actions, road and bridge construction would take place within the buffer zone of the Sandia-Mortandad Canyon and Los Alamos Canyon Mexican spotted owl Area of Environmental Interest. Additionally, they would pass through the core zone of the Sandia-Mortandad Canyon Mexican spotted owl Area of Environmental Interest. The biological assessment prepared by DOE determined that Auxiliary Action A would disturb up to 25.3 acres (10.2 hectares) of undeveloped core habitat and 0.1 acres (0.4 hectares) of undeveloped buffer habitat. Under Auxiliary Action B, construction would directly impact up to 37.1 acres (15 hectares) of undeveloped core habitat and 28.7 acres (11.6 hectares) of undeveloped buffer habitat. Further, under both actions construction would cause temporary increases in light and noise which would be permanent once the bridge was operational. The biological assessment concluded that even if reasonable and prudent measures are implemented to mitigate impacts, project activities may affect, and are likely to adversely affect, the Mexican spotted owl (LANL 2006b). Upon review of the biological assessment, the USFWS determined that it could not adequately analyze the affects of the proposed actions since the exact location and design of the bridges have not been determined. Instead the agency requested that DOE submit a request for consultation when plans are finalized (see Chapter 6, Section 6.5.2).

The biological assessment determined that with reasonable and prudent measures, the project may affect, but is not likely to adversely affect, the bald eagle. This determination was made based on the fact that some foraging habitat degradation would be associated with construction. Since the closest southwestern willow flycatcher Area of Environmental Interest is more than 2.3 miles (3.7 hectares) from the nearest construction area, the biological assessment determined that there would be no effect to this species (LANL 2006b). The USFWS has concurred with the biological assessment as it relates to bald eagle and southeastern willow flycatcher (see Chapter 6, Section 6.5.2).

Technical Area Impacts

Two projects are planned that could impact ecological resources within TA-3 and TA-21. These are addressed below.

Technical Area 3

Construction related to the Replacement Office Building Project would involve clearing and grading 13 acres (5.3 hectares) of mixed conifer forest within TA-3, resulting in loss of less mobile wildlife such as reptiles and small mammals and displacing more mobile species such as birds or large mammals. Construction of the new buildings and parking lot would not impact wetlands because none are located in or near the construction zone. Potential impacts to the Mexican spotted owl were evaluated in a biological assessment prepared by DOE. This assessment noted that although 11.2 acres (4.5 hectares) of buffer habitat would be disturbed, if all reasonable and prudent measures are taken, actions associated with the construction may affect, but are not likely to adversely affect, the Mexican spotted owl. The Area of Environmental Interest for the bald eagle does not include any part of TA-3. However, since some bald eagle foraging habitat degradation could be associated with the project, the biological assessment concluded that provided reasonable and prudent measures are implemented, the project may affect, but is not likely to adversely affect, the bald eagle. The nearest southwestern willow flycatcher Area of Environmental Interest is more than 4.6 miles (7.4 kilometers) from the project site. Thus, the biological assessment concluded that the proposed project would have no effect on this species (LANL 2006b). The USFWS has concurred with the biological assessment as it relates to these three species (see Chapter 6, Section 6.5.2).

Operation of the Replacement Office Building complex would likely have minimal impact on terrestrial resources within or adjacent to TA-3 (see Appendix G.2).

Technical Area 21

DD&D of structures at TA-21 would occur within the highly disturbed industrial portion of the TA, which contains little wildlife habitat. Demolition-related disturbances to wildlife would likely be intermittent and localized. After DD&D of the buildings and structures, the site would be contoured and revegetated. Revegetation would have only relatively short-term benefits to wildlife, however, because both the parcel conveyed to Los Alamos County and the parcel retained by DOE could be developed in the future. Elimination of two NPDES-permitted outfalls associated with TA-21 operations would reduce the quantity of surface water discharged to the adjacent canyons.

TA-21 falls within the Los Alamos Canyon Mexican spotted owl Area of Environmental Interest. Because TA-21 is highly disturbed, no suitable foraging or nesting habitat would be lost as a result of DD&D activities. Because noise levels would increase as a result of demolition activities the biological assessment prepared by DOE concluded that provided reasonable and prudent measures are implemented, DD&D activities may affect, but are not likely to adversely affect, the Mexican spotted owl. Since no bald eagle nesting or foraging habitat would be lost as a result of DD&D activities and the southwestern willow flycatcher Area of Environmental Interest is more than 2.6 miles (4.2 kilometers) from TA-21, the biological assessment determined that the proposed project would have no effect on either species (LANL 2006b). The USFWS has concurred with the biological assessment as it relates to these three species (see Chapter 6, Section 6.5.2).

Key Facilities Impacts

Four projects related to Key Facilities at LANL are planned that could affect ecological resources.

Radiochemistry Facility

Although construction of some of the new facilities associated with the Radiological Sciences Institute would take place on previously disturbed land, it would be necessary to clear about 12.6 acres (5.1 hectares) of ponderosa pine forest at TA-48, which would directly and indirectly impact area wildlife. Construction of the Radiological Sciences Institute would not directly impact wetlands located in Mortandad Canyon or the small wetland situated between TA-48 and TA-55, and best management practices would reduce the potential for indirect impacts. There would be no impact to aquatic resources from construction and operation of the Radiological Sciences Institute.

Portions of TA-48 are located within core and buffer zones of the Sandia-Mortandad Canyon and Pajarito Canyon Mexican spotted owl Areas of Environmental Interest. However, only a small portion of the Radiological Sciences Institute may be built within buffer habitat. Thus, the biological assessment prepared by DOE concluded that with the application of reasonable and prudent measures, the project may affect, but is not likely to adversely affect, the Mexican spotted owl. Areas of Environmental Interest for the bald eagle do not include any part of TA-48 or TA-55. Since some bald eagle foraging habitat degradation is possible with construction of the Radiological Sciences Institute, the biological assessment concluded that with reasonable and prudent measures the project may affect, but is not likely to adversely affect, the bald eagle. The nearest southwestern willow flycatcher Area of Environmental Interest is over 3 miles (4.8 kilometers) from the project site. Thus, it was determined that there would be no effect on this species (LANL 2006b). The USFWS has concurred with the biological assessment as it relates to these three species (see Chapter 6, Section 6.5.2).

Removal of existing buildings and structures at TA-48, as well as those to be replaced by the Radiological Sciences Institute, would generate increased noise and levels of human disturbance. These impacts would be temporary, however, and would likely have minimal effect on wildlife because these structures exist within previously disturbed areas and wildlife in adjacent areas is accustomed to human activity. As wetlands do not exist in the immediate area of any of the buildings to be replaced by the new Radiological Sciences Institute, there would be no direct impacts on this resource. Of the buildings to be demolished in connection with the Radiological Sciences Institute project, only those located in TA-35 are located in developed core habitat for the Mexican spotted owl. The removal of these buildings could produce increased noise levels in undeveloped core habitat. However, the biological assessment concluded that demolition may affect, but is not likely to adversely affect, the Mexican spotted owl, provided that reasonable and prudent measures are followed. DD&D activities would have no effect on the bald eagle and southwestern willow flycatcher (LANL 2006b). The USFWS has concurred with the biological assessment as it relates impacts to these three species (see Chapter 6, Section 6.5.2).

Radioactive Liquid Waste Treatment Facility

No impacts to terrestrial resources or wetlands would be expected from implementing any of the alternatives for the Radioactive Liquid Waste Treatment Facility upgrade because it is located within a highly developed industrial area of TA-50. However, the evaporation tanks and pipeline that are proposed as an auxiliary action to this project would be located in undeveloped core and buffer habitat of the Sandia-Mortandad Canyon Mexican spotted owl Area of Environmental Interest. The biological assessment prepared by DOE determined that the tanks and pipeline would remove 3.1 acres (1.3 hectares) of undeveloped buffer habitat and 2.3 acres (0.9 hectares) of undeveloped core habitat. It was also determined that construction of the Radioactive Liquid Waste Treatment Facility would likely raise noise levels in the core zone. The biological assessment concluded that with the application of reasonable and prudent measures the project may affect, but is not likely to adversely affect, the Mexican spotted owl. The bald eagle Area of Environmental Interest is not located near the proposed project site; however, because the entire LANL site is considered potential bald eagle foraging habitat there may be some habitat degradation associated with the project. Provided reasonable and prudent measures are implemented, the biological assessment concluded that construction may affect, but is not likely to adversely affect, the bald eagle. The proposed project is not within or upstream of the southwestern willow flycatcher Area of Environmental Interest; thus, the project would not effect this species (LANL 2006b). The USFWS has concurred with the DOE biological assessment as it relates to these three species (see Chapter 6, Section 6.5.2). Implementation of the evaporation tank option would likely reduce the extent of perennial and intermittent stream reaches, associated wetlands, and riparian habitat, which would reduce the abundance and diversity of prey species for the Mexican spotted owl. Significant adverse impacts to the Mexican spotted owl, however, are not expected.

Solid Radioactive and Chemical Waste Facilities

Under both the options proposed as part of Waste Management Facilities Transition activities within TA-54, including new construction and removal of the white-colored domes, all activities would occur within developed areas. Thus, there would be little to no impact on ecological resources. Although TA-54 includes a portion of the southwestern willow flycatcher Area of Environmental Interest, the area within which project related activities would take place is located about 450 feet (137 meters) from the core habitat. Provided reasonable and prudent measures are implemented, the biological assessment prepared by DOE concluded that the project may affect, but is not likely to adversely affect, the southwestern willow flycatcher. With respect to the bald eagle and Mexican spotted owl, the biological assessment determined that there would be no effect on either species as a result of implementing the proposed project. This is the case since the site does not include any portion of Areas of Environmental Interest for these species, foraging habitat would not be disturbed, and noise levels would be low (LANL 2006b). The USFWS has concurred with this assessment as it relates to these three species (see Chapter 6, Section 6.5.2).

The proposed TRU Waste Facility could be located within a generic area in the Pajarito Road corridor selected from among a number of TAs, and would disturb about 2.5 to 7 acres (1 to 2.8 hectares) of land. In most cases this would involve the removal of ponderosa pine forest or

open field habitat; however, the generic site within TA-54 West is developed. Impacts to wetlands and aquatic resources from this project would not be expected.

At least some portion of either the core or buffer zone of Mexican spotted owl Areas of Environmental Interest would be affected by construction of the new facility within all generic sites except in TA-48, TA-51, and TA-54 West. For those generic sites where the new facility has the potential to affect the spotted owl, either directly or indirectly (for example, by excess noise or light), it would be necessary to conduct a biological assessment and initiate formal consultation with the USFWS. None of the generic sites are within Areas of Environmental Interest for the bald eagle or southwestern willow flycatcher.

Pajarito Site

DD&D of facilities at TA-18 would have little impact on wildlife habitat because the facilities are located within areas that are developed and fenced. Animals could be intermittently disturbed by activity and noise during the demolition period. Implementation of best management practices during demolition would prevent potentially sediment-laden runoff from reaching the wetland located at the eastern end of TA-18. Ultimately, previously disturbed areas would be restored using native species, which would benefit area wildlife.

DD&D of buildings and structures at TA-18 would not directly impact the Mexican spotted owl because all activities would take place within developed areas. However, the biological assessment performed by DOE noted that noise levels in the core zone would be elevated above background levels. The biological assessment concluded that with the implementation of reasonable and prudent measures, DD&D activities may affect, but are not likely to adversely affect, the Mexican spotted owl. With respect to the bald eagle, DD&D of TA-18 facilities would have no effect since the project would not remove any bald eagle foraging habitat. While the project would take place upstream from the southwestern willow flycatcher Area of Environmental Interest, it was determined that with the application of reasonable and prudent measures, the project may affect, but is not likely to adversely affect, the southwestern willow flycatcher (LANL 2006b). The USFWS has concurred with the biological assessment as it relates to these three species (see Chapter 6, Section 6.5.2).

Biosciences Facilities

Construction of the Science Complex would involve clearing and grading approximately 5 acres (2 hectares) of ponderosa pine forest under the Northwest TA-62 and Research Park Site options, which would result in loss and displacement of wildlife. Indirect impacts from construction, such as noise or human disturbance, could also impact wildlife. Construction of the new buildings and parking structure would not impact wetlands because none are located in or near the construction zone under either option. Operation of the Science Complex would minimally impact terrestrial resources because wildlife residing in the area has already adapted to levels of noise and human activity associated with development in the general area. Impacts to ecological resources would be minimal under the South TA-3 option because the area is already partially developed and is within the more developed part of TA-3.

Under the Northwest TA-62 Option a portion of the project area falls within the core and buffer zone of the Los Alamos Canyon Area of Environmental Interest for the Mexican spotted owl. The biological assessment prepared by DOE determined that construction would remove some undeveloped core habitat and buffer habitat. Further, the project would potentially increase noise levels in the core zone. The biological assessment noted that provided all reasonable and prudent measures are implemented, the project may affect, but is not likely to adversely affect, the Mexican spotted owl. Areas of Environmental Interest for the bald eagle and southwestern willow flycatcher are not located near the proposed Northwest TA-62 Science Complex location. However, because the bald eagle forages over all of LANL and some habitat degradation associated with construction could occur, the biological assessment concluded that with reasonable and prudent measures, the project may affect, but is not likely to adversely affect, the bald eagle. The nearest southwestern willow flycatcher Area of Environmental Interest is not within or downstream of the project site; thus, there would be no effect on this species (LANL 2006b). The USFWS has concurred with the biological assessment as it relates to these three species (see Chapter 6, Section 6.5.2). Although the Research Park Site Option was not addressed in the biological assessment, the site is not within an Area of Environmental Interest for the Mexican spotted owl, bald eagle, or willow flycatcher. Thus, impacts to these species under this option would not be expected.

Warehouse and Truck Inspection Station

The proposed project would include clearing and grading approximately 4 acres (1.6 hectares) of ponderosa pine forest and pinyon-juniper woodland, which would result in loss and displacement of wildlife. Indirect impacts from construction, such as noise or human disturbance, could also impact wildlife. Operation of the proposed Remote Warehouse and Truck Inspection Station would not likely pose significant adverse effects to area wildlife. The new facility would not be located within Areas of Environmental Interest for the Mexican spotted owl, bald eagle, or southwestern willow flycatcher. However, because the bald eagle forages over all of LANL and some habitat degradation associated with construction could occur, the biological assessment prepared by DOE concluded that with appropriate reasonable and prudent measures, the project may affect, but is not likely to adversely affect, the bald eagle. The biological assessment further concluded that there would be no effect on the Mexican spotted owl or southwestern willow flycatcher (LANL 2006b). The USFWS has concurred with this assessment (see Chapter 6, Section 6.5.2).

5.6 Human Health

5.6.1 Radiological Impacts on the Public

People can be exposed to radiation through a variety of ways. Airborne radioactive particles can be inhaled. Radioactive particles can be ingested if they are on the surface of food or if the food was produced in areas that are contaminated with radioactive material that can be taken up by plants and animals. The body can be directly exposed to radiation from radionuclides in air emissions or from proximity to radioactive materials that have been deposited on the ground. Radiation also can enter the body through skin breaks. Estimates were made of the amount of radioactive materials to which the public could be exposed due to LANL radioactive air

emissions (see Section 5.4.2). Using these estimates, radiation doses from LANL operations to the public and at certain receptor locations were calculated (details can be found in Appendix C).

The total annual radiation dose received by an individual is a combination of the potential dose received from LANL operations and the doses received from other radiation sources such as naturally occurring background radiation, medical radiation, and radiation from other nuclear activities. A challenge in measuring dose is that no person has the same actual exposure rate as any other. Because of this, health impacts analyses often evaluate the upper bound for individual exposure, which is expressed as the potential dose to the hypothetical MEI. For this analysis, the MEI is a hypothetical person who is assumed to remain in place outdoors without shelter and without taking any protective action for the entire period of exposure. In reality, no one would receive a dose approaching that of an MEI, but the concept is useful as an expression of the upper bound of any possible dose to an individual.

Historical data and capabilities were reviewed for the *1999 SWEIS* to determine which LANL facilities would be analyzed as Key Facilities. For this new SWEIS, changes to those capabilities and past emissions determined which facilities would remain designated as Key Facilities. **Table 5–15** lists those Key Facilities used in the human health analyses of this SWEIS.

Table 5–15 List of Facilities Modeled for Radionuclide Air Emissions from Los Alamos National Laboratory

Key Facility Name	*Technical Area/Building*
Chemistry and Metallurgy Research Building	TA-3-29
Sigma Complex	TA-3-66
Machine Shops	TA-3-102
High Explosives Processing Facilities	TA-11
High Explosives Testing Facilities	TA-15/36
Tritium Facilities [a]	TA-16
Pajarito Site	TA-18
Radiochemistry Facility	TA-48
LANSCE	TA-53
Solid Radioactive and Chemical Waste Facilities [b]	TA-54
Plutonium Facility Complex	TA-55
Non-Key Facilities	TA-21

TA = technical area, LANSCE = Los Alamos Neutron Science Center.

[a] This facility includes the Weapons Engineering Tritium Facility (TA-16). The Tritium Science Fabrication Facility and Tritium System Test Assembly at TA-21 continue to have emissions while awaiting DD&D, and are included under the non-Key Facilities.

[b] Includes MDA G and the Decontamination and Volume Reduction System.

Some facilities that have historically low emission rates are unmonitored. These unmonitored point sources receive periodic confirmatory measurements by LANL personnel to verify that emissions remain low. The *1999 SWEIS* analyzed air emissions data from TA-50-1 (Radioactive Liquid Waste Treatment Facility) and confirmed that air emissions were "insignificant relative to other sources at LANL" (LANL 1997b), so the public dose from those emissions was not analyzed. For this new SWEIS, air emissions data from the Radioactive Liquid Waste Treatment Facility were again reviewed for the period from 1999 to 2004. This review of actual radiological air emissions showed a decreasing trend since 1992, with a low of 7.9×10^{-8} curies per year recorded in 2004. The six-year average for TA-50 emissions during that period

(1.1×10^{-7} curies) is far less than emissions from LANSCE (2,700 curies), the major contributor to the public dose. It is anticipated that air emissions data would remain the same for the purposes of analyses presented in this new SWEIS, and therefore would result in insignificant health-related impacts to the public compared to other sources.

To calculate these doses for this new SWEIS, the Clean Air Act Assessment Package – 1988 (CAP-88) software was used. CAP-88 is an EPA-approved computer model for calculating the effective dose equivalent to members of the public, as required by emission monitoring and compliance procedures for DOE facilities [40 CFR 61.93 (a)]. CAP-88 uses modified Gaussian plume equations to estimate the average dispersion of radionuclides released to the air from up to six emitting sources. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area.

For this SWEIS, an estimated dose to the facility-specific MEI was calculated for each modeled facility. The location of each facility-specific MEI is where the dose from that facility's emissions to a member of the public would be largest, and is based on wind direction and meteorological data for that facility. **Table 5–16** shows the distance and direction from each facility to its facility-specific MEI. Doses from all modeled facilities were calculated at the facility-specific MEI location; thus, the dose to the facility-specific MEI represents the estimated dose to an individual from the specific facility and all other modeled facilities. The LANL site-wide MEI is the single highest facility-specific MEI; therefore, any other facility-specific MEI doses would be less than the LANL site-wide MEI for the alternative under analysis.

Table 5–16 Distance and Direction from Key Facilities to the Facility-Specific Maximally Exposed Individual

Key Facility	*MEI Distance Feet (meters)*	*MEI Direction*
Chemistry and Metallurgy Research Building (TA-3–29)	3,575 (1,090)	N
Sigma Complex (TA-3–66)	3,560 (1,085)	N
Machine Shops (TA-3–102)	3,380 (1,030)	N
High Explosives Processing Facilities (TA-11)	4,300 (1,311)	S
High Explosives Testing Facilities (TA-15/36)	7,415 (2,260)	NE
Tritium Facilities (TA-16)	2,885 (879)	SSE
Pajarito Site (TA-18)	2,820 (860)	NE
Radiochemistry Facility (TA-48)	2,920 (890)	NNE
LANSCE (TA-53)	2,625 (800)	NNE
Solid Radioactive and Chemical Waste Facilities (TA-54)	1,195 (364)	NE
Plutonium Facility Complex (TA-55)	3,690 (1,125)	N
Non-Key Facilities (TA-21)	1,050 (320)	N

MEI = maximally exposed individual, TA = technical area, LANSCE = Los Alamos Neutron Science Center.

Population dose estimates were made for the entire population within a 50-mile (80-kilometer) radius of LANL by summing the estimated doses to all people within that radius. The population dose from each facility was modeled independently for each alternative. The total dose from all facilities for one alternative represents the projected population dose from implementing that alternative.

In addition to dose, estimates of risk to the public and the MEI were calculated. Scientists and decisionmakers quantify relationships among risks by using mathematical probabilities. In this SWEIS, risks are defined in terms of the number of additional latent cancer fatalities (excess LCFs due to the estimated dose) from LANL operations. The number of additional LCFs is calculated as the product of the dose in units of person-rem and the risk factor (0.0006 LCF per person-rem). These estimates are intended to be conservative measures of the potential public health impacts of the three alternatives for use in the decisionmaking process; they do not necessarily accurately represent actual anticipated fatalities.

Tables 5–17 and **5–18** summarize the projected public doses resulting from normal operations under each alternative for both an MEI near LANL property and the general population within 50 miles (80 kilometers) of LANL. The potential impact from shutdown of LANSCE operations under the Reduced Operations Alternative would substantially decrease the dose to the general public and to the MEI. Under all of the alternatives, the MEI would receive a smaller dose than the exposure limits set by DOE and EPA.

Table 5–17 Summary of Projected Doses to the Maximally Exposed Individual from Normal Operations at Los Alamos National Laboratory (millirem per year)

	No Action Alternative	***Reduced Operations Alternative***	***Expanded Operations Alternative***
LANL Site-Wide			
Dose from MDA remediation only to LANL Site-Wide MEI	Not applicable	Not applicable	less than 0.42 [b]
Key Facilities [a], includes contributions from:			
CMR Building	0.011	0.0034	0.011
Sigma Complex	0.0041	0.0060	0.0041
Machine Shops	0.00032	0.00045	0.00032
High Explosives Processing Facilities	1.3×10^{-6}	1.8×10^{-6}	1.3×10^{-6}
High Explosives Testing Facilities	0.25	0.72	0.25
Tritium Facilities	0.0036	0.0045	0.0036
Pajarito Site	0.0070	0.0080 [c]	0.0070 [c]
Radiochemistry Facility	0.00029	0.00050	0.00029
LANSCE [d]	7.5	0	7.5
Solid Radioactive and Chemical Waste Facilities	0.0012	0.0012	0.0012 [e]
Plutonium Facility Complex	0.012	0.024	0.012
Non-Key Facility (TA-21)	0.012	0.0071	0.012 [f]
Total LANL Site-Wide MEI Dose	7.8	0.78	Less than 8.2 [b]

MDA = material disposal area, MEI = maximally exposed individual, CMR = Chemistry and Metallurgy Research, LANSCE = Los Alamos Neutron Science Center, TA = technical area.

[a] Under the No Action and the Expanded Operations Alternatives, the LANL site-wide MEI would be located near LANSCE. Under the Reduced Operations Alternative, the LANL site-wide MEI would be located near the High Explosives Testing (Firing Sites) at TA-36.

[b] This dose could be smaller depending on which MDA is being remediated, whether the MDA is being capped or removed, the number of MDAs being remediated at one time, and whether exhumation occurs under an enclosure (see Appendix I).

[c] Dose would be zero following shutdown of Pajarito Site (TA-18) after about 2009.

[d] The maximum dose to the MEI as a result of emissions from LANSCE would be limited to 7.5 millirem per year using administrative controls.

[e] This dose could increase to 0.0018 millirem per year if the Decontamination and Volume Reduction System, the new TRU Waste Facility, and remote-handled transuranic waste retrieval and processing activities operated simultaneously (estimated to occur from 2012 through 2015).

[f] Dose would be zero following decontamination, decommissioning, and demolition of TA-21 after about 2009.

Table 5–18 Summary of Projected Doses to the General Public Within 50 Miles (80 kilometers) of Los Alamos National Laboratory from Normal Operations (person-rem per year)

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site-Wide			
Dose from MDA remediation	Not applicable	Not applicable	Less than 6.2 [a]
Key Facilities, includes contributions from:			
CMR Building	0.43	0.11	0.43
Sigma Complex	0.16	0.16	0.16
Machine Shops	0.01	0.01	0.01
High Explosives Processing Facilities	0.00005	0.00004	0.00005
High Explosives Testing Facilities	6.4	5.2	6.4
Tritium Facilities	0.09	0.09	0.09
Pajarito Site	0.23	0.23 [b]	0.23 [b]
Radiochemistry Facility	0.01	0.01	0.01
LANSCE	22	0	22
Solid Radioactive and Chemical Waste Facilities	0.04	0.04	0.04 [c]
Plutonium Facility Complex	0.19	0.19	0.20
Non-Key Facility (TA-21)	0.09	0.09	0.09 [d]
Total Dose to General Population	**30**	**6.1**	**Less than 36.2 [a]**

MDA = material disposal area, CMR = Chemistry and Metallurgy Research, LANSCE = Los Alamos Neutron Science Center, TA = technical area.

[a] This dose could be smaller depending on which MDAs are being remediated, whether the MDA are being capped or removed, the number of MDAs being remediated at one time, and whether exhumation occurs under an enclosure (see Appendix I).

[b] Dose would be zero following shutdown of Pajarito Site (TA-18) after about 2009.

[c] This dose could increase to 0.06 person-rem per year if the Decontamination and Volume Reduction System, the new TRU Waste Facility, and remote-handled transuranic waste retrieval and processing activities operated simultaneously (estimated to occur from 2012 through 2015).

[d] Dose would be zero following decontamination, decommissioning, and demolition of TA-21 after about 2009.

5.6.1.1 No Action Alternative

Annual doses to the general public and the MEI under the No Action Alternative are generally projected to remain at levels similar to those projected in the *1999 SWEIS* Expanded Operations Alternative. The projected doses for the MEI and population are dominated by estimated emissions from operations at LANSCE. The projected doses also reflect the expected relocation of certain tritium capabilities from the Chemistry and Metallurgy Research Building to the Plutonium Facility Complex as well as the change in operating levels as the Tritium Facilities (TA-21) begin DD&D.

Los Alamos National Laboratory Site-Wide Impacts

The projected annual collective dose to the population living within a 50-mile (80-kilometer) radius of LANL could be as high as 30 person-rem for the No Action Alternative. Nearly all of this dose (greater than 99 percent) would result from Key Facilities operations; the remaining contribution would come from non-Key Facility operations. Overall, the projected dose of 30 person-rem would result in no additional fatalities in the affected population (0.018 LCFs). The doses to the general public and an MEI under the No Action Alternative are presented in

Table 5–19. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

Table 5–19 Annual Radiological Impacts on the Public from Los Alamos National Laboratory Operations under the No Action Alternative

	Population within 50 Miles (80 kilometers) [a]	***Maximally Exposed Individual***
Dose	30 person-rem	7.8 millirem (LANSCE MEI) [b]
Latent cancer fatality risk [c]	0.018	4.7×10^{-6}
Regulatory dose limit [d]	Not applicable	10 millirem
Dose as a percent of regulatory limit	Not applicable	78
Dose from background radiation [e]	135,000 person-rem	400 millirem
Dose as a percent of background dose	0.02	2

LANSCE = Los Alamos Neutron Science Center, MEI = maximally exposed individual.

[a] The population estimated to be living within 50 miles (80 kilometers) of each Key Facility is unique for each facility. The year 2000 estimates range from 271,568 to 404,913, depending on the facility used.

[b] As a mitigating measure, operational controls at LANSCE would limit the MEI dose to 7.5 millirem per year.

[c] Based on a risk estimate of 0.0006 LCF per person-rem.

[d] 40 CFR Part 61 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.

[e] The annual individual dose from natural background radiation at LANL ranges from a low of about 300 to a high of about 500 millirem (see Appendix C).

Under this alternative, the LANL site-wide MEI would be located approximately 2,625 feet (800 meters) north-northeast of LANSCE. This is the location where the dose resulting from emissions from all Key Facilities would be the highest. The annual dose to the MEI under this alternative could be up to 7.8 millirem. This projected dose corresponds to an increased risk of the MEI developing a fatal cancer due to LANL operations under the No Action Alternative of about 1 in 213,000 (4.7×10^{-6}) per year.

Specific Receptors

In addition to potential impacts to the public from the air exposure pathway, the risk to individuals from ingestion of water, foodstuffs, and soils is analyzed in Appendix C. These three individual scenarios, collectively referred to as "specific receptors," include a Los Alamos County resident whose entire diet consists of locally produced foodstuffs, a user of outdoor recreational resources, and a special pathways receptor who relies heavily on fish and wildlife for subsistence. Using the average consumption rates, **Table 5–20** presents the projected doses to these individuals and the associated risks of developing a fatal cancer. Doses from a high consumption rate were also analyzed and detailed in their respective tables in Appendix C. The total doses to each receptor as a result of the potential consumption at these higher rates would be increased by a factor of less than three.

Table 5–20 Annual Ingestion Pathway Dose for Average Consumption Rates by Specific Receptors

	Dose (millirem)	***Cancer Fatality Risk*** [a]
Offsite county resident	2.7	1.6×10^{-6}
Recreational resources user	4.0	2.4×10^{-6}
Special pathways receptor	4.5	2.7×10^{-6}

[a] Based on a risk estimate of 0.0006 LCF per person-rem.

The associated LCF risks resulting from the doses shown in Table 5–20 would be about 1 in 230,000 for the offsite county resident, 1 in 180,000 for the recreational resources user, and 1 in 156,000 for the special pathways receptor per year. These doses from ingestion would be almost entirely due to naturally occurring radioactivity in the environment and contamination in water and soils from worldwide fallout and past LANL operations. The contribution to ingestion pathway doses from current and projected future LANL operations tends to be extremely small by comparison, largely due to the more stringent effluent control and waste management practices now in use. Accordingly, these ingestion pathway dose and risk values are expected to remain essentially unchanged for some time and would apply to all three alternatives.

Technical Area Impacts

No measurable doses to the population or the site-wide MEI are expected to result from TA impacts under the No Action Alternative outside those associated with Key Facilities operations (as discussed below).

Key Facility Impacts

Los Alamos Neutron Science Center

Nearly all of the calculated MEI dose (96 percent) under the No Action Alternative would be attributable to gaseous mixed activation products from operations at LANSCE. Because of the close proximity of the LANSCE facility to the LANL site boundary, gaseous mixed activation product emissions remain the largest source of offsite dose from the airborne pathway. As a mitigating measure, administrative controls have been established at LANSCE that regulate beam operations as emissions levels increase. These controls require operational changes to prevent the generation of excessive radioactive air emissions so that the maximum dose to the LANL site-wide MEI from air emissions at LANSCE is 7.5 millirem per year, or less. The remainder of the dose to the LANL site-wide MEI as a result of LANL operations at all other Key Facilities (0.3 millirem per year) is small compared to that from operations at LANSCE.

5.6.1.2 Reduced Operations Alternative

Under the Reduced Operations Alternative, a major decrease in doses to the public compared to those under the No Action Alternative would result from lack of radiological air emissions from LANSCE after potential shutdown. Doses lower than those under the No Action Alternative also would be expected from reductions in high explosives processing and testing operations, and from reduced emissions from the Chemistry and Metallurgy Research Building. In 2009, shutdown of Pajarito Site (TA-18) operations would further reduce doses to the public.

Los Alamos National Laboratory Site-Wide Impacts

The projected annual collective dose to the population living within a 50-mile (80-kilometer) radius of LANL, as shown in **Table 5–21,** could be as high as 6.1 person-rem under the Reduced Operations Alternative. Nearly all of this dose (greater than 98 percent) would come from Key Facilities operations, and the remaining contribution would come from non-Key Facility operations. Overall, the projected annual collective dose of 6.1 person-rem would produce no additional fatalities in the affected population (0.0038 LCFs).

Table 5–21 Annual Radiological Impacts on the Public from Los Alamos National Laboratory Operations under the Reduced Operations Alternative

	Population within 50 Miles (80 kilometers) [a]	*Maximally Exposed Individual*
Dose [b]	6.1 person-rem	0.78 millirem (TA-36 MEI)
Latent cancer fatality risk [c]	0.0037	4.7×10^{-7}
Regulatory dose limit [d]	Not applicable	10 millirem
Dose as a percent of regulatory limit	Not applicable	7.8
Dose from background radiation [e]	135,000 person-rem	400 millirem
Dose as a percent of background dose	0.005	0.2

TA = technical area, MEI = maximally exposed individual, MDA = material disposal area.

[a] The population estimated to be living within 50 miles (80 kilometers) of each Key Facility is unique for each facility. The year 2000 estimates range from 271,568 to 404,913, depending on the facility used.

[b] Shutdown of TA-18 in about 2009 would result in a decrease in the population dose of 0.23 person-rem and a negligible decrease in the MEI dose.

[c] Based on a risk estimate of 0.0006 LCF per person-rem.

[d] 40 CFR Part 61 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.

[e] The annual individual dose from natural background radiation at LANL ranges from a low of about 300 to a high of about 500 millirem (see Appendix C).

The LANL site-wide MEI under this alternative would be located 7,415 feet (2,260 meters) northeast of the High Explosives Testing Facilities at TA-36. This is the location where the dose resulting from emissions from all Key Facilities would be the highest. The estimated dose to this MEI would be 0.78 millirem per year for the foreseeable future. This projected dose corresponds to an increased risk of the MEI developing a latent fatal cancer as a result of LANL operations under the Reduced Operations Alternative of about 1 in 2.1 million (4.7×10^{-7}) per year.

Specific Receptors

The risk to the public specific receptors from ingestion of foodstuffs and water under the Reduced Operations Alternative does not differ from that described under the No Action Alternative, as most of the risk is attributable to existing levels of contamination, not future operations at LANL.

Technical Area Impacts

No measurable doses to the population or the site-wide MEI are expected to result from TA impacts under the Reduced Operations Alternative other than those associated with Key Facilities operations (discussed below).

Key Facility Impacts

Los Alamos Neutron Science Center

Under this alternative, operations at LANSCE would not be active and high explosives processing and testing would be reduced by 20 percent, resulting in a 79 percent reduction in the total projected dose to the population compared to the dose for the No Action Alternative.

High Explosives Testing Facilities

Long-lived uranium isotope emissions from the reduced level of activities at the High Explosives Testing Facilities at TA-15 and TA-36 would produce the majority of the population dose (80 percent). Because the location of the LANL site-wide MEI under the Reduced Operations Alternative would change from the location of the MEI associated with the No Action Alternative, the dose contributions from each Key Facility to the new MEI location would be different. For instance, although there is a 20 percent reduction in high explosives testing under the Reduced Operations Alternative, the dose to the LANL site-wide MEI from operations at the High Explosives Testing Facilities under this alternative is projected to be 0.72 millirem per year, compared to a dose of 0.25 millirem from high explosives testing under the No Action Alternative. In fact, more than 90 percent of the dose to the MEI under the Reduced Operations Alternative would come from emissions of uranium isotopes produced at the High Explosives Testing Facilities.

Pajarito Site

After about 2009, a decrease in the population dose of 0.23 person-rem per year would result from permanent shutdown of operations at the Pajarito Site (TA-18). The population dose from the Reduced Operations Alternative would therefore decline by approximately 4 percent.

Chemistry and Metallurgy Research Building

Limited operation of the Chemistry and Metallurgy Research Building under this alternative would decrease the dose to the population surrounding LANL population by 0.32 person-rem, which is reflected in the estimated population dose of 6.1 person-rem per year.

5.6.1.3 Expanded Operations Alternative

Under the Expanded Operations Alternative, there would be increased levels of activities at certain facilities in addition to construction projects, as well as some reduced activities. Operations resulting from LANSCE's refurbishment could increase air emissions, including radiological emissions (and consequential dose), due to enhanced operational availability of the accelerator facilities. There also would be an increase in pit production within the Plutonium Facility Complex (TA-55), up to 80 pits per year, which would produce additional radiological air emissions. Under this alternative, there could be an additional temporary or one-time dose to the public from removal of waste from the MDAs, which would last until MDA exhumations are completed. Actions proposed under this alternative that would result in smaller doses include completion of DD&D of buildings at TA-21 and shutdown of SHEBA operations at TA-18.

Los Alamos National Laboratory Site-Wide Impacts

The projected annual collective dose to the population living within a 50-mile (80-kilometer) radius of LANL, as shown in **Table 5–22,** could be as high as 36 person-rem for the Expanded Operations Alternative; 30 person-rem of that total dose would come from operations at the Key Facilities and the remaining 6 person-rem from removal activities at the various MDAs. Overall, the projected dose of 36 person-rem would result in no additional fatalities in the affected population (0.022 LCFs).

Table 5–22 Annual Radiological Impacts on the Public from Los Alamos National Laboratory Operations under the Expanded Operations Alternative

	Population within 50 Miles (80 kilometers) [a]	***MEI***
Dose [b]	36 person-rem	8.2 millirem (LANSCE MEI) [c]
Latent cancer fatality risk [d]	0.022	4.9×10^{-6}
Regulatory dose limit [e]	Not applicable	10 millirem
Dose as a percent of regulatory limit	Not applicable	82
Dose from background radiation [f]	135,000 person-rem	400 millirem
Dose as a percent of background dose	0.027	2.1

LANSCE = Los Alamos Neutron Science Center, MEI = maximally exposed individual, MDA = material disposal area.

[a] The population estimated to be living within 50 miles (80 kilometers) of each Key Facility is unique for each facility. The year 2000 estimates range from 271,568 to 404,913, depending on the facility used.

[b] These reflect the additional doses to the public from remediation of the larger MDAs and the simultaneous operation of the Decontamination and Volume Reduction System, the new TRU Waste Facility, and remote-handled transuranic waste retrieval and processing activities. The shutdown of TA-18 and TA-21 in about 2009 would result in a decrease in population dose of 0.32 person-rem and a negligible decrease in MEI dose.

[c] As a mitigating measure, operational controls at LANSCE would limit the MEI dose to 7.5 millirem per year. Population and MEI doses are projected at 6.2 person-rem and 0.42 millirem respectively, and are attributable to MDA remediation.

[d] Based on a risk estimate of 0.0006 LCF per person-rem.

[e] 40 CFR Part 61 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.

[f] The annual individual dose from natural background radiation at LANL ranges from a low of about 300 to a high of about 500 millirem.

Under this alternative, the LANL site-wide MEI would be located 2,625 feet (800 meters) north-northeast of LANSCE. This is the location where the dose resulting from emissions from all Key Facilities would be the highest. Including the additional dose from remediation activities at the MDAs under this Alternative could bring the MEI dose to about 8.2 millirem. This projected dose corresponds to an increased risk of developing a latent fatal cancer for the MEI from LANL operations under the Expanded Operations Alternative of about 1 in 203,000 (4.9×10^{-6}) per year.

The various effects of radiological air emissions from the major MDA remediation activities, canyon cleanups, and other Consent Order actions could range from small long-term to temporary short-term doses to the public under the Expanded Operations Alternative. Under the MDA Capping Option, although the waste would remain in place, the long-term doses to the public would be reduced. The potential for radionuclides to be dispersed into the air would be reduced by the improved covers, which also would reduce doses. The MDA Removal Option would result in lower long-term risks to the public because the bulk of the contamination would be removed from the site. In the short term, however, the release of radionuclides into the air during removal could result in higher radiological doses to the public. If that removal took place under an enclosure, radiological air emissions would be filtered before exiting the structure, resulting in lower short-term doses to the public.

Under the MDA Removal Option, various radiological air emissions could be released depending on the inventory of radionuclides at the MDA being remediated and whether the removal was performed under an enclosure. These removal activities would be completed within a finite time of a few months to several years, depending on the MDA. For that specified amount of time, there would be an additional dose to the public resulting from emissions released during the

removal of the MDA. There are several large MDAs to be remediated. The total estimated dose to the public (6.2 person-rem per year) within 50 miles (80 kilometers) of operations at LANL under this alternative is based on a conservative assumption that all MDAs would be exhumed at the same time.

The same factors—the inventory of radionuclides present in a given MDA and whether or not an enclosure is used—would affect the dose to the MEI. In addition, the location of the MDA being remediated could affect the dose an MEI would receive. The impacts of remediating the MDAs on the LANL site-wide MEI were analyzed in Appendix I. Removal activities at each MDA could contribute to the dose received by the LANL site-wide MEI under the Expanded Operations Alternative, who is assumed to be located northeast of LANSCE near the East Gate. Assuming *all* the large MDAs were remediated at the same time, the portion of the estimated dose to the LANL site-wide MEI contributed by MDA removal activities would be no more than 0.42 millirem in any given year.

Specific Receptors

The risk to the public specific receptors from ingestion of foodstuffs and water under the Expanded Operations Alternative would not differ from that described under the No Action Alternative, as most of the risk is attributable to the existing levels of contamination, not future operations at LANL.

Technical Area Impacts

No measurable doses to the population or the site-wide MEI are expected to result from TA impacts under the Expanded Operations Alternative apart from those associated with Key Facilities operations (discussed below) or MDA remediation activities (discussed above).

Key Facility Impacts

Under the Expanded Operations Alternative, impacts to the public from activities at the Key Facilities, including both increases in some activities and decreases in others, would be similar to those under the No Action Alternative. The change in the location of emissions from the Chemistry and Metallurgy Research Building in TA-3 to the Chemistry and Metallurgy Research Replacement Facility in TA-55 would have little effect on doses to the public compared to impacts from operations at LANSCE. Increased pit production at the Plutonium Facility Complex in TA-55 would cause a small increase in emissions, but the resulting doses to the public would be relatively small compared to the contribution from activities at LANSCE. Similarly, if the evaporation tank auxiliary action were implemented under the Radioactive Liquid Waste Treatment Facility Upgrade, the doses that would result from the tank air emissions (primarily tritium) would be small and bounded by the impacts from other key facilities.

Los Alamos Neutron Science Center

Over 60 percent of the projected population dose (22.3 person-rem per year) would result from radiological air emissions from LANSCE (TA-53). Similar to the No Action Alternative, the majority of the dose to the LANL site-wide MEI under the Expanded Operations Alternative would result from emissions of gaseous mixed activation products from operations at LANSCE.

Because of the close proximity of LANSCE to the LANL site boundary, gaseous mixed activation product emissions remain the greatest source of offsite dose via the airborne pathway. If the LANSCE Refurbishment Project were implemented, the dose from air emissions at LANSCE to the LANL site-wide MEI could potentially increase. As described in the No Action Alternative (see Section 5.6.1.1), however, the dose to the LANL site-wide MEI from air emissions at LANSCE would be limited by operational controls to 7.5 millirem per year.

High Explosives Testing Facilities

An additional 18 percent of the dose (6.4 person-rem per year) to the public would come from operations at the High Explosives Testing Facilities (TA-15 and TA-36).

Solid Radioactive and Chemical Waste Facilities

Implementation of the Waste Management Facilities Transition Project would result in relatively small additional impacts to the population near LANL. From 2012 through 2015, there would be a potential for simultaneous operation of the Decontamination and Volume Reduction System, the new TRU Waste Facility, and remote-handled transuranic waste retrieval and processing activities. Resulting impacts to the population from operations of these systems during this time would be negligible (an additional 0.02 person-rem per year) and are included in Table 5–22. Long-term impacts to the public would include a reduction in dose due to eventual removal of stored wastes in Area G.

Plutonium Facility Complex

The higher level of activity at the Plutonium Facility Complex associated with increased pit production also would result in a small increase in the dose to the public to 0.20 person-rem per year. The higher level of activity at the Plutonium Facility Complex associated with increased pit production would cause a negligible increase in the dose to the LANL site-wide MEI (less than 0.001 millirem).

Pajarito Site and Tritium Facilities

The estimated population dose would decrease slightly (by 0.32 person-rem per year) due to the permanent elimination of emissions from activities at the Pajarito Site at TA-18 and the Tritium Facility at TA-21 which is expected to occur in about 2009. The lack of activity at the Pajarito Site (TA-18) and the Tritium Facility (TA-21) would have a small effect (a decrease of 0.02 millirem per year) on the dose to the MEI compared to the dose from operations at LANSCE (7.5 millirem per year).

5.6.2 Chemical Impacts on the Public

5.6.2.1 No Action Alternative

Key Facilities

The combined cancer risk due to all carcinogenic pollutants from all TAs, as analyzed in the *1999 SWEIS*, was dominated by chloroform emissions expected from the Bioscience Facilities

(formerly the Health Research Laboratory) (see **Tables 5–23** and **5–24**). Assuming that 100 percent of the chloroform used was emitted (and assuming no change in other carcinogenic pollutant emissions compared to those evaluated), the estimated combined incremental cancer risk at the Los Alamos Medical Center would be slightly above the guideline value of 1 in a million (1.0×10^{-6}). In other words, one person in a population of a million would develop cancer if this population were exposed to this concentration over a lifetime, a level of concern established in the Clean Air Act. It is known, however, that less than 100 percent of the chloroform used is emitted as a toxic air pollutant (as much as 25 pounds per year [8 liters per year] were disposed of as liquid chemical waste); thus, the incremental cancer risk under the No Action Alternative would be less than the guideline value. In addition, recent use of chloroform has been about 30 percent of the use projected for the Expanded Operations Alternative described in the *1999 SWEIS*. Based on the information discussed above, toxic air pollutants released under this new SWEIS No Action Alternative are not expected to cause air quality impacts that would affect human health and the environment.

Table 5–23 Estimated Annual Emission Rates of Carcinogenic Pollutants that Could Be Released from the Health Research Laboratory of the Technical Area 43 Facilities

Pollutants	*Stack ID*	*Annual Average Emission Rates*	
		Pounds per Year	*Grams per Second*
Acrylamide	Building 247	0.00586	8.44×10^{-8}
	Building 124/126	0.00586	8.44×10^{-8}
	N. Side FH	0.00586	8.44×10^{-8}
	S. Side FH	0.00586	8.44×10^{-8}
Chloroform	Building 247	2.2	0.0000317
	Building 124/126	21.3	0.000307
	N. Side FH	21.3	0.000307
	S. Side FH	21.3	0.000307
Formaldehyde	Building 247	0.173	0.0000025
	Building 124/126	1.68	0.0000241
	N. Side FH	1.68	0.0000241
	S. Side FH	1.68	0.0000241
Methylene Chloride	N. Side FH	0.946	0.0000136
	S. Side FH	0.946	0.0000136
Trichloroethylene	N. Side FH	10.2	0.000147

Source: DOE 1999a.

Table 5–24 Results of the Dispersion Modeling Analysis of Carcinogenic Pollutants from the Health Research Laboratory at Technical Area 43

Carcinogenic Pollutants	*Estimated Annual Concentration (micrograms per cubic meter)*
Acrylamide	0.0000115
Chloroform	0.0304
Formaldehyde	0.0024
Methylene Chloride	0.00078
Trichloroethylene	0.00334

Source: DOE 1999a.

Public health consequences from emissions of beryllium, lead, and depleted uranium from the High Explosives Testing Facilities (see Table 5−9) were analyzed by calculating hazard indices for lead and depleted uranium and calculating the excess LCFs from beryllium. A hazard index equal to or above 1 is considered consequential from a human toxicity standpoint. Beryllium has no established EPA reference dose from which to calculate the hazard index. The worst-case hazard indices for lead and depleted uranium were less than 0.000015 and 0.000065, respectively. The excess LCFs from beryllium were estimated to be 1 in 2,780,000 (3.6×10^{-7}) (DOE 1999a). Use of foam to control emissions from the High Explosives Testing Facilities would further reduce these emissions and health effects by about 50 to 95 percent (LANL 2006a).

Emissions from beryllium sources currently at the Beryllium Technology Facility in the Sigma Complex (TA-3) and Plutonium Facility Complex (TA-55) (see Table 5–10) are controlled by HEPA filtration with a removal efficiency of 99.95 percent. The maximum cancer risk of beryllium releases from TA-3 using its unit risk factor is approximately 1 in 415 million (2.41×10^{-9}), which is below the guideline value of 1 in a million (1.0×10^{-6}). In other words, one person in a population of a million would develop cancer if this population were exposed to this concentration over a lifetime, a level of concern established in the Clean Air Act. The maximum combined cancer risk of beryllium releases from TA-55 using its unit risk factor is approximately 1 in 4.3 billion (2.35×10^{-10}), which is also below the guideline value of 1 in a million (1.0×10^{-6}) (DOE 1999a).

5.6.2.2 Reduced Operations Alternative

Key Facilities

Public risk resulting from chemical releases under the Reduced Operations Alternative would be approximately the same as those associated with the No Action Alternative. There would be a reduction in risks associated with high explosives processing and testing activities because these activities would be reduced by 20 percent under this alternative. There also would be minor reductions in risk to the public as a result of shutting down operations at LANSCE and the Pajarito Site (TA-18) under this alternative.

5.6.2.3 Expanded Operations Alternative

Key Facilities

Public risk resulting from chemical releases under the Expanded Operations Alternative would be approximately the same as those associated with the No Action Alternative, except for a small increase (2.5 percent) in risk due to high explosives processing activities.

5.6.3 Worker Health

Worker risks associated with continued operations at LANL include radiological (ionizing and non-ionizing) risks, chemical exposure risks, and risk of injury during normal operations. The consequences to worker health from implementing the No Action, Reduced Operations, and Expanded Operations Alternatives are discussed below.

DOE has developed new regulations to require non-nuclear DOE contractors to comply with relevant Occupational Safety and Health Administration safety and health standards. Noncompliance could result in monetary fines. This is the first DOE regulation to provide for the protection of non-nuclear contractor workers. This new rule, 10 CFR Part 851, goes into effect on February 7, 2007, to allow 1 year for contractor and site management compliance training (DOE 2006a).

5.6.3.1 No Action Alternative

Ionizing Radiation Consequences

Table 5–25 presents the projected worker exposure from normal operations under the No Action Alternative. This projection is larger than the average annual worker dose shown in Chapter 4, Section 4.6.2.1, because it includes the dose associated with achieving a production level of 20 pits per year at TA-55, as well as the dose from increased levels of activity associated with additional personnel working in the new Chemistry and Metallurgy Research Replacement Facility. This projected collective worker dose represents the dose to the LANL workforce for the foreseeable future under the No Action Alternative.

Table 5–25 Projected Worker Radiation Exposure under the No Action Alternative

Collective worker dose (person-rem per year)	280
Number of workers with measurable dose	2,018
Excess LCF risk per year among worker population	0.17 [a]
Average individual worker measurable dose (millirem)	139
Excess LCF risk per year for average individual worker	0.000083 [a]
DOE limit on annual worker radiation exposure (millirem)	5,000
LANL average individual worker dose as a percentage of DOE limit (percent)	2.8

LCF = latent cancer fatality.
[a] Based on a risk estimate of 0.0006 LCF per person-rem (see Appendix C).

Worker exposures to radiation and radioactive materials in radiological control areas would be controlled using established procedures that require doses to be kept as low as reasonably achievable (ALARA). Potential hazards would be evaluated as part of the radiation worker and occupational safety programs at LANL. Nonroutine construction activities may require special work permits and worker protection measures for specific locations and activities.

DOE limits set the standard for worker exposure at 5,000 millirem per year whole body dose equivalent. In 10 CFR Part 835, DOE requires the ALARA process to be applied to reduce worker exposure to ionizing radiation. DOE has set an administrative control level of 2,000 millirem per year for an individual worker exposure (DOE 1999e). This level can be intentionally exceeded only with higher-level management approvals.

Under the No Action Alternative, the average individual worker dose of 139 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 in 12,000 (8.3×10^{-5}) per year of operations. In addition to the 2,018 workers expected to receive a measurable dose, under the No Action Alternative, over 11,000 LANL workers or approximately

85 percent of the workforce would not likely receive any measurable dose during a year of normal operations.

Non-ionizing Radiation Consequences

Under the No Action Alternative, negligible effects on LANL worker health from normal operations of non-ionizing radiation sources, infrared radiation from instrumentation and welding, lasers, magnetic and electromagnetic fields, and microwaves would likely continue.

Biohazardous Material Exposure Consequences

Under the No Action Alternative, there would be negligible effects on LANL worker health from normal operations of the existing Biosafety Level 1 and 2 facilities. As explained in Appendix C, workers are protected by a combination of microbiological safety practices, safety equipment acting as primary barriers, and facilities that provide secondary barriers to preclude contamination or infection by biohazardous material.

Chemical Exposure Consequences

Occasional reportable, but minor, chemical exposures could occur at the rate of one to three incidents annually due to worker exposure to airborne asbestos, lead paint particles, crystalline silica, fuming perchloric acid, hydrofluoric acid, or acids or alkalis (via skin contact).

Operation of the Beryllium Technology Facility in the Sigma Complex presents a potential risk of worker exposure to beryllium. Other uses of beryllium at LANL include metals applications, which present little risk. The annual worker risk associated with high-explosives-testing-related applications of beryllium (evaluated as a carcinogen in the *1999 SWEIS*) at LANL was estimated to be less than 1 in 2.7 million (3.6×10^{-7}). This estimate is still valid under the No Action Alternative of this SWEIS.

Occupational Injuries and Illness

Occupational injury and illness rates under the No Action Alternative are projected to follow the patterns observed from 1999 through 2005, as reported in Chapter 4, Section 4.6.2.1. Using LANL's average rates during this period, there would be 2.40 recordable cases and 1.18 cases when workers missed days or their activities were restricted or transferred due to an occupational injury or illness for every 200,000 hours worked. These rates are well below industry averages, which in 2004 were 4.8 recordable cases and 2.5 cases where days were missed as a result of an occupational injury or illness (BLS 2005). Assuming that LANL's employment levels remain at current levels as expected (see Section 5.8.1.1), there would be approximately 311 recordable cases of occupational injury and illness and approximately 153 cases that resulted in days away or restricted or transferred duties per year. No fatalities would be expected under this alternative.

5.6.3.2 Reduced Operations Alternative

Ionizing Radiation Consequences

As shown in **Table 5–26**, under the Reduced Operations Alternative, involved workers would be exposed to lower cumulative doses of ionizing radiation from normal operations at LANL than under the No Action Alternative due to the potential shutdown of LANSCE and TA-18 operations.

Table 5–26 Projected Worker Exposure to Radiation under the Reduced Operations Alternative

Collective worker dose (person-rem per year)	257
Number of workers with measurable dose	1,659
Excess LCF risk per year among worker population	0.15 [a]
Average individual worker measurable dose (millirem per year)	155
Excess LCF risk per year for average individual worker	0.000093 [a]
DOE limit on annual worker radiation exposure (millirem per year)	5,000
LANL average individual worker dose as a percentage of DOE limit (percent)	3.1

LCF = latent cancer fatality.
[a] Based on a risk estimate of 0.0006 LCFs per person-rem (see Appendix C).

The average dose received by workers is projected to increase slightly from 139 millirem per year to 155 millirem per year under the Reduced Operations Alternative compared to the No Action Alternative. This is due to a decrease in the number of workers who would receive less than the average dose under this alternative. The average individual worker dose of 155 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 in 10,750 (9.3×10^{-5}) per year of operation. Similar to the No Action Alternative, 1,659 workers would be expected to receive a measurable dose, but over 11,000 LANL workers or over 87 percent of the workforce would not be expected to receive any measurable dose during a year of normal operations under the Reduced Operations Alternative.

Non-ionizing Radiation Consequences

Under the Reduced Operations Alternative, negligible effects on LANL worker health from non-ionizing radiation sources, infrared radiation from instrumentation and welding, lasers, magnetic and electromagnetic fields, and microwaves would likely continue.

Biohazardous Material Exposure Consequences

Under the Reduced Operations Alternative, effects on LANL worker health from normal operations would not be substantially different from those under the No Action Alternative.

Chemical Exposure Consequences

Under the Reduced Operations Alternative, chemical exposure consequences to workers would likely be small and not substantially different than those under the No Action Alternative.

Occupational Injuries and Illness

Under the Reduced Operations Alternative, the number of occupational injuries and illnesses would likely be smaller than those observed under the No Action Alternative due to a smaller projected workforce, as discussed in Section 5.8.1.2. Using LANL's average rates, there would be approximately 300 recordable cases of occupational injury and illness and approximately 147 cases that result in days away or restricted or transferred duties per year, compared to 311 and 153, respectively, under the No Action Alternative. No fatalities would be expected under this alternative.

5.6.3.3 Expanded Operations Alternative

Ionizing Radiation Consequences

As shown in **Table 5–27**, the expansion of certain radiologically intensive operations at LANL would increase cumulative worker dose and annual average worker exposure under the Expanded Operations Alternative. Operations expected to expand under this alternative include pit production, remediation of a number of large MDAs, and DD&D of a number of TAs. In the long run, DD&D of the TAs and closure of many facilities such as those associated with the MDAs at LANL and older waste management facilities in TA-54, Area G, should reduce workers' annual radiation exposures.

Table 5–27 Projected Worker Exposure to Radiation under the Expanded Operations Alternative

	With MDA Removal Option	*With MDA Capping Option*
Collective worker dose (person-rem per year)	543	407
Number of workers with measurable dose	3,849	2,344
Excess LCF risk per year among worker population	0.33 [a]	0.24 [a]
Average individual worker measurable dose (millirem per year)	141	174
Excess LCF risk per year for average individual worker	8.5×10^{-5} [a]	0.00010 [a]
DOE limit on annual worker radiation exposure (millirem per year)	5,000	5,000
LANL average individual worker dose as a percentage of DOE limit (percent)	2.8	3.5

MDA = material disposal area, LCF = latent cancer fatality.
[a] Based on a risk estimate of 0.0006 LCFs per person-rem (see Appendix C).

The largest factors affecting worker dose under this alternative are increased pit production at TA-55 from 20 plutonium pits per year to up to 80 pits per year and remediation of the MDAs. The contribution to the collective worker dose from production of 20 pits per year is 90 person-rem per year under the No Action Alternative compared to 220 person-rem from production of up to 80 pits per year under the Expanded Operations Alternative. Remediation of the MDAs under this alternative also is expected to add to the site-wide collective worker dose. If the MDA

Removal Option were pursued, it would add an average of 137 person-rem per year to the site-wide collective worker dose. If the MDA Capping Option were pursued, it would add an average of just over 1 person-rem per year to the site-wide collective worker dose. DD&D activities across the site would add another 6 person-rem per year to the site-wide collective worker dose. Conversely, cessation of SHEBA operations at TA-18 would reduce LANL's site-wide collective worker dose under the Expanded Operations Alternative by 10 person-rem per year.

Under the Expanded Operations Alternative – MDA Removal Option, the average individual worker dose of 141 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 in 11,800 (8.5×10^{-5}) per year of operations. Under the Expanded Operations Alternative – MDA Capping Option, the average individual worker dose of 174 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 in 10,000 (1.0×10^{-4}) per year of operations.

Waste management workers, who currently receive an average dose of approximately 163 millirem annually, would receive a lower annual dose under the Expanded Operations Alternative after 2015. By the end of 2015, all legacy transuranic waste would be removed from the site and shipped to the Waste Isolation Pilot Plant (WIPP). Direct penetrating radiation levels in Area G, which currently measure above background levels in certain areas, would decrease to within background levels by this time. Waste management workers would still process newly generated transuranic waste at the proposed new TRU Waste Facility (to be built in either TA-50 or TA-63), but their exposures would be smaller than those currently observed because management of the newly generated waste would not be as time-intensive as currently required. Workers associated with retrieval of remote-handled transuranic waste from below-ground storage between 2011 and 2015 could see increases in radiation exposure, but their exposures would be monitored and engineering and administrative controls would be used to ensure their exposures are ALARA and within administrative control levels.

Non-ionizing Radiation Consequences

Under the Expanded Operations Alternative, negligible effects on LANL worker health from non-ionizing radiation sources, infrared radiation from instrumentation and welding, lasers, magnetic and electromagnetic fields, and microwaves would likely continue.

Biohazardous Material Exposure Consequences

Under the Expanded Operations Alternative, effects on LANL worker health from normal operations would not be substantially different from those under the No Action Alternative.

Chemical Exposure Consequences

Under the Expanded Operations Alternative, chemical exposure consequences to workers would likely be small and not substantially different from those under the No Action Alternative.

Occupational Injuries and Illness

As shown in **Table 5–28**, the projected number of annual occupational injuries and illnesses would be higher under the Expanded Operations Alternative compared to the No Action Alternative. This is due to two main factors. First, the size of the workforce is expected to continue to grow under this alternative, as discussed in Section 5.8.1.3. Second, more construction, DD&D, and remediation work is expected under the Expanded Operations Alternative, and these activities have higher incidence rates of occupational injuries and illnesses than the other types of work being performed at LANL.

While both total recordable cases and cases resulting in days away or restricted or transferred duties would be 12 to 13 percent higher under the Expanded Alternative compared to the No Action Alternative, no fatalities are expected under this alternative.

Table 5–28 Annual Projected Occupational Injuries and Illnesses Under the Expanded Operations Alternative

	Total Recordable Cases	***Cases Resulting in Days Away, Restricted, or Transferred***
General Laboratory Operations [a]	291.4	143.2
Construction	21.3	10.4
Remediation (MDA Removal Option)	35.1	17.1
Decontamination, decommissioning, and demolition	2.4	1.2
Total	350.2	171.9

MDA = material disposal area.

[a] Based on LANL averages of 2.40 total recordable cases and 1.18 cases resulting in days away, restricted, or transferred per 200,000 hours worked.

5.7 Cultural Resources

Potential impacts to cultural resources were assessed under the No Action, Reduced Operations, and Expanded Operations Alternatives. Cultural resources include archaeological resources, historic buildings and structures, and traditional cultural properties. Information used for impact assessment was derived from the results of systematic cultural resource inventories on LANL.

The analysis of impacts to cultural resources addressed potential direct and indirect impacts at each site from construction and operation. Direct impacts included those resulting from groundbreaking activities associated with new construction, building modifications, and demolition, as appropriate. Indirect impacts included those associated with reduced access to resource sites, as well as with increased stormwater runoff, traffic, and visitation to sensitive areas. The locations of known cultural resources were compared to the areas of potential effect from LANL activities. The potential for these activities to impact cultural resources was then assessed.

A summary of impacts is presented in **Table 5–29**.

Table 5–29 Summary of Environmental Consequences on Cultural Resources

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Conveyance and Transfer – Conveyance or transfer of known cultural resources out of the responsibility and protection of DOE. – Potential damage to cultural resources on conveyed or transferred parcels due to future development. – Potential impacts on protection and accessibility to American Indian sacred sites. *Trails Management Program* – Enhanced protection of cultural resources	Same as No Action Alternative	Same as No Action Alternative plus: *MDA Remediation Project* – No direct impacts expected for either Capping or Removal Options. – Potential indirect adverse effects on resources located in vicinity of some MDAs and PRSs. *Security-Driven Transportation Modifications Project* – No direct impacts. – Potential indirect adverse effects on historic site located in vicinity of TA-63 and the proposed bridge over Mortandad Canyon. – Pedestrian and vehicle bridges under all options could impact canyon views from traditional cultural properties.
Affected Technical Areas			
TA-3	No change in impacts to cultural resources.	Same as No Action Alternative	*Physical Science Research Complex* – Two historic buildings, one eligible for the National Register of Historic Places and one that will be assessed for eligibility, would be removed. *Replacement Office Buildings* – Potentially adverse effects on nearby historic trail.
TA-21	No change in impacts to cultural resources.	Same as No Action Alternative	*TA-21 Structure DD&D* – Adverse effects on National Register of Historic Place-eligible historic buildings and structures.
Key Facilities			
Chemistry and Metallurgy Research Building (TA-3, TA-48, and TA-55)	Resulted in excavation of an archaeological site in TA-50.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Processing Facilities (TA-16)	Adverse effect from demolition and remodeling of historic buildings.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Testing Facilities (TA-6, TA-22, and TA-40)	Adverse effects from demolition and remodeling of historic buildings.	Same as No Action Alternative	Same as No Action Alternative

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Pajarito Site (TA-18)	No change in impacts to cultural resources.	Same as No Action Alternative	Potentially adverse effect from demolition of historic buildings.
Radiochemistry Facility (TA-48)	No change in impacts to cultural resources.	Same as No Action Alternative	*Radiological Sciences Institute Project* – Potentially adverse effects on two archeological sites located near Radiochemistry Building. – Potentially adverse effect from demolition of Radiochemistry Building and other potentially historic buildings.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in impacts to cultural resources.	Same as No Action Alternative	– Changes to the existing Radioactive Liquid Waste Treatment Facility could alter its original appearance. – Minimal impact on historic buildings possibly requiring documentation to resolve adverse effects.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in impacts to cultural resources.	Same as No Action Alternative	– Potential indirect effects on cultural resources located in vicinity of project associated activities in TA-54. – Removal of domes would positively impact views from traditional cultural properties located on adjacent lands of the Pueblo of San Ildefonso. – Potential impact to cultural resources from construction of TRU Waste Facility. – TRU Waste Facility could be visible from lands of the Pueblo of San Ildefonso.
LANSCE (TA-53)	No change in impacts to cultural resources.	Same as No Action Alternative	– Potentially adverse effect to LANSCE or other historic buildings experiencing internal modifications.
Radiography Facility (TA-55)	No change in impacts to cultural resources.	Same as No Action Alternative	– Same as No Action Alternative.
Bioscience Facilities	No change in impacts to cultural resources.	Same as No Action Alternative	*Science Complex Project* – Under all options, an eligibility assessment of the buildings to be replaced by the new Science Complex would be required. – Potentially adverse effects on three prehistoric archeological sites under Option 1. – No adverse effects to cultural resource sites under Options 2 and 3.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in impacts to cultural resources.	Same as No Action Alternative	– Potentially adverse effects on three archeological sites.

MDA = material disposal area; PRS = potential release site; TA = technical area; DD&D = decontamination, decommissioning, and demolition; LANSCE = Los Alamos Neutron Science Center.

5.7.1 No Action Alternative

The No Action Alternative was analyzed in terms of the existing environment as it relates to cultural resources (see Chapter 4, Section 4.7), as well as several actions that are planned, but have may not been fully implemented. These actions were analyzed in the *1999 SWEIS* or in other NEPA compliance reviews issued since the *1999 SWEIS*. Impacts to cultural resources are described in terms of those projects that impact the site as a whole and those that affect specific TAs. Key Facilities are addressed separately.

Los Alamos National Laboratory Site-Wide Impacts

Two projects have been approved since publication of the *1999 SWEIS* that could impact cultural resources across a number of TAs. These projects involve the conveyance and transfer of certain parcels of land and the management of the trails system at LANL. Site-wide projects that have been determined to have no impact on cultural resources include electrical power system upgrades, the Wildfire Hazard Reduction Program, disposition of Cerro Grande Fire structures, and the Security Perimeter Project (DOE 1999d, 2000a, 2000e, 2002j, 2003a, 2003b; NNSA 2004a, 2005a). Continuing the LANL environmental restoration program that existed before the 2005 Consent Order is expected to have little or no impact on cultural resources. Management of construction fill would not be expected to have an impact on cultural resources because the fill would be stored in existing borrow areas at TA-16 or TA-61.

The conveyance and transfer of 10 tracts of land would have both direct and indirect impacts on cultural resources. To date, eight parcels have been entirely or partly conveyed or transferred (see Chapter 4, Table 4–2). Direct impacts have included the transfer of known cultural resources and historic properties out of the responsibility and protection of DOE, including resources eligible for the National Register of Historic Places. It should be noted that a data recovery plan was implemented to resolve the adverse effects of conveying three tracts to the County of Los Alamos for future development that include 49 archaeological sites that are eligible for the National Register of Historic Places. In addition, 34 archaeological sites are included within three protective easements at a single tract to be conveyed to the county for recreational purposes (LANL 2002b). The disposition of each of these tracts affects their protection and accessibility as Native American sacred sites that are needed for the practice of traditional religion. In addition, the disposition of the tracts would potentially affect the treatment and disposition of any human remains, funerary objects, sacred objects, and objects of cultural patrimony that may be discovered on the tracts. Indirect impacts of the conveyance and transfer of land include potential future development of 826 acres (334 hectares) and use of the tracts for recreational purposes. This action could result in the physical destruction, damage, or alteration of cultural resources located on the tracts and in adjacent areas, as well as disturbance of traditional religious practices (DOE 1999d).

The Trails Management Program would enhance protection of cultural resources at LANL. Management activities would be coordinated with LANL archaeologists in consultation with appropriate Native American Tribes to minimize damages to any cultural resources present along the trail reaches. Where activities associated with trail maintenance or use would adversely affect a trail, that trail could be closed to all or certain users until the involved segment of trail could be rerouted around the cultural resources. Alternatively, certain trail segments could be

closed periodically for Native American use. If work necessary to close a trail to all user groups would adversely affect a cultural resource, a data recovery plan would be prepared and the State Historic Preservation Officer and appropriate Native American Tribes would be consulted before such work commenced. New trails would not be constructed in locations where the activities of trail users or maintenance workers would adversely affect cultural resources (DOE 2003b).

Technical Area Impacts

Technical Area 3

One project within TA-3, the installation of combustion turbine generators, underwent a NEPA compliance review since issuance of the *1999 SWEIS* and was not fully implemented. The analysis presented in the project-specific EA determined that there would be no impact on cultural resources from implementation of this project (DOE 2002l).

Technical Area 54

Within TA-54, the proposed implementation of corrective measures at MDA H underwent a NEPA compliance review since issuance of the *1999 SWEIS*. The analysis presented in the EA for MDA H remediation supported NNSA's determination that implementation of corrective measures would not significantly impact cultural resources (DOE 2004e).

Key Facilities Impacts

Since issuance of the *1999 SWEIS*, NEPA compliance documentation was prepared for three currently active projects related to Key Facilities: Chemistry and Metallurgy Research Replacement Facility construction at TA-55, Weapons Manufacturing Support Facility consolidation and refurbishment at TA-16, and Two-Mile Mesa Complex consolidation at TA-22. Each of these projects was determined to have some potential impacts on cultural resources.

Chemistry and Metallurgy Research Building

A NEPA compliance review determined that construction of the new Chemistry and Metallurgy Research Replacement Facility at TA-55 would have no adverse impacts on cultural resources (DOE 2003d). A parking lot associated with the complex to be located in TA-50 will impact an archaeological site, the "Romero Cabin Site," which was originally excavated in the 1980s. Implementation of a data recovery plan to resolve the adverse effects of construction of the parking lot at the cabin site was completed in 2005.

High Explosives Processing Facilities

The planned consolidation and refurbishment of the TA-16 Weapons Manufacturing Support Facility will not affect the one prehistoric archaeological site that is located in the area. Demolition and remodeling of various buildings, however, which is a part of the project, will adversely affect historic structures, many of which were constructed in the 1950s, that are eligible for the National Register of Historic Places. A Memorandum of Agreement between NNSA and the State Historic Preservation Officer to resolve these adverse effects will be

prepared following the State Historic Preservation Officer's concurrence with the National Register of Historic Places eligibility assessment of these structures. The Advisory Council on Historic Preservation will be notified of the Memorandum of Agreement and will have an opportunity to comment (DOE 2002l).

The planned consolidation and construction that is part of the Two-Mile Mesa Complex Project at TA-22 will not impact any recorded prehistoric or historic sites. Demolition of various historic buildings as a part of that action, however, will adversely affect historic structures that are potentially eligible for the National Register of Historic Places. As noted above for the TA-16 Weapons Manufacturing Support Facility, a Memorandum of Agreement between NNSA and the State Historic Preservation Officer to resolve these adverse effects will be prepared following the State Historic Preservation Officer's concurrence with the National Register of Historic Places eligibility assessment. The Advisory Council on Historic Preservation will be notified of the Memorandum of Agreement and will have an opportunity to comment (DOE 2003e).

5.7.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under the Reduced Operations Alternative, the same impacts to cultural resources as those discussed under the No Action Alternative (see Section 5.7.1) would occur.

Key Facilities Impacts

Activity levels at certain Key Facilities would change. High explosives processing and testing would be reduced by 20 percent. LANSCE would cease operation and be placed into a safe shutdown mode, and buildings at the Pajarito Site (TA-18) would undergo safe shutdown as well. As a result, the Pajarito Site would be dropped from the list of Key Facilities. As there would be no change in cultural resources associated with the reduction in high explosives processing and testing or the closure of LANSCE and TA-18, these actions are not addressed further.

5.7.3 Expanded Operations Alternative

The Expanded Operations Alternative includes proposals that would expand overall operations levels at LANL above those established for the No Action Alternative. Thus, under the Expanded Operations Alternative, the same impacts to cultural resources as those discussed under the No Action Alternative (see Section 5.7.1) would occur. Additionally, some of the new projects proposed under the Expanded Operations Alternative would potentially impact cultural resources. Not all new projects or activities would affect these resources, however, because many would involve actions within or modifications to existing structures, or the construction of new facilities within previously developed areas of LANL. For example, an increase in pit production would not require new construction and hence would not affect cultural resources. Only those projects that could impact cultural resources are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

There are two options (Capping and Removal) for remediation of MDAs at LANL. The cultural resources impacts for both options would be generally similar. The surfaces of the MDAs would be disturbed whether they are capped or contamination is removed. Because no archaeological resources are located within any of the MDAs, neither option would directly impact such sites. Risk of impacts to cultural resources during remediation of any of the hundreds of other PRSs at LANL would depend on the situation and the corrective measure implemented, if any. Unlike the MDAs, many of the PRSs (such as firing sites) contain only surface or near-surface contamination that could be recovered relatively easily.

Indirect impacts to cultural resources from remedial actions are possible due to increased erosion resulting from clearing, capping, removal, or contamination recovery operations; from locating temporary remediation support facilities near the remediation sites; and from workers or equipment in the work area. In those cases where archaeological resource sites and historic buildings and structures are located near work areas, site boundaries would be marked and the site would be fenced, as appropriate. As one example, a building eligible for the National Register of Historic Places is located within the solid waste management units comprising Firing Site R-44 in TA-15. If remediation of R-44 were required by the New Mexico Environment Department, however, it would take place in a manner that protects the building.

Most actions associated with implementing the Security-Driven Transportation Modifications Project would have little or no impacts on cultural resources because no known cultural sites are located within any of the areas to be disturbed. A historic site is situated near an area to be disturbed within TA-63; however, direct impacts would be unlikely. Prior to any disturbance, site boundaries would be marked and the site would be fenced, as appropriate. If previously unknown resources were identified during ground-disturbing activities, the procedures in *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (*Cultural Heritage Management Plan*) would be followed (LANL 2006f). The proposed vehicle and pedestrian bridges over Ten Site Canyon would be highly visible from both nearby and distant locations. Thus, they may degrade views of the canyon from sites identified by Native American and Hispanic communities as traditional cultural properties.

Under Auxiliary Actions A and B of the Security-Driven Transportation Modifications Project, bridges would be built over Mortandad Canyon and Sandia Canyon, respectively. As the corridors where the bridges would be constructed do not contain any known cultural resource sites, it is unlikely that construction of the bridges (or associated roadways) would directly impact such resources. There are a number of prehistoric sites and one historic site located to the east and west of the proposed Mortandad Canyon bridge corridor. Due to the relative proximity of these resources to the bridge corridor, it may be necessary to mark and fence sites, as appropriate. No cultural resource sites are located near the Sandia Canyon bridge corridor. In the event that a previously unknown resource is identified during ground-disturbing activities associated with the proposed options, the procedures in LANL's *Cultural Heritage Management Plan* (LANL 2006f) would be followed. As noted above for the road and pedestrian bridges over Ten Site Canyon, construction of the bridges could degrade views of the canyon from sites identified by Native American and Hispanic communities as traditional cultural properties (see Appendix J).

Technical Area Impacts

Three projects are being proposed that would potentially impact cultural resources within TA-3 and TA-21. These projects are related to the Physical Science Research Complex and the Replacement Office Buildings in TA-3 and TA-21 Structure DD&D.

Technical Area 3

The proposed site of the Physical Science Research Complex is in an already-developed area of TA-3. Building TA-3-0028, a potentially significant historic building, would be removed. Prior to its demolition, it would be assessed for inclusion in the National Register of Historic Places. The current Administration Building (TA-3-0043) has been formally declared as eligible for the National Register of Historic Places and a Memorandum of Agreement has been signed regarding required documentation prior to its removal.

Although no cultural resource sites that are eligible for the National Register of Historic Places are located in TA-3 in the vicinity of the Replacement Office Buildings, a historic trail located to the south of the parking lot must be managed until formally determined otherwise. Due to its proximity to the proposed project, there could be potentially adverse effects to the trail from construction. Appropriate measures, such as fencing, would be implemented to resolve any potentially adverse effects.

Technical Area 21

Decontamination and demolition of buildings and structures at TA-21 would directly affect those associated with the Manhattan Project and Cold War years that are eligible for the National Register of Historic Places. In total, there are 15 historic buildings and structures in TA-21; however, a number of these are located within the parcel that was conveyed to Los Alamos County. Regarding those historic buildings and structures that would be affected, NNSA, in conjunction with the State Historic Preservation Officer, has developed documentation measures to resolve adverse effects to eligible properties. Prior to demolition, these measures would be incorporated into a formal Memorandum of Agreement between NNSA and the New Mexico Historic Preservation Division. The Advisory Council on Historic Preservation would be notified of the Memorandum of Agreement and would have an opportunity to comment.

Key Facilities Impacts

Four projects are proposed that are related to Key Facilities at LANL under the Expanded Operations Alternative.

Pajarito Site

Prehistoric resources (specifically, 40 cavates and a rock shelter) and historic resources (specifically the Ashley Pond Cabin) are located on the Pajarito Site (TA-18). These resources would continue to be protected during DD&D activities. Three LANL-associated buildings located within TA-18 have been identified as eligible for the National Register of Historic Places, including the Slotin Building (18-1) and two other buildings (18-2 and 18-5). However, there are additional buildings within the TA that have yet to be assessed for eligibility to the National

Register of Historic Places. Prior to any DD&D activities, these buildings would have to be evaluated. Those that are candidates for long-term retention would be protected during DD&D activities, whereas others would be documented to resolve the adverse effects. As noted previously, NNSA, in conjunction with the State Historic Preservation Officer, has developed documentation measures to resolve adverse effects on eligible properties at LANL. Appropriate measures would be defined in a Memorandum of Agreement between NNSA and the New Mexico Historic Preservation Division prior to any DD&D activities. The Advisory Council on Historic Preservation would be notified of the Memorandum of Agreement and would have an opportunity to comment.

Radiochemistry Building

Construction of the Radiological Sciences Institute would not directly impact prehistoric cultural resources because none are located within areas to be disturbed by construction. One prehistoric site, however, is located across the access road from the existing Radiochemistry Building, which is itself is considered a historic structure. New construction in the area of the prehistoric site would require the site boundaries to be marked and the site to be fenced.

Before demolition could begin on parts of the Radiochemistry Building or other structures to be replaced by the Radiological Sciences Institute, NNSA, in conjunction with the State Historic Preservation Officer, would implement documentation measures to resolve any adverse effects to eligible properties. These measures would be incorporated into a formal Memorandum of Agreement between NNSA and the New Mexico Historic Preservation Division. The Advisory Council on Historic Preservation would be notified of the Memorandum of Agreement and would have an opportunity to comment. Impacts from construction and operation of the Radiological Sciences Institute on traditional cultural properties are unlikely because most development would take place within previously disturbed portions of TA-48. Potential views of TA-48 from any traditional cultural properties located in the vicinity would remain largely unchanged (see Appendix G, Section G.3.3.2).

Radioactive Liquid Waste Treatment Facility

Under the construction options for upgrades to the Radioactive Liquid Waste Treatment Facility, one or more treatment buildings would be constructed near the existing facility and the East and North Annexes would be demolished. Effects to cultural resources would be minimal. Under one of the auxiliary actions, which could be applied to any of the options, evaporation tanks and pipelines would be constructed. Impacts to cultural resources in the vicinity of the pipeline and evaporation tanks would be avoided during the siting process. If the pipeline alignment were to encroach on archaeological sites near the evaporation tanks, however, the archaeological sites would require testing or excavation. These options would have minimal effects on historic buildings because removal of later annexes to Radioactive Liquid Waste Treatment Facility would not likely affect the original historic fabric of the building. Changes to the process area of Radioactive Liquid Waste Treatment Facility, however, would require historic documentation before any equipment is removed from the building. The environmental consequences to cultural resources would be the same if the upgraded treatment capabilities were housed in one or multiple structures.

The New Construction and Renovation Option for the Radioactive Liquid Waste Treatment Facility involves renovation of the existing facility in addition to construction of one or more treatment buildings. This option also would result in minimal adverse effects on cultural resources. If the auxiliary action of construction of evaporation tanks and pipeline were implemented, the impacts to cultural resources would be the same as described above. However, changes to the structure of the existing Radioactive Liquid Waste Treatment Facility would alter the original historic appearance of the building. Removal of equipment, modification of the building, and demolition of the annexes would require documentation and consultation with the New Mexico Historic Preservation Office. For all options, mitigation plans would have to be implemented before or during implementation of the project.

Solid Radioactive and Chemical Waste Facilities

Impacts to cultural resources from Waste Management Facilities Transition activities would be similar under both options: Option 1, Accelerated Actions for Meeting the Consent Order or Option 2, Interim Actions Necessary for Meeting the Consent Order. All activities taking place in TA-54, including new construction and removal of the domes, would occur within developed areas. Thus, there would be no direct impacts on cultural resources. But because a number of cultural resource sites are located nearby, a potential exists for indirect impacts to these resources. To ensure these resources would not be affected under either alternative, cultural resource site boundaries would be marked and fenced, as appropriate. Although archaeological resources are located in the generic area considered for the TRU Waste Facility, only those in TA-50, TA-54-West, and TA-66 have the potential to be directly affected by construction of the TRU Waste Facility. Direct and indirect impacts to archaeological resources would require notifying appropriate LANL personnel and implementing the requirements of the LANL Cultural Resources Management Plan (LANL 2006f). Mitigation measures, including avoidance, would be taken to ensure that construction activity, traffic and ground disturbances would not result in damage to the resources. These measures would be incorporated into a formal Memorandum of Agreement between DOE and the New Mexico Historic Preservation Division to resolve adverse effects. The Advisory Council on Historic Preservation would have an opportunity to comment on the Memorandum of Agreement. Construction of the TRU Waste Facility would not impact any National Register of Historic Places-eligible buildings or structures. However, if the TRU Waste Facility were built within generic sites in TA-51, TA-52, or TA-54-West, it would be visible from San Ildefonso Pueblo lands. Thus, impacts to traditional cultural properties are possible if the new facility were built within these TAs. Impact potential is reduced within TA-54-West because construction would take place within a developed area. Removal of the white-colored domes at TA-54 would positively impact views from Pueblo of San Ildefonso lands, which border the TA to the north.

Los Alamos Neutron Science Center

The LANSCE accelerator building has been determined to be eligible for the National Register of Historic Places. Although project-related modifications would not affect the external appearance of the structure, it would be necessary to determine the potentially adverse effects and document existing conditions, as appropriate. Additionally, any other significant historic buildings at TA-53 that could experience internal modifications would have to be evaluated for National Register of Historic Places eligibility status; these buildings must be considered potentially eligible until formally assessed.

Science Complex

Three archaeological sites are situated near the proposed Northwest TA-62 location, and each has been determined to be eligible for the National Register of Historic Places. These three sites are at risk of indirect adverse effects from construction of the Science Complex. Mitigation measures would be taken as appropriate to resolve any adverse effects in conjunction with the State Historic Preservation Office and Advisory Council on Historic Preservation. There would be no adverse effects on cultural resources from construction of the Science Complex under the Research Park Site or South TA-3 Site options. Under all options, the buildings to be replaced by the Science Complex would have to be evaluated for their historic importance prior to being demolished.

Remote Warehouse and Truck Inspection Station

The Remote Warehouse and Truck Inspection Station could impact the three recorded prehistoric archaeological sites at the proposed location. Mitigation measures would be taken in conjunction with the State Historic Preservation Office and Advisory Council on Historic Preservation, as appropriate, to ensure that construction activity, traffic, and ground disturbances do not damage the sites. The Mortandad Trail located east of the proposed project site leads to the Mortandad Cave Kiva National Historic Landmark and is closed to public access except for organized tours. Although the proposed project would not affect normal access to the trail, it would incorporate fencing around the perimeter of the Warehouse and Truck Inspection Station to protect sensitive areas, including the Mortandad Cave Kiva National Historic Landmark, from unauthorized increased visitation.

5.8 Socioeconomics and Infrastructure

This section discusses the environmental effects of LANL operations on the socioeconomic region of influence and LANL site infrastructure. The effects are described for each of the alternatives.

5.8.1 Socioeconomics

The primary (direct) and secondary (indirect) impacts of LANL activities on employment, salaries, and procurement are analyzed in this SWEIS. The primary impacts were determined by analyzing projected changes in employment (in terms of full-time equivalents at LANL). Changes in employment were projected based on information regarding changes in activities at the Key Facilities. Employment for the rest of LANL was assumed to remain the same.

Projected changes in employment were distributed among the tri-county area (the three counties closest to LANL: Los Alamos County, Rio Arriba County, and Santa Fe County). Employment changes would likely result in additional, secondary changes in employment, salaries, and expenditures in the area, as well as changes in demands for social services. These secondary impacts would occur within a regional economy because jobs added in a primary industry such as LANL would create local opportunities for new employment in supporting industries. Analysis of these secondary economic and social impacts of LANL activities across the alternatives was conducted using the multipliers developed by the U.S. Department of Commerce, Bureau of

Economic Analysis's Regional Input-Output Modeling System (RIMS II) for the tri-county area to predict total LANL socioeconomic impacts in the area (DOC 2006d)[4]. For example, if LANL were to expand employment by 100 full-time workers who resided in the tri-county area, the secondary effect would be the addition of approximately 106 new secondary jobs in the tri-county labor market. On the other hand, if LANL were to reduce employment by 100 full-time workers, the reverberating effect across the tri-county economy would be the loss of 106 other jobs.

The projected changes in employment were used to determine whether there would be significant impacts in the tri-county area on the need for housing units, construction requirements at LANL, changes in local government finances, and the need for public services.

Table 5–30 summarizes the expected socioeconomic changes for each of the proposed alternatives.

5.8.1.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

LANL Employment

LANL continues to be a major economic force within the region of influence consisting of Santa Fe, Los Alamos, and Rio Arriba Counties (the tri-county area). Chapter 4, Table 4–28, shows the percentage of LANL employees residing in the region of influence. As shown in this table, approximately 11.5 percent of the total number of persons employed in the region of influence are affiliated with LANL, and this level has remained relatively steady over a number of years.

At the end of 2005, LANL employed 13,504 individuals, nearly 19 percent more than the employment projection of 11,351 presented in the *1999 SWEIS*. From 1996 through 2005, employment at LANL increased by approximately 2.2 percent per year. During the same period, employment in the region of influence increased by an average of 2.5 percent annually. Under the No Action Alternative, it is assumed that LANL employment levels would no longer increase but would remain steady at the 2005 level.

Assuming LANL continues to directly employ 13,504 employees, it is estimated that approximately 11,560 of these employees would live within the region of influence based on existing residence rates (LANL 2006g). The existence of these direct jobs would be expected to result in the creation of another 12,240 indirect jobs for a total number of jobs related to LANL operations in the region of influence of approximately 23,800 jobs; about 21 percent of the total number of people expected to be employed in the region of influence in 2007.

[4] *The LANL site specific multiplier was developed using a weighted average of RIMS II detailed industry multipliers for the tri-county area made up of the following industries: scientific research and development, environmental and other technical consulting services, construction, and investigative and security services.*

Table 5–30 Summary of Socioeconomic Consequences

No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site		
LANL Employment		
2005 levels of employment assumed to remain steady at 13,504 employees, 11,560 of whom would be expected to reside in the region of influence creating another 12,240 indirect jobs in the region of influence.	A decrease of 500 employees from 2005 levels would be expected to result in the loss of about 530 indirect jobs in the region. Loss of 1,030 jobs in the region would be less than 1 percent of total civilian workforce.	An employment increase of 2.2 percent per year from 2007 to 2011 would result in an additional 600 to 1,890 employees working at LANL and creation of another 640 to 2,000 indirect jobs. This growth rate is consistent with the projected regional growth rate.
Housing		
No new housing units would be needed specific to changes in LANL's employment level.	Additional housing units could become available in the tri-county area as a result of the projected decrease in LANL's employment level. These would likely offset the need for additional housing units in the region because the population would still be expected to grow, though at a slower rate (about 1.5 percent versus 2.3 percent).	Additional housing units would be required in the tri-county area due to the projected increases in LANL's employment level and in the regional population. More LANL employees could be expected over time to reside in Rio Arriba, Santa Fe, or other surrounding counties, compared to Los Alamos County, where a shortage of available housing would likely continue. The number of housing units needed would depend on the number of workers relocating from outside the area. Overall, the number of units needed would likely be small compared to overall needs in the tri-county area.
Construction		
Completion of previously approved construction projects would likely draw workers already living in the region who historically work from job-to-job.	Same as No Action Alternative.	An increase in the number of construction projects would likely draw workers already in the region who historically work from job-to-job.
Local Government Finance		
Annual gross receipts tax yields would likely remain at current levels in real terms.	Annual gross receipts tax yields directly and indirectly associated with LANL employment could decrease by approximately 1.1 percent.	Annual gross receipts tax yields directly and indirectly associated with LANL employment are projected to increase by between 1.3 and 3.9 percent from 2007 through 2011 above 2005 levels in real terms due to increases in LANL's workforce during that timeframe.
Services		
Demand for services such as police, fire, and hospital beds would likely remain at current levels in proportion to LANL employment. The regional population is projected to increase even if LANL employment remains flat, so the demand for regional services would continue to increase, but the increase would not be driven by LANL employment growth.	Demand for services associated with LANL employment would likely decrease in proportion to the number of out-of-work LANL-related employees forced to leave the region. The regional population is still projected to increase, however, in spite of the small decreases in LANL employment envisioned in this alternative, so demand for services would likely increase as well, though at a slower pace than under the No Action Alternative.	Demand for services associated with LANL employment would likely increase in proportion to the number of additional LANL-related jobs added to the region. The number of additional school-age children associated with these increases is projected at between 440 and 1,400 in the tri-county area, resulting in an estimated need for increased public school funding from the state of $3.2 million to $11 million between 2007 and 2011. Most of the additional services would be required in Rio Arriba, Santa Fe, and other surrounding counties because the population in Los Alamos County is projected to increase by a very small rate compared to the other counties.

Completion of construction projects previously approved under completed NEPA compliance reviews would likely draw workers who already live in the region of influence and historically work from job-to-job in the region. Thus, this sector of employment associated with LANL is not expected to grow as a result of the No Action Alternative.

Housing

No new housing units beyond current regional trends are likely to be needed under the No Action Alternative, because LANL employment levels would be expected to stay at current levels.

Local Government Finance

Under this alternative, the tri-county area's annual gross receipts tax yields would be expected to grow at the same level as the population. Changes in tax rates are assumed to be driven by the need to increase service levels to meet public demand in the case of a tax increase or a determination that service levels can reduced in some way in the case of a tax cut.

Services

Annual school enrollment trends in the tri-county area would likely continue due to projected population growth that is unrelated to LANL. Demands for police, fire, and other municipal services directly resulting from LANL employment needs would be expected to remain at current levels, because LANL employment levels would be expected to stay at current levels.

5.8.1.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

LANL Employment

Under the Reduced Operations Alternative, employment at LANL could decrease by approximately 3.7 percent, or 500 employees, as a result of closing LANSCE, reducing high explosives processing and testing by 20 percent, and cessation of TA-18 activities. This would equate to a projected employment level of about 13,000 in 2007 under this alternative. As a result of this decrease in employment at LANL, a loss of about 530 indirect jobs also is projected.

If all of these displaced workers remained in the region of influence in 2007 and were unable to find new employment immediately, regional unemployment rates would be expected to increase by approximately 0.8 percent. As these projected decreases are less than 1 percent of the total civilian labor force for the region of influence, the changes would not be expected to result in any significant change in the regional economy. Similar swings in LANL employment were seen recently with no apparent impacts on the regional economy. For example, employment levels at LANL decreased by approximately 3 percent from 1999 to 2000, while the number of persons employed in the region of influence increased by 4 percent during the same period. A similar decrease was seen from 2003 to 2004 when LANL employment decreased by 2.6 percent, while the number of persons employed in the region of influence increased by 1.2 percent.

Under this alternative, LANL would be expected to directly employ approximately 13,000 employees. It is estimated that approximately 11,140 of these employees would live within the region of influence based on existing residence rates (LANL 2006g). The existence of these direct jobs would be expected to result in another 11,790 indirect jobs for a total number of jobs related to LANL operations in the region of influence of approximately 22,920 jobs; about 20 percent of the total number of people expected to be employed in the region of influence in 2007. The anticipated construction impacts would be the same as under the No Action Alternative.

Housing

In the event all of the persons affected by the projected reduction in LANL's workforce moved out of the region, available housing units in the region of influence would likely increase. This would not be expected to have a significant adverse impact on the region, however, because the population is expected to grow at the same time, so available units would likely fill new demands. The immediate impacts on the housing market in Los Alamos County would likely be greater than in Santa Fe or Rio Arriba Counties because a greater percentage of LANL employees reside in Los Alamos County. Given the lack of available units in Los Alamos County, however, any available units would likely be desired by others who may have wanted to move into the county but were unable due to lack of available housing. Thus, any initial increase in available units would likely be offset by pent-up demand. (In 2000, only 5.5 percent of the housing units in Los Alamos County were vacant, compared to over 13 percent in the State of New Mexico and 9 percent across the United States [DOC 2006a]).

Local Government Finance

Under the Reduced Operations Alternative, the tri-county annual gross receipts tax yields associated with LANL operations (both direct and indirect) would be expected to decrease by approximately 1.1 percent if all of the affected employees relocated outside of the region. Any reduction in tax revenues associated with the potential loss of LANL employees, however, would likely be offset by the continued growth in the regional workforce outside of LANL, similar to the increases seen in 2000 and 2004.

Services

Annual school enrollment in the tri-county area could decrease due to out-migration of affected LANL employees and their families, as well as indirect personnel and their families. The potential loss would likely be offset by the continued influx of non-LANL employees into the region as the region is expected to continue to grow, though at a slower rate.

Demands for police, fire, and other municipal services are not expected to be impacted by the projected employment changes under this alternative because affected LANL employees and their families represent less than 1 percent of the regional demand.

5.8.1.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

LANL Employment

Under the Expanded Operations Alternative, employment at LANL would continue to rise due to both increased pit production and increased remediation and DD&D activities. In addition, work at LANL would likely increase beyond current operations in areas that cannot be easily identified at this time, but could be tied to expanding research efforts such as homeland security. Similar increases have been seen in recent years.

If LANL's employment rate were to continue increasing at the same level experienced from 1996 through 2005 (2.2 percent annually), approximately 15,400 individuals could be employed at LANL by the end of 2011, as shown in **Table 5–31**, which would be an increase of about 1,890 above the 2005 level. In addition to direct employees associated with LANL, approximately 2,000 positions would likely be created indirectly as a secondary impact on the region's payrolls by the end of 2011.

Table 5–31 Projected Los Alamos National Laboratory Employment under the Expanded Operations Alternative

Year	*Projected LANL Employees*	*LANL Employees Residing in ROI*	*Number of Indirect Jobs in ROI Related to LANL Employment*	*Total Number of Jobs Related to LANL in ROI*	*ROI Employed*	*LANL as a Percent of ROI Employed*
2007	14,107	12,080	12,782	24,862	112,435	22.1
2008	14,418	12,347	13,065	25,412	115,207	22.1
2009	14,736	12,619	13,352	25,971	118,047	22.0
2010	15,061	12,898	13,648	26,546	120,957	21.9
2011	15,394	13,182	13,948	27,130	123,939	21.9

ROI = region of influence.

Under this alternative, LANL would be expected to directly employ between approximately 14,100 employees in 2007 and 15,400 employees in 2011. Between 12,080 and 13,182 of these employees would live within the region of influence based on existing residence rates (LANL 2006g). The existence of these direct jobs would be expected to result in another 12,782 to 13,948 indirect jobs for a total number of jobs related to LANL operations in the region of influence of approximately 24,862 to 27,130 jobs; about 22 percent of the total number of people expected to be employed in the region of influence from 2007 through 2011.

Under the Expanded Operations Alternative, construction and remediation efforts at LANL would increase; however, similar to the No Action Alternative, these projects would likely be staffed by workers who are already present in the region of influence and historically work construction jobs in the region. Thus, this sector of employment associated with LANL is expected to grow as a result of the Expanded Operations Alternative, but at a rate comparable with the operational growth rate.

Housing

An increase in LANL employment along with associated increase in indirect hires, would likely increase the need for housing in the region of influence. Although available housing is currently limited in Los Alamos County, construction of new housing is planned within the next year. These units would likely be filled quickly and a larger percentage of LANL-related housing needs would still need to be accommodated by workers relocating to Santa Fe, Rio Arriba, or other nearby counties, in keeping with the trend in recent years.

Additional housing needs would not be expected to exceed regional growth projections because the region is already expected to grow by approximately 2.3 percent annually between 2000 and 2010 (LANL 2004c).

Local Government Finance

Under this alternative, the tri-county area's annual gross receipts tax yields would be expected to increase by between 1.3 and 3.9 percent in real terms as a result of the addition of workers to LANL's workforce from 2007 through 2011. Any increases in tax revenues needed to offset the cost of additional services to support the associated increased population under the Expanded Operations Alternative would be covered by these new employees.

Services

Annual school enrollment in the tri-county area due to increases in LANL-related employment (direct and indirect) is projected to increase by between 435 and 1,360 students from 2007 to 2011 under the Expanded Operations Alternative. Additional annual funding assistance from the State of New Mexico of about $3.2 million to $11 million would be required for public school operations because of these enrollment increases, which would be part of an expected increase of about 6,000 to 10,000 in school-age children in the tri-county area during that period.

In Los Alamos County, the school district would likely be able to absorb the anticipated new enrollment levels because the levels would not be expected to change significantly from current levels due to the lack of available housing units. If Los Alamos County approves plans to build additional homes, the need for additional schools would need to be evaluated. In Rio Arriba County and the cities of Española and Santa Fe, this increase would be greater, as a larger portion of LANL's workforce would likely reside in these areas.

The demand for police, fire, and other municipal services would likely increase in proportion to the increase in population expected in each county.

5.8.2 Infrastructure

Site infrastructure includes the utility systems required to support construction and/or modification and operation of LANL facilities. It includes the capacities of the electric power transmission and distribution system, natural gas and liquid fuel (fuel oil, diesel fuel, and gasoline) supply systems, and the water supply system. The region of influence for utility infrastructure resources includes the LANL site, including the affected TAs and the individual facilities and utility systems (electric power, natural gas, and water) that serve LANL.

Descriptions of these utility systems, along with analyses of historic trends in LANL usage and other demands within the region of influence that supports this analysis, are provided in Chapter 4, Section 4.8.2.

In general, potential infrastructure impacts were assessed by comparing projections of utility resource requirements under each alternative against utility system capacities. While many LANL facilities do not meter utility use, annual site-wide demands are known and were used to make projections for each of the alternatives considered in this SWEIS. In addition, base trends in site-wide infrastructure requirements to date, as well as within the larger region of influence, were identified and extrapolated to make predictions for future years. The data were then adjusted for LANL project-specific actions within specific TAs and at Key Facilities considered under each alternative. Any projected demand for infrastructure resources exceeding its availability can be regarded as an indicator of impact. Where projected demand approaches or exceeds capacity, further analysis for that resource is warranted. It should be noted that utility projections include considerable inherent uncertainty as demands for electric power, natural gas, and water can be greatly affected by climate conditions from year to year. As such, the further into the future such projections are made, the greater the uncertainty in the projection.

Projected site utility infrastructure requirements under the Proposed Action and alternatives are summarized in **Table 5–32**.

5.8.2.1 No Action Alternative

Annual utility infrastructure requirements for current LANL operations and for other Los Alamos County users that rely upon the same utility system, along with current utility system capacities, are presented in **Table 5–33**. Values from 2005 are presented as a reference baseline for comparing projections for the three proposed alternatives in this SWEIS. Under the Expanded Operations Alternative analyzed in the *1999 SWEIS* (DOE 1999a) and selected in the subsequent ROD, LANL operations were projected to require 782,000 megawatt-hours of electricity (electrical energy) with a peak load demand of 113 megawatts, 1,840,000 decatherms of natural gas, and 759 million gallons (2.87 billion liters) of water annually. LANSCE alone was projected to require 437,000 megawatt-hours of electricity with a peak load demand of 63 megawatts, and 265 million gallons (1.03 billion liters) of water (DOE 1999a). LANSCE operations historically have accounted for up to one-quarter to one-half of LANL's total water and electrical power demand, respectively (LANL 2004c, 2006a). LANSCE projections in the *1999 SWEIS* included operation of the Low-Energy Demonstration Accelerator, which operated from late 1998 until it was shut down in December 2001 and later decommissioned (LANL 2006g). Operation of this facility was forecast to more than double LANSCE's electric peak load demand and its water demand for cooling tower operation (LANL 2006a), but it will not be a factor in future LANSCE operations. The *1999 SWEIS* did not project natural gas consumption for LANSCE or forecast utility infrastructure requirements for other Los Alamos County users.

Table 5–32 Summary of Environmental Consequences on Site Infrastructure

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
Total Alternative (annual)	*Electricity requirements* 645,000 megawatt-hours total (495,000 megawatt-hours for LANL); 49 percent of system capacity. *Electric Peak Load* 111 megawatts total (91.2 megawatts for LANL); 74 percent of system capacity. *Natural gas requirements* 2,215,000 decatherms total (1,197,000 decatherms for LANL); 27 percent of system contract supply capacity. *Water requirements* 1,621 million gallons total (380 million gallons for LANL); 90 percent of system available water rights.	*Electricity requirements* 516,000 megawatt-hours total (366,000 megawatt-hours for LANL); 39 percent of system capacity. *Electric Peak Load* 80.6 megawatts total (60.4 megawatts for LANL); 54 percent of system capacity. *Natural gas requirements* 2,181,000 decatherms total (1,163,000 decatherms for LANL); 27 percent of system contract supply capacity. *Water requirements* 1,544 million gallons total (303 million gallons for LANL); 85 percent of system available water rights.	*Electricity requirements* 827,000 megawatt-hours total (677,000 megawatt-hours for LANL); 63 percent of system capacity. *Electric Peak Load* 144 megawatts total (124 megawatts for LANL); 96 percent of system capacity. *Natural gas requirements* 2,331,000 decatherms total (1,313,000 decatherms for LANL); 29 percent of system contract supply capacity. *Water requirements* 1,763 million gallons total (522 million gallons for LANL); 98 percent of system available water rights.
MDA Remediation (10-year total)	No change in utility demands	Same as No Action Alternative	Up to 70 million gallons of liquid fuels and 58 million gallons of water for remediation activities.
Security-Driven Transportation Modifications (project total)	No change in utility demands	Same as No Action Alternative	Up to 4.0 million gallons of liquid fuels and 20 million gallons of water for construction.
Affected Technical Areas			
TA-3	TA-3 Co-Generation Complex upgrades would have a positive incremental impact on site electrical energy and peak load capacity, but natural gas consumption could increase to support higher electricity generation. Negligible short-term increase in utility demands from constructing new office buildings, with no net increase in operational demands.	Same as No Action Alternative	Replacement Office Buildings–1.8 million gallons of liquid fuels and 9.6 million gallons of water for construction and an additional 0.356 million gallons of liquid fuels and 11.3 million gallons of water for DD&D; no net increase in utility demands for operations. Physical Science Research Complex–2.6 million gallons of liquid fuels and 14.4 million gallons of water for construction and an additional 0.129 million gallons of

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
			liquid fuels and 4.1 million gallons of water for DD&D; no net increase in utility demands for operations.
TA-18	No change in utility demands	Elimination of utility demands in TA-18 from Pajarito Site shutdown with a negligible decrease in site-wide demands.	DD&D of TA-18 Structures–activities are expected to require 0.273 million gallons of liquid fuels and 8.4 million gallons of water. As activities would be staggered over an extended period of time, overall increase in utility demands would be minimal.
TA-21	No change in utility demands	Same as No Action Alternative	DD&D of TA-21 Structures–activities are expected to require 0.043 million gallons of liquid fuels and 1.3 million gallons of water. As activities would be staggered over an extended period of time, overall increase in utility demands would be minimal.
TA-54	Negligible short-term increase in utility demands from MDA H closure activities.	Same as No Action Alternative	Same as No Action Alternative
TA-61	No change in utility demands	Same as No Action Alternative	Negligible temporary increase in utility demands, especially liquid fuels and water, from excavation.
Key Facilities			
Chemistry and Metallurgy Research Building (TA-3, TA-48, and TA-55)	Negligible short-term increase in utility demands from DD&D of old facility at TA-3 and construction of new facility at TA-55. Little or no change in utility demands from CMRR Facility operation when moved to TA-55.	No incremental change from transfer of nonnuclear activities to TA-55.	Same as No Action Alternative
Sigma Complex (TA-3)	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative
Machine Shops	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative
Materials Science Laboratory	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative
Metropolis Center	No change in utility demands	Same as No Action Alternative	Moderate to major increase in electrical energy, peak load, and water demands over the No Action due to increased operational levels.
High Explosives Processing Facilities (TA-16)	Negligible short-term increase in utility demands from TA-16 Engineering Complex activities and demolition of structures.	Same as No Action Alternative	Potential negligible increase in operational utility demands.
High Explosives Testing Facilities (TA-6, TA-22, and TA-40)	Negligible to minor short-term increase in utility demands from construction of 15 to 25 new structures within the Twomile Mesa Complex and removal or demolition of vacated structures.	Same as No Action Alternative	Same as No Action Alternative

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Pajarito Site (TA-18)	No change in utility demands	Elimination of utility demands in TA-18 from Pajarito Site shutdown with a negligible decrease in site-wide demands.	DD&D of TA-18 Structures–activities are expected to require 0.273 million gallons of liquid fuels and 8.4 million gallons of water. As activities would be staggered over an extended period of time, overall increase in utility demands would be minimal.
Tritium Facilities (TA-21)	No change in utility demands	Same as No Action Alternative	TA-21 Structures DD&D activities are expected to require 0.043 million gallons of liquid fuels and 1.3 million gallons of water. As activities would be staggered over an extended period of time, overall increase in utility demands would be minimal.
Target Fabrication Facility	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative
Bioscience Facilities	No change in utility demands	Same as No Action Alternative	Science Complex–4.3 million gallons of liquid fuels and 23 million gallons of water for construction; no net increase in utility demands for operations.
Radiochemistry Facility (TA-48)	No change in utility demands	Same as No Action Alternative	Radiological Science Institute–4.2 million gallons of liquid fuels and 22.4 million gallons of water for construction and an additional 0.101 million gallons of liquid fuels and 3.1 million gallons of water for DD&D; no net increase in utility demands for operations.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in utility demands	Same as No Action Alternative	Radioactive Liquid Waste Treatment Facility–1.04 million gallons of liquid fuels and 7.5 million gallons of water for construction and related DD&D; no net increase in utility demands for operations.
LANSCE (TA-53)	Moderate increase in operational utility demands from increase in annual hours of operation.	Moderate to major decrease in infrastructure utility demands in TA-53 and sitewide due to shut down of operations with a minor reduction within the Los Alamos region.	LANSCE Refurbishment–Negligible, short-term increase in utility demands from refurbishment. Moderate increase in electrical energy, peak load, and water demands over the No Action due to increased operational levels.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in utility demands	Same as No Action Alternative	Waste Management Facilities Transition–Up to 0.893 million gallons of liquid fuels and 4.9 million gallons of water for TRU Waste Facility construction; negligible incremental increase in utility demands for operations.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Plutonium Facility Complex (TA-55)	No change in utility demands	Negligible increase in utility demands from transfer of nonnuclear activities at CMR Building to TA-55.	Plutonium Facility Complex Refurbishment Negligible short-term increase in utility demands for construction and related DD&D; minor incremental increase in utility demands for operations to support increased pit production. Radiography Facility–0.042 million gallons of liquid fuels and 0.234 million gallons of water for construction; no net increase in utility demands for operations.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in utility demands	Same as No Action Alternative	Up to 0.420 million gallons of liquid fuels and 2.0 million gallons of water for construction; negligible incremental increase in utility demands for operations.

MDA = material disposal area; TA = technical area, DD&D = decontamination, decommissioning, and demolition; CMRR = Chemistry and Metallurgy Research Replacement; LANSCE = Los Alamos Neutron Science Center, CMR = Chemistry and Metallurgy Research.
Note: To convert gallons to liters, multiply by 3.78533.

Table 5–33 Baseline Infrastructure Requirements and System Capacities for the Los Alamos National Laboratory Region of Influence

Resource	System Capacity	Current Requirement (2005 [a])		Total Requirement
		LANL	Other Los Alamos County Users	
Electricity				
Energy (megawatt-hours per year)	1,314,000 [b]	421,413	129,457	550,870
Peak load demand (megawatts)	150 [b]	69.5	18.3	87.8
Fuel				
Natural gas (decatherms per year)	8,070,000 [c]	1,187,855	943,559	2,131,414
Water (million gallons per year)	1,806 [d]	359	1,034	1,393

[a] Electric and fuel data for 2005 are fiscal year basis while water data are calendar year basis (see Sections 4.8.2.1, 4.8.2.2, and 4.8.2.3).
[b] Electrical energy and peak load capacity reflect the current import capacity of the electric transmission lines that deliver electric power to the Los Alamos Power Pool, as well as completion of upgrades at the TA-3 Co-Generation Complex, which will add 40 megawatts (350,400 megawatt-hours) of generating capacity. Values do not reflect completion of a new transmission line and other ongoing electrical power system upgrades.
[c] Reflects contractually limited capacity of the natural gas system serving the Los Alamos area (see Section 4.8.2.2).
[d] Equivalent to the total water rights from the regional aquifer managed by Los Alamos County.
Note: A decatherm is equivalent to 1,000 cubic feet.
Sources: Arrowsmith 2006, LANL 2006g.

While demand for key infrastructure resources (electricity, natural gas, and water) within the region of influence has generally followed an upward trend, there are notable exceptions. For electricity, total LANL demand increased by approximately 14 percent between 1999 and 2005, while other Los Alamos County user demands increased by 22 percent. In contrast, LANL natural gas consumption declined by nearly 17 percent between 1999 and 2005, but demand within the County increased by about 8 percent over roughly the same period. The decline at LANL is attributable to warmer-than-normal seasonal temperatures that have persisted since the early 1990s and a switch from district heating plants to more efficient systems at individual LANL facilities. Total LANL demand for water also decreased by nearly 21 percent between 1999 and 2005, but this was offset by an approximately 18 percent increase in demand among other Los Alamos County users, who account for the largest portion of total water use in the region of influence.

Los Alamos National Laboratory Site-Wide Impacts

Projected annual utility infrastructure requirements under the No Action Alternative are presented in **Table 5–34**. The No Action Alternative represents a future baseline that includes projects that have already been implemented to some degree (and may already be reflected in the current baseline values), are in the process of being implemented, or would be implemented fully between now and 2011. These projects are independent of subsequent project decisions at LANL, and their ongoing activities add to the overall increasing trend in utility infrastructure demand in the Los Alamos area as a whole.

Table 5–34 Projected Site Infrastructure Requirements under the No Action Alternative

Resource	*LANL Requirements*	*Other Requirements* [a]	*Total Requirements*	*Percent of Capacity* [b]
Electricity				
Energy (megawatt-hours per year)	495,000	150,000	645,000	49
Peak load demand (megawatts)	91.2	20.2	111	74
Fuel				
Natural gas (decatherms per year)	1,197,000	1,018,000	2,215,000	27
Water (million gallons per year)	380	1,241	1,621	90

[a] Projections through 2011 for electrical energy, peak load, natural gas, and water also include projected usage for other Los Alamos County users that rely upon the same utility system as LANL.
[b] A calculation based on the system capacity as shown in Table 5–33.
Note: A decatherm is equivalent to 1,000 cubic feet.
Sources: Projections based on Arrowsmith 2005, 2006, Glasco 2005, DOE 2002i, LANL 2000f, 2001e, 2002e, 2003h, 2004c, 2005f, 2006a, 2006g.

These infrastructure resource projections are made for operations levels at LANL Key Facilities actually approaching the operational levels forecast in the *1999 SWEIS* and associated ROD. The levels of operations forecast in the *1999 SWEIS* have not been realized to date, however, and LANL operational demands have trended well below the *1999 SWEIS* projections as a result (see Table 5–34). Some of the discrepancy between forecast and actual trends in infrastructure demands also reflect the rather conservative bounding approach used in the original estimates. As such, the projections made in this SWEIS, to the extent possible, account for those key factors that would prevent LANL operations from practically realizing the infrastructure resource demands forecast in the *1999 SWEIS*. Factors considered for LANSCE operations were previously discussed. While funding shortfalls have limited hours of operation at LANSCE and thus reduced utility demands, aging equipment physically limits the total operational availability of LANSCE such that the levels of operations forecast in the *1999 SWEIS* would not be reasonably foreseeable under the No Action Alternative for this SWEIS. Nonetheless, projections under the No Action Alternative do assume that easing of budgetary constraints and resumption of isotope production (as occurred in 2005) would result in an overall increase in annual hours of operation, with LANSCE utility demands approaching those recorded in years immediately prior to release of the *1999 SWEIS.*

No infrastructure capacity constraints are expected from implementation of the No Action Alternative in the short term because LANL operational and Los Alamos area demands on key infrastructure resources (electricity, natural gas, and water) have trended below previously forecasted levels. Under this alternative, total annual electricity, electric peak load, natural gas, and water requirements would be about 49 percent, 74 percent, 27 percent, and 90 percent, respectively, of the capacity of the utility systems that serve LANL.

Total peak load demand is projected to require 74 percent of the Los Alamos Power Pool's peak load capacity by 2011. This projection includes the generating capacity of the TA-3 Co-Generation Complex with an electric generating capacity of at least 40 megawatts after a new turbine became operational in September 2007. Ongoing upgrades to the electrical power transmission and distribution system, including construction of a third transmission line, would allow the import of additional power and support a higher electric peak load.

Natural gas is abundant in New Mexico, and the region has a high import capacity. Ongoing upgrades to the natural gas distribution system by the Public Service Company of New Mexico should ensure the adequacy and reliability of natural gas (see Chapter 4, Section 4.8.2.2). Completion of upgrades to the TA-3 Co-Generation Complex could make its use more attractive for electrical energy production by LANL than in the past; thus, the Complex could support an increase in natural gas consumption over time. Regardless, maintenance of an adequate capacity margin is forecast under the No Action Alternative.

Total water demand within the region of influence could approach 90 percent of Los Alamos County-managed rights to withdraw water from the regional aquifer, although projections indicate that LANL operational demands would remain within the site's annual water use ceiling quantity (542 million gallons [2,050 million liters]) under the No Action Alternative (see Chapter 4, Section 4.8.2.3). As described in Section 4.8.2.3, Los Alamos County has completed feasibility studies for accessing up to 391 million gallons (1,500 million liters) of water per year from the San Juan-Chama Transmountain Diversion Project; however, the earliest that this water could be made available for use would be 2010 (Glasco 2005).

Technical Areas Impacts

Under the No Action Alternative, construction and related DD&D requirements for electricity, fuels and water in the affected TAs are expected to be negligible, including those for Replacement Office Building construction, continued upgrades to the Co-Generation Complex in TA-3, and MDA H remediation and closure activities in TA-54. In the short term, these activities would entail short-term spikes in utility infrastructure resource demands on a TA basis, but would have negligible impacts on the capacities of affected utility systems and on the overall trend in utility resource demands.

Technical Area 3

New facility operations in TA-3 would likely have a negligible impact on overall trends in infrastructure resource requirements because the new facilities generally would replace older, less resource-efficient facilities. Further, upgrades at the TA-3 Co-Generation Complex would positively impact the Los Alamos Power Pool's electric power availability by increasing LANL's onsite generating capacity and improving the reliability of the complex, as discussed above. The completed upgrades, however, could contribute to higher natural gas consumption if the facility were required to provide more electricity in the future, as previously discussed.

Key Facilities Impacts

Completion of programmed construction projects and related DD&D activities, including the Chemistry and Metallurgy Research Replacement Facility at TA-55, the Weapons Manufacturing Support Facility at TA-16, and new Dynamic Experimentation Complex facilities within the Twomile Mesa Complex (part of TA-6, TA-22, and TA-40), would entail short-term spikes in utility resource demands. These activities would have a negligible impact on the capacity of affected utility systems and on the overall trend in utility resource demands.

Operation of these new facilities would not be expected to cause a measurable overall increase in utility infrastructure demands because modern facilities would replace antiquated, less resource-efficient facilities, creating an economy of scale in operational efficiency. For example, completing construction of the 15 to 25 new buildings within the Two-Mile Mesa Complex would replace about 59 structures currently used for such operations.

5.8.2.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Projected annual utility infrastructure requirements under the Reduced Operations Alternative are presented in **Table 5–35**. Utility infrastructure demand resulting from actions under the No Action Alternative would continue, with certain operational reductions, under this alternative. Reductions in the levels of high explosives processing and testing activities would have negligible-to-minor impacts on overall utility infrastructure requirements, but most other ongoing projects and activities included under the No Action Alternative also would move forward under the Reduced Operations Alternative. The entire LANSCE complex and TA-18 Pajarito Site, however, would be placed into safe shutdown mode under this alternative, although not all activities and associated utility demands would cease. LANSCE accelerator and support operations currently demand a relatively large share (about 22 and 15 percent in 2005) of LANL's electricity and water, respectively. As such, shutdown of LANSCE as part of the Reduced Operations Alternative would measurably reduce site-wide infrastructure resource demands compared to both the No Action Alternative and current operations. Under this alternative, total annual electricity, electric peak load, natural gas, and water requirements would be reduced to about 39 percent, 54 percent, 27 percent, and 85 percent, respectively, of the capacity of the utility systems that serve LANL.

Table 5–35 Projected Site Infrastructure Requirements under the Reduced Operations Alternative

Resource	*LANL Requirements*	*Other Requirements* [a]	*Total Requirements*	*Percent of Capacity* [b]
Electricity				
Energy (megawatt-hours per year)	366,000	150,000	516,000	39
Peak load demand (megawatts)	60.4	20.2	80.6	54
Fuel				
Natural gas (decatherms)	1,163,000	1,018,000	2,181,000	27
Water (million gallons per year)	303	1,241	1,544	85

[a] Projections through 2011 for electrical energy, peak load, natural gas, and water also include projected usage for other Los Alamos County users that rely on the same utility system as LANL.
[b] A calculation based on the system capacity as shown in Table 5–33.
Note: A decatherm is equivalent to 1,000 cubic feet.
Sources: Projections based on Arrowsmith 2005, 2006, Glasco 2005, DOE 2002i, LANL 2000f, 2001e, 2002e, 2003h, 2004c, 2005f, 2006a, 2006g.

Technical Area Impacts

Operational demands on utility infrastructure under this alternative would be similar to those under the No Action Alternative on a TA basis (except for TA-53) because base requirements would not be appreciably reduced due to high explosives processing and testing reductions.

Key Facilities Impacts

Los Alamos Neutron Science Center

Shutdown of LANSCE operations is projected to result in a moderate-to-major reduction in electrical energy, electric peak load demand, and water use at TA-53 compared to the demand under the No Action Alternative. This would specifically represent reductions of approximately 125,000 megawatt-hours in total electricity, 30.3 megawatts in electric peak load, and 73 million gallons (276 million liters) in water demand annually at LANSCE as compared to operational levels projected for the No Action Alternative. This action alone would result in a minor overall reduction in utility demands within the region of influence. Natural gas demand within the region would not be measurably affected on a percentage basis because LANSCE's operational demand for natural gas is a small percentage of that used by LANL as a whole and usage by LANL and other Los Alamos County users is affected more by weather and onsite electricity generation needs.

Pajarito Site

Shutdown of the Pajarito Site (TA-18) would result in a negligible site-wide decrease in operational utility needs.

5.8.2.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Projected annual utility infrastructure requirements under the Expanded Operations Alternative are presented in **Table 5–36**. On a site-wide basis, numerous additional projects involving new facility construction, facility renovation, facility DD&D, and site closure activities affecting many TAs would occur under this alternative. Infrastructure requirements for these actions would be additive to those for actions identified as part of the No Action Alternative. Although these new activities collectively would result in a spike in utility resource demands, principally for liquid fuels and water, their contribution to the overall trend in site-wide or Los Alamos area demands would be minor due to the extended timeframe over which projects such as the MDA Remediation Project would be implemented. Liquid fuels, mainly diesel fuel and gasoline, would be required to operate heavy equipment, vehicles, and other worksite equipment; however, unlike natural gas, which is the principal heating fuel used at LANL, liquid fuels are not considered limiting resources because they can be procured from offsite sources and supplied at the point of use as needed.

For a number of new projects at LANL that involve DD&D of existing facilities whose capabilities would be replaced by newly constructed facilities, an economy of scale in operational efficiency would be achieved, resulting in a net decrease in utility demands. This economy of scale would tend to moderate the overall trend toward increasing utility demands at LANL and by Los Alamos County users that rely upon the same utility systems. Still, other projects would entail operational expansions that would result in a minor-to-moderate overall increase in demand for electricity, particularly in electric peak load demand, as well as water compared to projected demand under the No Action Alternative. Only minor increases in natural gas demand are forecast. Under the Reduced Operations Alternative, total annual electricity, electric peak

load, natural gas, and water requirements would be about 63 percent, 96 percent, 29 percent, and 98 percent, respectively, of the capacity of the utility systems that serve LANL.

Table 5–36 Projected Site Infrastructure Requirements under the Expanded Operations Alternative

Resource	*LANL Requirements*	*Other Requirements* [a]	*Total Requirements*	*Percent of Capacity* [b]
Electricity				
Energy (megawatt-hours per year)	677,000	150,000	827,000	63
Peak load demand (megawatts)	124	20.2	144	96
Fuel				
Natural gas (decatherms)	1,313,000	1,018,000	2,331,000	29
Water (million gallons per year)	522	1,241	1,763	98

[a] Projections through 2011 for electrical energy, peak load, natural gas, and water also include projected usage for other Los Alamos County users that rely upon the same utility system as LANL.
[b] A calculation based on the system capacity as shown in Table 5–33.
Note: A decatherm is equivalent to 1,000 cubic feet.
Sources: Projections based on Arrowsmith 2005, 2006, Glasco 2005, DOE 2002i, LANL 2000f, 2001e, 2002e, 2003h, 2004c, 2005f, 2006a, 2006g.

The electric peak load capacity of the Los Alamos Power Pool could be approached due to increased operational demands at LANL combined with the trend of increasing demand that is forecast to persist for other Los Alamos County users. The predicted spike in electric peak load demand at LANL is primarily attributable to the Metropolis Center Increase in Levels of Operations and the proposed LANSCE Refurbishment Projects. Under the Expanded Operations Alternative, LANSCE operations would potentially require 208,000 megawatt-hours of electricity annually with a peak load demand of 51 megawatts, as compared to about 139,000 megawatt-hours of electricity with a peak load demand of 34 megawatts under the No Action Alternative. The Metropolis Center would require about 131,400 megawatt-hours of electricity annually with a peak load demand of 18 megawatts, as compared to about 44,000 megawatt-hours of electricity with a peak load demand of 6 megawatts under the No Action Alternative. As discussed for the No Action Alternative, ongoing upgrades to the electrical power transmission and distribution system, including construction of a third transmission line, would allow the import of additional power and support a higher electric peak load.

As previously described, heating demand and associated natural gas consumption at LANL has steadily declined in recent years despite higher overall activity levels at the site, mainly due to higher-than-normal seasonal temperatures. While this trend could be partly reversed by implementing the Expanded Operations Alternative for this SWEIS, including operation of the TA-3 Co-Generation Complex for electric power generation, the capacity of the Los Alamos area natural gas delivery system is expected to be adequate for the foreseeable future.

In recent years, combined LANL and county water demands have consumed between 80 and 90 percent of the currently developed water rights. Under the Expanded Operations Alternative, increased operations at LANL, combined with projected growth in the rest of Los Alamos County, could approach the county-managed rights to withdraw water from the regional aquifer. LANSCE operations would potentially require 119 million gallons (450 million liters) of water annually, as compared to up to about 77 million gallons (291 million liters) under the No Action

Alternative. The Metropolis Center could require up to 51 million gallons (193 million liters) of water annually, as compared to about 19 million gallons (72 million liters) under the No Action Alternative. Nevertheless, LANL operational demands are projected to remain within the site's annual water use ceiling quantity (542 million gallons [2,050 million liters]) under the Expanded Operations Alternative. As discussed under the No Action Alternative (see Section 5.8.2.1) and detailed in Chapter 4, Section 4.8.2.3, supplementing the Los Alamos County water supply system with San Juan-Chama water will be essential to ensuring that the region has adequate water supplies under this alternative and in the future.

Technical Area Impacts

Construction and related DD&D requirements for utility infrastructure resources, including electricity, fuels, and water, are expected to be negligible to minor for most actions, including construction of the Physical Science Research Complex and Replacement Office Buildings projects in TA-3 and the TA-18 and TA-21 Structure DD&D Projects. Implementation of the TA-21 Structure DD&D Project, which would include the natural-gas fired TA-21 steam plant, also would result in a negligible-to-minor reduction in LANL natural gas consumption because the plant's natural gas demand historically was smaller than 10 percent of site-wide demand and has decreased appreciably in recent years as NNSA missions in TA-21 have been relocated or discontinued.

Key Facilities Impacts

A number of project actions undertaken as part of this alternative would enhance the operational capabilities of Key Facilities, causing a net increase in infrastructure resource demands to support the increased level of operations. Specifically, the Metropolis Center Increase in Levels of Operations and LANSCE Refurbishment Projects would result in a minor-to-moderate increase in LANL infrastructure resource requirements and requirements within the region of influence to support higher levels of operations as described above. Increased pit production at TA-55 under this alternative would cause a minor increase in LANL infrastructure requirements because existing Plutonium Facility Complex operations currently constitute a relatively small percentage (generally 3 to 5 percent) of LANL's total demands. A very conservative estimate is that increased pit production at TA-55 could require an additional 8,500 megawatt-hours of electricity, 1.4 megawatts in electric peak load, 28,000 decatherms of natural gas, and 8.2 million gallons (31 million liters) of water annually.

5.9 Waste Management

Waste management impacts were evaluated based on the quantities of waste generated by Key Facilities, non-Key Facilities, and LANL's environmental restoration activities. Waste generation rates were used to measure the impacts on the LANL waste management infrastructure and local environment. Other impacts associated with waste management are addressed in the following sections: Air Quality (Section 5.4); Worker Health (Section 5.6.3); Transportation (Section 5.10); and Facility Accidents (Section 5.12). Waste management practices related to handling, treating, storing, and preparing for transport and disposal are described in Chapter 3 of this SWEIS.

Waste quantities were compiled by waste type and included process wastewaters (sanitary liquid waste, high-explosives-contaminated liquid waste, and industrial effluents); solid waste; and radioactive (including radioactive liquid) and chemical wastes. Due to the large number of construction and demolition projects now underway or planned at LANL, additional categories of construction and DD&D waste were included in the impacts analysis. LANL's environmental restoration wastes are presented as a separate category in this SWEIS.

Impacts associated with waste management were evaluated in the *1999 SWEIS* based on historical waste generation rates, projections of future waste generation, and the infrastructure in place to manage the wastes. With the exception of liquid waste, solid (sanitary) waste, and low-level radioactive waste, all LANL wastes were assumed to be disposed of offsite. For purposes of the transportation analysis (see Section 5.10) all wastes are assumed to be disposed of offsite.

In this analysis, the *1999 SWEIS* projections were reviewed and adjusted as needed to develop bounding values for the waste quantities associated with each alternative. As discussed in Chapter 4, Section 4.9, the *1999 SWEIS* projections adequately covered waste generated through facility operations; exceedances were the result of one-time events such as chemical cleanouts, maintenance, remediation, and cleanup following the Cerro Grande Fire.

In addition to wastes generated onsite, LANL historically has received small quantities of low-level radioactive and transuranic waste from offsite locations. Some of these wastes are generated by LANL activities at other locations and some by other DOE facilities that do not have the capability to manage the wastes. Receipt of these wastes by LANL is expected to continue at the historical rate of 5 to 10 waste shipments per year. The expected quantities of offsite waste would be small compared to the onsite waste generated and would be easily accommodated by the existing LANL waste management infrastructure.

In the sections that follow, waste generation rates for each facility are evaluated for the three alternatives. Bounding waste generation rates were projected for the No Action Alternative, considering the actions covered by the *1999 SWEIS* and any subsequent actions that have received independent NEPA analysis. Under the Reduced Operations Alternative, waste projections were selectively reduced to correspond to a lower level of operations. For the Expanded Operations Alternative, planned additional activities were considered and waste projections were increased as necessary to adequately bound the impacts. **Table 5–37** summarizes the waste management impacts associated with each of the alternatives.

5.9.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

The types and quantities of wastes expected to be generated by LANL operations under the No Action Alternative are generally the same as those presented for the Expanded Operations Alternative in the *1999 SWEIS*, but modified for a lower level of pit production.

Table 5–37 Summary of Total (Operations, Decontamination, Decommissioning, and Demolition, and Remediation) Waste Generation Projections by Alternative (Cumulative 2007 through 2016)

Waste Type	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Low-Level Radioactive Waste [a, b]			
Bulk low-level radioactive waste (cubic yards)	39,000	39,000	196,000 to 884,000
Packaged low-level radioactive waste (cubic yards)	33,000 to 128,000	33,000 to 110,000	80,000 to 183,000
High activity low-level radioactive waste (cubic yards)	–	–	0 to 347,000
Remote-handled low-level radioactive waste (cubic yards)	–	–	480 to 1,700
Mixed low-level radioactive waste (cubic yards)	1,800 to 2,800	1,800 to 2,800	3,900 to 183,000
Transuranic Waste			
Contact-handled (cubic yards) [a]	3,500 to 5,900	3,500 to 5,900	5,300 to 33,000
Remote-handled (cubic yards)	–	–	11 to 61
Construction and demolition debris [c] (cubic yards)	198,000	197,000	642,000 to 722,000
Chemical waste [d] (pounds)	19,000,000 to 37,000,000	19,000,000 to 36,000,000	64,000,000 to 129,000,000
Liquid Radioactive Waste			
Liquid transuranic waste (gallons)	300,000	300,000	500,000
Liquid low-level radioactive waste (at TA-50) (gallons)	40,000,000	40,000,000	50,000,000
Liquid low-level radioactive waste (at TA-53) (gallons)	1,400,000	50,000 [e]	1,400,000

TA = technical area.

[a] Operations waste volumes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High-activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides) and therefore is not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[c] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe, and vegetative matter from land clearance.

[d] Chemical waste includes wastes regulated under the Resource Conservation and Recovery Act, Toxic Substance Control Act, or state hazardous waste regulations.

[e] Under the Reduced Operations Alternative, operations at LANSCE would cease. Approximately 5,000 gallons (20,000 liters) of radioactive liquid waste per year from TA-50 would continue to be treated at TA-53.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; gallons to liters, multiply by 3.78533; for pounds to kilograms, multiply by 0.45359. Values have been rounded to the nearest hundred, thousand, or million.

Wastewaters are collected and managed in systems designed for each specific category of wastewater – sanitary liquid waste, high explosives-contaminated liquid waste, and industrial effluent. Sanitary wastes from across the LANL facility are delivered by dedicated pipeline to the Sanitary Wastewater System Plant at TA-46. The Sanitary Wastewater System Plant design capacity of 600,000 gallons (2.3 million liters) per day (DOE 1999a) is expected to be adequate

for demand under the No Action Alternative. The treated wastewater is pumped to TA-3 for recycling in the Steam Plant cooling towers or is discharged into Outfall 001. Reuse of treated sanitary wastewater is expected to continue. Sludge from the treatment of sanitary wastewater will continue to be disposed of offsite as a New Mexico special waste. Offsite disposal capacity is expected to be adequate. (See Chapter 4, Section 4.9.1, for more details on sanitary wastewater treatment.)

Wastewaters containing high explosives compounds are generated by high explosives testing and processing activities. The High Explosives Wastewater Treatment Facility, located in TA-16, treats process waters containing high explosives compounds. Under the No Action Alternative, the High Explosives Wastewater Treatment Facility is expected to continue to operate within the 170,000-gallon (640,000-liter) projection for annual discharges included in the *1999 SWEIS* (DOE 1999a). (See Chapter 4, Section 4.9.1.3, for additional discussion of high explosives treatment.)

Industrial effluent is discharged to a number of NPDES-permitted outfalls across LANL. Currently, LANL facilities discharge wastewater to a total of 21 outfalls, down from the 55 identified in the *1999 SWEIS* (LANL 2005h). LANL's projected industrial effluent discharges would be approximately 280 million gallons (1.1 billion liters) per year under the No Action Alternative (see Section 5.3.1). (See Chapter 4, Section 4.9.1.4, for more details on industrial effluents.)

Sanitary waste generated at LANL is generally managed at a transfer station, where solid waste is sorted and consolidated for transport to an offsite landfill (LANL 2005a, 2006a. LANL conducts an aggressive waste minimization and recycling program, which greatly reduces the amount of sanitary waste requiring disposal (LANL 2004l). Sanitary solid waste includes both routine and nonroutine wastes. Routine waste is waste produced from any type of periodic or recurring work, including waste produced from production operations; analytical, and/or research and development laboratory operations; and treatment, storage, and disposal facility operations. Under the No Action Alternative, routine sanitary waste quantities are expected to be bounded at 5,000 tons (4,500 metric tons) per year.

Nonroutine waste is defined as one-time operations waste, including waste produced from construction, environmental restoration, and DD&D activities (LANL 2003e). Nonroutine waste quantities are projected for construction, DD&D, and environmental restoration wastes in the sections that follow. (Solid wastes from environmental restoration may be sent directly to an offsite facility rather than being processed through the transfer station.) Under the No Action Alternative, three major construction projects would generate significant quantities of construction wastes: TA-16 Refurbishment, Chemistry and Metallurgy Research Replacement Facility at TA-55, and consolidation of certain activities at the Dynamic Experimentation Complex at TA-6, TA-22, and TA-40. Construction wastes associated with these projects are expected to total about 12,000 cubic yards (9,200 cubic meters) (DOE 2002l, 2003d, 2003e). Generally, construction wastes may be disposed of in a solid waste landfill or a construction and demolition debris landfill; offsite disposal capacity is expected to be adequate.

Under the No Action Alternative, DD&D wastes would be generated by six projects, as detailed in **Table 5–38**. Although large quantities of demolition debris and low-level radioactive waste

could be generated under this alternative, most wastes could be disposed of offsite and offsite capacity is expected to be sufficient. Chemistry and Metallurgy Research Building DD&D would likely not occur until after 2015, after the new Chemistry and Metallurgy Research Replacement Facility is operational. Waste generated by the demolition process for that structure would likely involve both onsite and offsite disposal capacity.

Table 5–38 Wastes from Decontamination, Decommissioning, and Demolition Activities – No Action Alternative (cubic yards)

Decontamination, Decommissioning, and Demolition Project	*Bulk Low-Level Radioactive Waste*	*Packaged Low-Level Radioactive Waste*	*Mixed Low-Level Radioactive Waste*	*Demolition Debris*	*Chemical Waste [a] (pounds)*
TA-16	8	3	–	5,800	51,000
Los Alamos Site Office	–	–	–	10,000	486,000
General Excess Facilities	13,900	4,600	26	128,000	246,000
Dynamic Experimentation Buildings [b]	–	20	–	21,000	781,000
Chemistry and Metallurgy Research Building [c]	12,000	4,000	280	20,000	280,000
LANSCE Area A [d]	4,000	–	89	520	3,000
Total [e]	30,000	8,700	400	186,000	1,847,000

TA = technical area, RCRA = Resource Conservation and Recovery Act, TSCA = Toxic Substances Control Act, LANSCE = Los Alamos Neutron Science Center.

[a] Chemical waste includes RCRA hazardous waste and TSCA waste (asbestos).

[b] Values from *Dynamic Experimentation EA* (DOE 2003e).

[c] Values from the *Chemistry and Metallurgy Research Building Replacement EIS* (DOE 2003d) and *Preliminary Chemistry and Metallurgy Research Building Disposition Study* (LANL 2003a).

[d] Values from the *1999 SWEIS* (DOE 1999a) and *National Environmental Policy Act Review LAN-05-018* (LANL 2006a).

[e] Totals may not add due to rounding.

Note: To convert cubic yards to cubic meters, multiply by 0.76456.

Wastes generated by LANL's environmental restoration activities are presented separately from operational wastes. These nonroutine waste quantities vary widely from year to year and could differ significantly from projections due to selection of remedies and actual site-specific conditions encountered during field activities. Low-level radioactive waste generated by LANL's environmental restoration activities could be disposed of onsite at TA-54 Area G or offsite at a commercial or DOE disposal facility. Chemical waste quantities generated by LANL's environmental restoration activities are expected to be substantial (LANL 2004g); however, offsite capacity for all waste types is expected to be sufficient.

The expected impacts of waste generation are discussed below for each category of chemical and radioactive waste. Projections of chemical and radioactive waste quantities are presented in **Table 5–39**. The information presented is based on the *1999 SWEIS* projections, which were updated with information from the *Waste Volume Forecast* prepared in June 2003 (LANL 2003e) and updated in September 2004 (LANL 2004g) and information from LANL staff (LANL 2006a). The *Forecast* integrates historical generation data with near- and long-term program plans (LANL 2003e). To aid the analysis, waste categories were further characterized as routine or nonroutine.

Table 5–39 Radioactive and Chemical Waste Projections from Routine Operations – No Action Alternative

Key and Non-Key Facilities	Waste Projections (cubic yards per year) [a]			
	Low-Level Radioactive Waste	Mixed Low-Level Radioactive Waste	Transuranic Waste	Chemical Waste (pounds per year)
Chemistry and Metallurgy Research Building [b]	2,400 [b]	25	55 [b]	24,000
Sigma Complex	1,300	5	0	22,000
Machine Shops	790	0	0	1,045,000
Materials Science Laboratory	0	0	0	1,300
Metropolis Center [c]	0	0	0	0
High Explosives Processing Facilities	20	<1	0	29,000
High Explosives Testing Facilities	1,200	10 [d]	<1	78,000
Tritium Facilities	630	4	0	3,800
Pajarito Site	190	2	0	8,800
Target Fabrication Facility	13	<1	0	8,400
Bioscience Facilities	45	4	0	29,000
Radiochemistry Facility	350	5	0	7,300
Radioactive Liquid Waste Treatment Facility [e]	330	3	13	880
Los Alamos Neutron Science Center	1,400	1	0	37,000
Solid Radioactive and Chemical Waste Facilities [f]	300 [g]	10 [g]	35	2,000
Plutonium Facility Complex	990	20	440	19,000
Non-Key Facilities	2,000 [h]	40	30 [h]	1,435,000
TOTAL [i]	12,000	130	570	2,749,000

[a] Projected values from *1999 SWEIS* ROD, as documented in the *2004 SWEIS Yearbook* (LANL 2005f), unless otherwise noted. Projections are based upon expected, routine facility operations and do not include wastes from nonroutine events such as chemical cleanouts and construction projects.

[b] Values reflect a pit production level of 20 pits per year.

[c] Value was not projected in the *1999 SWEIS* ROD. The Metropolis Center was not a designated Key Facility at that time. No wastes are projected for this facility.

[d] Value adjusted upward from *1999 SWEIS* projection based on projected waste volumes resulting from hydrotesting activities (LANL 2006a).

[e] Values adjusted from *1999 SWEIS* projections based on historical generation rates and new projections (LANL 2006a).

[f] This Key Facility includes the Legacy Transuranic Waste Retrieval Program and the Off-Site Source Recovery Project.

[g] Value adjusted upward from *1999 SWEIS* ROD projection based on projections in the 2004 revision to the *Waste Volume Forecast* (LANL 2004g).

[h] Value adjusted upward from *1999 SWEIS* projection based on historical generation rates and projections in the 2004 revision to the *Waste Volume Forecast* (LANL 2004g). Low-level radioactive waste increases are attributable to heightened activities and new construction. Transuranic waste increases are attributable to waste generated by the Off-Site Source Recovery Project; because this waste comes from shipping and receiving, it is attributed to non-Key Facilities (LANL 2006g).

[i] Totals may not add because all values have been rounded.

Note: To convert pounds to kilograms, multiply by 0.45359; for cubic yards to cubic meters, multiply by 0.76456. Values have been rounded to the nearest hundred, thousand, or million.

Low-Level Radioactive Wastes—Routine low-level radioactive waste generation has been declining (LANL 2003e) and is expected to continue in this direction under the No Action Alternative. Some fluctuations in facility-specific generation rates are expected. For example, the High Explosives Testing Key Facilities, due to increased numbers of hydrotests, are projected to double their average low-level radioactive waste generation (LANL 2004g). In addition, relocating the actinide processing and recovery capability to the Chemistry and Metallurgy Research Replacement Facility may increase low-level radioactive waste quantities by up to 24 cubic yards (18 cubic meters) per year (DOE 2003d). Table 5–39 presents the projected annual low-level radioactive waste quantities from routine operations at Key and non-Key Facilities. The TA-54 Area G expansion into Zone 4 is designed to provide 40 years of disposal capacity for operational low-level radioactive waste, assuming a disposal rate of about 3,900 cubic yards (3,000 cubic meters) per year. In addition, offsite disposal capacity is available and, together with onsite capacity, is expected to be adequate for wastes generated under the No Action Alternative.

Mixed Low-Level Radioactive Wastes—The pattern for mixed low-level radioactive waste generation is similar to that for low-level radioactive waste, with routine generation declining and LANL's environmental restoration-generated quantities varying widely (LANL 2004g). Table 5–39 presents the projected annual mixed low-level radioactive waste quantities from routine operations at Key and non-Key Facilities.

Transuranic and Mixed Transuranic Wastes—In the *Waste Volume Forecast*, transuranic and mixed transuranic categories have been combined for discussion; both waste categories are managed for disposal at WIPP. Higher generation rates, up to about 1600 cubic yards (1,200 cubic meters) per year LANL-wide, are projected for the short term (2005 through 2007), primarily due to activities under the Legacy Transuranic Waste Retrieval Program and several nuclear materials programs (LANL 2004g). The Nuclear Materials Technology vault cleanout would contribute nonroutine transuranic wastes for the short term. Pit production activities (up to 20 pits per year) are expected to yield quantities of transuranic and mixed transuranic wastes at the Plutonium Facility Complex. Relocating the actinide processing and recovery capability to the Chemistry and Metallurgy Research Replacement Facility may increase transuranic waste quantities by 8 cubic yards (6.1 cubic meters) per year (DOE 2003c). After 2007, most transuranic wastes would be generated through routine activities (LANL 2003e). The WIPP capacity attributed to newly-generated transuranic waste from LANL is about 14,000 cubic yards (10,800 cubic meters) (DOE 2002f), which is expected to be adequate for wastes generated under the No Action Alternative. Table 5–39 presents the projected annual transuranic quantities from routine operations at Key and non-Key Facilities.

Chemical Wastes—Routine chemical waste generation has been trending downward (LANL 2003e) and is expected to continue in this direction under the No Action Alternative. Bulk chemical wastes generated by LANL operations and environmental restoration activities make up approximately 90 percent of the chemical and hazardous waste generated across LANL (LANL 2003e). Although LANL's environmental restoration waste quantities are highly variable, operational bulk chemical waste is generated primarily at the Sanitary Wastewater Systems Plant in steady quantities. Nonbulk chemical and hazardous wastes are generated by a wide range of operations at LANL (LANL 2004g). Approximately half of the nonbulk chemical

waste is not regulated as hazardous by the State of New Mexico, but this waste does not meet waste acceptance criteria for disposal at a solid waste landfill (LANL 2003e). Generation rates for nonbulk chemical and hazardous wastes from operations are expected to remain steady under the No Action Alternative (LANL 2003e). Scheduled cleanouts of outdated or unused chemicals periodically could increase annual quantities for specific facilities (LANL 2004g). Table 5–39 presents the projected annual chemical waste quantities from routine operations at Key and non-Key Facilities.

Radioactive Liquid Waste Treated at LANL—Radioactive liquid waste is treated at three locations, TA-21, TA-50 and TA-53. Treatment at TA-21 would continue only until all DD&D activities at this TA are complete. The Radioactive Liquid Waste Treatment Facility at TA-50 continues to treat the majority of radioactive liquid wastes generated at LANL. Treated radioactive liquid waste quantities at the Radioactive Liquid Waste Treatment Facility, including acid and caustic radioactive liquid waste treated in Room 60, are projected in **Table 5–40**. If hydrotesting activities at the High Explosives Testing Facilities continue to use foam as a containment matrix, up to 66,000 gallons (250,000 liters) of additional radioactive liquid waste annually may be treated at the Radioactive Liquid Waste Treatment Facility, but these quantities are well within projected treatment volumes. Quantities of radioactive liquid wastes at TA-53 are also included in Table 5–40.

Table 5–40 Radioactive Liquid Waste Treated at Los Alamos National Laboratory – No Action Alternative

Waste Treatment Activity	*Projection*
Pretreatment of radioactive liquid waste at TA-21	(a)
Pretreatment of transuranic liquid waste from TA-55 in Room 60	30,000 gallons (110,000 liters) per year
Solidification of transuranic sludge at TA-50	16 cubic yards (12 cubic meters) per year
Radioactive liquid waste treated at TA-50	4,000,000 gallons (15,000,000 liters) per year
Secondary treatment of radioactive liquid waste at TA-50	260,000 gallons (1,000,000 liters) per year
De-water low-level radioactive waste sludge at TA-50	70 cubic yards (50 cubic meters) per year
Radioactive liquid waste treated at TA-53	140,000 gallons (520,000 liters) per year [b]
Transport evaporator bottoms to Tennessee	66,000 gallons (250,000 liters) per year
Receive solidified evaporator bottoms from Tennessee [c]	25 cubic yards (20 cubic meters) per year

TA = technical area, LANSCE = Los Alamos Neutron Science Center.

[a] No new radioactive liquid waste is being generated at TA-21, and all inventory that existed in tanks and equipment was processed or transported to TA-54 in 2006.

[b] Radioactive liquid waste treated at TA-53 includes waste volumes from LANSCE plus approximately 5,000 gallons (20,000 liters) per year from TA-50.

[c] This is solid low-level radioactive waste that is disposed of at TA-54.

Source: LANL 2006a.

Summary—Waste management impacts from LANL operations under the No Action Alternative are expected to remain within the capacity of the LANL waste management infrastructure. **Table 5–41** summarizes the waste quantities estimated for operations, DD&D, and environmental restoration activities under the No Action Alternative. Although the summary table provides waste projections only through 2016, impacts from operations are expected to continue at comparable rates for the longer term. For operational waste, waste projections are presented as a range, with the lower end of the range representing the quantity projected in the *Waste Volume Forecast* (LANL 2004g) and the upper end representing the *1999 SWEIS*

projection, except as noted. For this summary table, the transuranic and low-level radioactive waste categories have been further subdivided (contact- and remote-handled transuranic) to facilitate identification of offsite disposal options and analysis of transportation impacts.

Table 5–41 Summary of Waste Types by Generator Category – No Action Alternative (Cumulative 2007 through 2016) (in cubic yards)

Waste Type	*Operational Waste* [a]	*DD&D Waste* [b]	*Remediation Waste* [c]	*Total*
Low-Level Radioactive Waste [d]				
Bulk low-level radioactive waste	–	30,000	8,800	39,000
Packaged low-level radioactive waste	25,000 to 120,000	8,700	–	33,000 to 128,000
High Activity low-level radioactive waste	–	–	–	–
Remote-handled low-level radioactive waste	–	–	–	–
Mixed Low-Level Radioactive Waste	270 to 1,300	400	1,100	1,800 to 2,800
Transuranic Waste				
Contact-handled	3,300 to 5,700	0	210	3,500 to 5,900
Remote-handled	–	–	–	–
Construction and Demolition Debris [e]	12,000 [f]	186,000	–	198,000
Chemical Waste [g] **(pounds)**	9,997,000 to 27,000,000	1,847,000	7,513,000	19,000,000 to 37,000,000

DD&D = decontamination, decommissioning, and demolition; TA = technical area; LANSCE = Los Alamos Neutron Science Center; MDA = material disposal area; CMRR = Chemistry and Metallurgy Research Replacement.

[a] Operations waste volumes are represented as a range, with the lower end represented by best-estimate values documented in the Waste Volume Forecasts (LANL 2003e, 2004g), and the upper end represented by the bounding *1999 SWEIS* projections (DOE 1999a), adjusted as detailed in Table 5–39. These wastes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] DD&D waste quantities were estimated for the following projects: TA-16 Refurbishment, Los Alamos Site Office Building Replacement, General Excess Facilities, CMRR Facility, LANSCE Area A Renovation, and consolidation of certain activities at the Dynamic Experimentation Complex at TA-6, TA-22, and TA-40.

[c] Details of LANL's environmental restoration activities and resulting wastes are provided in Appendix I.

[d] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High-activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides), which is not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[e] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe, and vegetative matter from land clearance.

[f] Construction debris quantities were estimated for the following projects: TA-16 Refurbishment, Chemistry and Metallurgy Research Replacement Facility, and consolidation of certain activities at the Dynamic Experimentation Complex at TA-6, TA-22, and TA-40.

[g] Chemical waste includes wastes regulated under Resource Conservation and Recovery Act, Toxic Substance Control Act, or state hazardous waste regulations.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; for pounds to kilograms, multiply by 0.45359. Totals may not add because values have been rounded to the nearest hundred, thousand, or million.

Most wastes, with the exception of some low-level radioactive waste, are disposed of offsite at permitted facilities designed for specific categories of wastes. The expansion of TA-54 Area G into Zone 4 is expected to provide onsite low-level radioactive waste disposal capacity for operations waste through the 2016 timeframe and beyond. Because of the difficulties in accurately predicting the volumes of wastes generated by LANL's environmental restoration activities, some variances from projections are possible in future years. The waste management infrastructure at LANL has adequate staffing and facilities to manage the quantities of waste expected to be generated under the No Action Alternative.

5.9.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Many of the waste management impacts under the Reduced Operations Alternative would be the same as those under the No Action Alternative. Wastewaters, including sanitary liquid waste, high explosives-contaminated liquid waste, and industrial effluent, would be collected and managed in systems designed for each category of waste. High explosive-contaminated waste quantities would be reduced by about 20 percent as operations are scaled back at the High Explosives Processing and Testing Facilities. Sanitary waste generated at LANL would generally be managed at a transfer station, where solid waste is sorted and consolidated for transport to an offsite landfill (LANL 2005a). (Solid waste from environmental restoration may be sent directly to an offsite facility rather than through the transfer station.) As discussed under the No Action Alternative, waste minimization and recycling activities would reduce the quantities of solid waste disposed of. Waste management impacts associated with construction and DD&D activities would be similar to those for the No Action Alternative. Construction waste from the Chemistry and Metallurgy Research Replacement Facility would be about 500 cubic yards (382 cubic meters) smaller than that for the No Action Alternative, and DD&D of the Chemistry and Metallurgy Research Building may be further delayed beyond 2015.

Under the Reduced Operations Alternative, smaller quantities of some radioactive and chemical wastes would be generated due to shutdown of the Pajarito Site and LANSCE, as well as reductions in high explosives processing and testing. Projections of chemical and radioactive waste quantities from routine operations at Key and non-Key Facilities are presented in **Table 5–42**.

Radioactive liquid waste treatment would be the same as under the No Action Alternative, with the exception of limited treatment at TA-53 as LANSCE operations are halted; some liquid wastes with high tritium content from TA-50 could continue to be processed at TA-53. Radioactive liquid waste treatment quantities are presented in **Table 5–43**.

Table 5–42 Radioactive and Chemical Waste Projections from Routine Operations – Reduced Operations Alternative

Key and Non-Key Facilities	Waste Projections (cubic yards per year) [a]			
	Low-Level Radioactive Waste	Mixed Low-Level Radioactive Waste	Transuranic Waste	Chemical Waste (pounds per year)
Chemistry and Metallurgy Research Building [b]	2,400	25	55	24,000
Sigma Complex	1,300	5	0	22,000
Machine Shops	790	0	0	1,045,000
Materials Science Laboratory	0	0	0	1,300
Metropolis Center [c]	0	0	0	0
High Explosives Processing Facilities	15 [d]	<1 [d]	0	23,000 [d]
High Explosives Testing Facilities	980 [d]	8	<1 [d]	62,000 [d]
Tritium Facilities	630	4	0	3,800
Pajarito Site [f]	0	0	0	0
Target Fabrication Facility	13	<1	0	8,400
Bioscience Facilities	45	4	0	29,000
Radiochemistry Facility	350	5	0	7,300
Radioactive Liquid Waste Treatment Facility [g]	330	3	13	880
Los Alamos Neutron Science Center [h]	5	1	0	0
Solid Radioactive and Chemical Waste Facilities [i]	300 [j]	10 [j]	35	2,000
Plutonium Facility Complex	990	20	440	19,000
Non-Key Facilities	2,000 [k]	40	30 [k]	1,435,000
Total [l]	10,000	130	570	2,682,000

[a] Projected values are from the *1999 SWEIS* ROD, as documented in the *2004 SWEIS Yearbook* (LANL 2005f), unless otherwise noted. Projections are based upon expected, routine facility operations and do not include wastes from nonroutine events such as chemical cleanouts and construction projects.

[b] Values reflect a pit production level of 20 pits per year.

[c] Value was not projected in *1999 SWEIS* ROD. The Metropolis Center was not a designated Key Facility at that time.

[d] A 20 percent reduction from No Action levels is projected, based on a 20 percent reduction in operations.

[e] Value adjusted upward from 1999 SWEIS projection based on projected waste volumes from hydrotesting activities (LANL 2006a).

[f] No wastes would be generated at TA-18 as activities are ceased.

[g] Values adjusted from *1999 SWEIS* projections based on historical generation rates and new projections (LANL 2006a).

[h] Only small quantities of waste would be generated as LANSCE operations are halted and the facility is maintained in standby mode.

[i] This Key Facility includes the Legacy Transuranic Waste Retrieval Program and the Off-Site Source Recovery Project.

[j] Value adjusted upward from *1999 SWEIS* ROD projection based on projections in the 2004 revisions to the *Waste Volume Forecast* (LANL 2004g).

[k] Value adjusted upward from *1999 SWEIS* projection based on historical generation rates and projections in the 2004 revisions to the *Waste Volume Forecast* (LANL 2004g). Low-level radioactive waste increases are attributable to heightened activities and new construction. Transuranic waste increases are attributable to waste generated by the Off-Site Source Recovery Project; because this waste comes from shipping and receiving, it is attributed to non-Key Facilities.

[l] Totals may not add due to rounding. Values have been rounded to the nearest hundred, thousand, or million.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; for pounds to kilograms, multiply by 0.45359.

Table 5–43 Radioactive Liquid Waste Treated at Los Alamos National Laboratory – Reduced Operations Alternative

Waste Treatment Activity	*Projection*
Pretreatment of radioactive liquid waste at TA-21	(a)
Pretreatment of transuranic liquid waste from TA-55 in Room 60	30,000 gallons (110,000 liters) per year
Solidification of transuranic sludge at TA-50	16 cubic yards (12 cubic meters) per year
Radioactive liquid waste treated at TA-50	4,000,000 gallons (15,000,000 liters) per year
Secondary treatment of radioactive liquid waste at TA-50	260,000 gallons (1,000,000 liters) per year
De-water low-level radioactive waste sludge at TA-50	70 cubic yards (50 cubic meters) per year
Radioactive liquid waste treated at TA-53	5,000 gallons (20,000 liters) per year [b]
Transport evaporator bottoms to Tennessee	66,000 gallons (250,000 liters) per year
Receive solidified evaporator bottoms from Tennessee [c]	25 cubic yards (20 cubic meters) per year

TA = technical area.
[a] No new radioactive liquid waste is being generated at TA-21, and all inventory that existed in tanks and equipment was processed or transferred to TA-54 in 2006.
[b] Under the Reduced Operations Alternative, operations at the LANSCE facility would cease. Approximately 5,000 gallons (20,000 liters) of radioactive liquid waste per year from TA-50 would continue to be treated at TA-53.
[c] This is solid low-level radioactive waste that is disposed of at TA-54.
Source: LANL 2006a.

Summary—Waste management impacts from LANL operations under the Reduced Operations Alternative are expected to be similar to those under the No Action Alternative, with some reductions in waste quantities due to the closure of LANSCE and the Pajarito Site and reduced operational levels at the High Explosives Facilities. **Table 5–44** summarizes the waste quantities estimated for operations, DD&D, and environmental restoration activities under the Reduced Operations Alternative. Although the summary table provides waste projections only through 2016, impacts from operations are expected to continue at comparable rates for the longer term. For operational waste, waste projections are presented as a range, with the lower end of the range representing the quantity projected in the *Waste Volume Forecast* (LANL 2004g) and the upper end representing the *1999 SWEIS* projection, except as noted. The waste management infrastructure at LANL has adequate staffing and facilities to manage the quantities of waste expected to be generated under the Reduced Operations Alternative.

5.9.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Many of the waste management impacts under the Expanded Operations Alternative would be the same as under the No Action Alternative although certain waste volumes would periodically increase. Wastewaters, including sanitary liquid waste, high explosives-contaminated liquid waste, and industrial effluent, would be collected and managed in systems designed for each category of waste. Sanitary waste generated at LANL would generally be managed at a transfer station where solid waste is sorted and consolidated for transport to an offsite landfill (LANL 2005a). (Large quantities of solid wastes from construction, DD&D, and environmental restoration may be shipped directly to an offsite disposal facility rather than being processed through the transfer station.) Waste minimization and recycling activities would reduce the quantities of solid waste disposed of.

Table 5–44 Summary of Waste Types by Generator Category – Reduced Operations Alternative (Cumulative 2007 through 2016) (in cubic yards)

Waste Type	*Operational Waste* [a]	*DD&D Waste* [b]	*Remediation Waste* [c]	*Total*
Transuranic Waste				
Contact-handled	3,300 to 5,700	–	210	3,500 to 5,900
Remote-handled	–	–	–	–
Low-Level Radioactive Waste [d]				
Bulk low-level radioactive waste	–	30,000	8,800	39,000
Packaged low-level radioactive waste	25,000 to 101,000	8,700	–	33,000 to 110,000
High-activity low-level radioactive waste	–	–	–	–
Remote-handled low-level radioactive waste	–	–	–	–
Mixed Low-Level Radioactive Waste	270 to 1,300	400	1,100	1,800 to 2,800
Construction and Demolition Debris [e]	12,000 [f]	186,000	–	198,000
Chemical Waste [g] **(pounds)**	9,997,000 to 27,000,000	1,847,000	7,513,000	19,000,000 to 36,000,000

DD&D = decontamination, decommissioning, and demolition.

[a] Operations waste volumes are represented as a range, with the lower end represented by best-estimate values documented in the *Waste Volume Forecasts* (LANL 2003e, 2004g) and the upper end represented by the bounding *1999 SWEIS* projections (DOE 1999a), adjusted as detailed in Table 5–42. These wastes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] DD&D waste quantities are the same as those under the No Action Alternative.

[c] Environmental restoration-related waste quantities are the same as those under the No Action Alternative. These waste estimates do not include an additional 600 cubic yards of chemical waste, and 4,800 cubic yards of bulk low-level radioactive waste may be generated by a removal action.

[d] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High-activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides), which is not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[e] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe, and vegetative matter from land clearance.

[f] Construction debris quantities are about 500 cubic yards (382 cubic meters) smaller than those for the No Action Alternative.

[g] Chemical waste includes wastes regulated under RCRA, TSCA, or state hazardous waste regulations.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; for pounds to kilograms, multiply by 0.45359. Totals may not add because values have been rounded to the nearest hundred, thousand, or million.

Waste management impacts associated with DD&D activities would increase under the Expanded Operations Alternative, as detailed in **Table 5–45**. Large quantities of demolition debris and bulk low-level radioactive waste wastes are expected from DD&D actions, along with smaller quantities of transuranic and mixed low-level radioactive waste and sanitary, asbestos, and hazardous wastes. Most of the waste would be disposed of offsite. Demolition debris may be sent to any solid waste landfill permitted to accept it. Low-level radioactive waste may be disposed of at TA-54 Area G or sent offsite to DOE or commercial facilities. Additional construction waste would be generated as new facilities are constructed under this alternative. **Table 5–46** summarizes the quantities of construction wastes associated with major new construction under the Expanded Operations Alternative.

Table 5–45 Wastes from Decontamination, Decommissioning, and Demolition Activities – Expanded Operations Alternative (cubic yards)

DD&D Project	*Contact-Handled Transuranic Waste*	*Bulk Low-Level Radioactive Waste*	*Packaged Low-Level Radioactive Waste*	*Mixed Low-Level Radioactive Waste*	*Demolition Debris*	*Chemical Waste [a] (pounds)*
No Action Total [b]	–	30,000	8,700	400	186,000	1,847,000
Physical Science Research Complex	–	13,000	4,300	< 1	177,000	314,000
Replacement Office Buildings	–	23	8	–	6,900	–
Radiological Sciences Institute	1,100 [c]	72,000	23,000 [c]	1,000	77,000	988,000
Radioactive Liquid Waste Treatment Facility Upgrade [d]	230	7,700	2,600	150	1,800	212,000
Plutonium Refurbishment	340	970	320	220	2,100	2,000
TA-18 Closure	–	4,700	–	5	17,000	75,000
TA-21 Structure	1	26,000	8,600	65	47,000	422,000
Waste Management Facilities Transition	–	23,000	7,600	8	54,000	566,000
Total [e]	1,700	177,000	56,000	1,900	569,000	4,425,000

DD&D = decontamination, decommissioning, and demolition; RCRA = Resource Conservation and Recovery Act; TSCA = Toxic Substances Control Act.

[a] Chemical waste includes RCRA hazardous waste and TSCA waste (asbestos).

[b] Details of the DD&D waste volumes generated under the No Action Alternative are provided in Table 5–38.

[c] In addition to these volumes, DD&D associated with the Radiological Sciences Institute is expected to generate 479 cubic yards of remote-handled low-level radioactive waste and 11 cubic yards of remote-handled transuranic waste.

[d] Waste volumes reflect the option that generates the most waste.

[e] Totals may not add because all values have been rounded to the nearest hundred, thousand, or million.

Note: To convert cubic yards to cubic meters, multiply by 0.76456.

Table 5–46 Construction Wastes [a] – Expanded Operations Alternative

Construction Project	*Waste Generated (cubic yards)*
No Action Total	12,000
Physical Science Research Complex	1,600
Replacement Office Buildings	1,700
Radiological Sciences Institute	2,800
Radioactive Liquid Waste Treatment Facility Upgrade	1,200
TA-55 Radiography Facility	24
Plutonium Facility Complex Refurbishment	690
Science Complex	3,300
Remote Warehouse and Truck Inspection Station	610
Waste Management Facilities Transition	500
Security-Driven Transportation Modifications	1,500
Total	26,000

TA = technical area.

[a] Construction debris includes uncontaminated wastes such as steel, brick, concrete, pipe and vegetative matter from land clearance.

Note: Totals may not add because values have been rounded to the nearest hundred, thousand, or million.

The type and extent of many environmental restoration activities that would be required by the New Mexico Environment Department are not yet known. To assess impacts under this uncertainty, LANL's MDA remediation activities were analyzed under two scenarios, the Capping Option and the Removal Option. The waste management impacts associated with both scenarios are presented here.

MDA remediation wastes would be generated under the Capping Option, with substantial quantities of demolition and low-level radioactive waste expected. Variations in actual versus projected waste quantities are expected for these wastes due to the difficulty in predicting selected environmental remedies and waste types and quantities. In addition, no credit was taken for waste volume reduction techniques, such as sorting.

Much greater quantities of MDA remediation wastes would be generated under the Removal Option than under the No Action Alternative because of the substantial quantities of demolition debris and low-level radioactive waste expected. The closure of some TA-54 Area G facilities and the subsequent remediation of the area would generate large quantities of demolition debris and low-level radioactive waste. Industrial, hazardous, and low-level radioactive liquid wastes also would be generated by remedial actions. These liquid wastes would be treated onsite at existing LANL facilities.

Under the Expanded Operations Alternative, larger quantities of some radioactive and chemical wastes would be generated due to increased levels of operations at various facilities. Expanded actinide activities at the Chemistry and Metallurgy Research Replacement Facility, increased pit production (up to 80 pits per year) at the Plutonium Facility Complex, and increased recovery of sealed sources under the Off-Site Source Recovery Project would result in larger quantities of transuranic and low-level radioactive wastes. Increased pit production is projected to annually result in about 240 cubic yards (180 cubic meters) of additional contact-handled transuranic waste. In addition, activities at TA-55 in support of mixed oxide fuel fabrication could generate additional quantities of transuranic waste (LANL 2004g). Projections of chemical and radioactive waste quantities from routine operations at Key and non-Key Facilities are presented in **Table 5–47**.

Radioactive liquid waste treatment volumes are expected to increase under the Expanded Operations Alternative due to increased pit production and activities in support of mixed oxide fuel fabrication. The TA-21 demolition work is expected to generate about 8,400 gallons (32,000 liters) of low-level radioactive liquid waste, which would be treated at the Radioactive Liquid Waste Treatment Facility in TA-50. Radioactive liquid waste treatment quantities are presented in **Table 5–48**.

Table 5–47 Radioactive and Chemical Waste Projections from Routine Operations – Expanded Operations Alternative

Key and Non-Key Facilities	*Waste Projections (cubic yards per year)* [a]			
	Low-Level Radioactive Waste	***Mixed Low-Level Radioactive Waste***	***Transuranic Waste***	***Chemical Waste (pounds per year)***
Chemistry and Metallurgy Research Building	2,600 [b]	30 [b]	90 [b]	25,000 [b]
Sigma Complex	1,300	5	0	22,000
Machine Shops	790	0	0	1,045,000
Materials Science Laboratory	0	0	0	1,300
Metropolis Center [c]	0	0	0	0
High Explosives Processing Facilities	20	<1	0	29,000
High Explosives Testing Facilities	1,200	10 [d]	<1	78,000
Tritium Facilities	630	4	0	3,800
Pajarito Site	190	2	0	8,800
Target Fabrication Facility	13	<1	0	8,400
Bioscience Facilities	45	4	0	29,000
Radiochemistry Facility	350	5	0	7,300
Radioactive Liquid Waste Treatment Facility [e]	390	3	18	1,100
Los Alamos Neutron Science Center	1,400	1	0	37,000
Solid Radioactive and Chemical Waste Facilities [f]	300 [g]	10 [g]	35	2,000
Plutonium Facility Complex	1,400 [h]	20	690 [i]	19,000
Non-Key Facilities	2,000 [j]	40	30 [j]	1,435,000
Total [k]	13,000	140	860	2,750,000

[a] Projected values are from the *1999 SWEIS* ROD, as documented in the *2004 SWEIS Yearbook* (LANL 2005f), unless otherwise noted. Projections are based upon expected, routine facility operations and do not include wastes from nonroutine events such as chemical cleanouts and construction projects.

[b] Value taken from *CMRR EIS* (DOE/EIS-0350).

[c] Values not projected in *1999 SWEIS* ROD. The Metropolis Center was not a designated Key Facility at that time.

[d] Value adjusted upward from *1999 SWEIS* projection based on projected waste volumes resulting from hydrotesting activities (LANL 2006a).

[e] Values adjusted from *1999 SWEIS* projections are based on historical generation rates and new projections (LANL 2006a).

[f] This Key Facility includes the Transuranic Waste Retrieval Project and the Off-Site Source Recovery Project.

[g] Value was adjusted upward from *1999 SWEIS* projection based on projections in *Waste Volume Forecast* (LANL 2004g).

[h] Projections for transuranic and low-level radioactive waste assume pit production of up to 80 pits per year, based on *1999 SWEIS* projections (DOE 1999a) and more recent waste estimates (LANL 2005d).

[i] Projections for transuranic and low-level radioactive waste assume pit production of up to 80 pits per year, based on *1999 SWEIS* projections (DOE 1999a) and more recent waste estimates (LANL 2005d). In addition, 46 cubic yards of transuranic waste per year are projected due to activities in support of mixed oxide fuel fabrication (LANL 2004g).

[j] Value was adjusted upward from the *1999 SWEIS* projection based on historical generation rates and projections in the *Waste Volume Forecast* (LANL 2004g). Low-level radioactive waste increases are attributable to heightened activities and new construction. Transuranic waste increases are attributable to waste generated by the Off-Site Source Recovery Project; because this waste comes from shipping and receiving, it is attributed to non-Key Facilities.

[k] Totals may not add because values have been rounded to the nearest hundred, thousand, or million.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; for pounds to kilograms, multiply by 0.45359.

Table 5–48 Radioactive Liquid Waste Treated at Los Alamos National Laboratory – Expanded Operations Alternative

Waste Treatment Activity	*Projection* [a]
Pretreatment of radioactive liquid waste at TA-21	(a)
Pretreatment of transuranic liquid waste from TA-55 in Room 60	50,000 gallons (190,000 liters) per year
Solidification of transuranic sludge at TA-50	22 cubic yards (17 cubic meters) per year
Radioactive liquid waste treated at TA-50	5,000,000 gallons (20,000,000 liters) per year
Secondary treatment of radioactive liquid waste at TA-50	320,000 gallons (1,200,000 liters) per year
De-water low-level radioactive waste sludge at TA-50	80 cubic yards (60 cubic meters) per year
Radioactive liquid waste treated at TA-53	140,000 gallons (520,000 liters) per year [b]
Transport evaporator bottoms to Tennessee	80,000 gallons (300,000 liters) per year
Receive solidified evaporator bottoms from Tennessee [c]	30 cubic yards (23 cubic meters) per year

TA = technical area, LANSCE = Los Alamos Neutron Science Center.

[a] No new radioactive liquid waste is being generated at TA-21, and all inventories that existed in tanks and equipment was processed or transferred to TA-54 in 2006.

[b] Radioactive liquid waste treated at TA-53 includes waste volumes from LANSCE plus approximately 5,000 gallons (20,000 liters) per year from TA-50.

[c] This is solid low-level radioactive waste that is disposed of at TA-54.

Source: LANL 2006a.

Summary—**Table 5–49** summarizes the waste quantities estimated for operations, DD&D, and LANL's environmental restoration activities under the Expanded Operations Alternative. Although the summary table provides waste projections only through 2016, impacts from operations are expected to continue at comparable rates for the longer term. For this summary table, the transuranic and low-level radioactive waste categories have been further subdivided (for example, contact- and remote-handled transuranic) to facilitate identification of offsite disposal options and analysis of transportation impacts. In addition, for the Operational Waste and Remediation Waste categories, the quantities are presented as ranges rather than discrete values. For Operational Waste, the lower end of the range represents the quantity projected in the *Waste Volume Forecast* (LANL 2004g) and the upper end represents the *1999 SWEIS* projection, except as noted.

Waste management impacts from LANL operations under the Expanded Operations Alternative are expected to increase compared to those under the No Action Alternative due to heightened operations at the Plutonium Facility Complex and increased characterization and management activities associated with legacy waste retrieval. Although operational transuranic waste quantities are higher under the Expanded Operations Alternative, waste disposal capacity at WIPP is expected to be adequate, assuming the best estimates are realized. Operational low-level radioactive waste quantities also are expected to increase under this alternative, and use of both onsite and offsite disposal options can be used to manage this waste. As detailed in Appendix H, Section H.3, improvements to the LANL waste management infrastructure would be implemented to ensure safe and efficient management of wastes.

Table 5–49 Summary of Waste Types by Generator Category – Expanded Operations Alternative (Cumulative 2007 through 2016) (in cubic yards)

Waste Type	*Operational Waste* [a]	*DD&D Waste* [b]	*Remediation Waste* [c]	*Total*
Transuranic Waste				
Contact-handled	3,300 to 8,600	1,700	280 to 22,000	5,300 to 33,000
Remote-handled	–	11	0 to 50	11 to 61
Low-Level Radioactive Waste [d]				
Bulk low-level radioactive waste	–	177,000	20,000 to 710,000	196,000 to 884,000
Packaged low-level radioactive waste	25,000 to 127,000	56,000	–	80,000 to 183,000
High-activity low-level radioactive waste	–	–	0 to 347,000	0 to 347,000
Remote-handled low-level radioactive waste	–	480	0 to 1,200	480 to 1,700
Mixed Low-Level Radioactive Waste	270 to 1,400	1,900	1,800 to 180,000	3,900 to 183,000
Construction and Demolition Debris [e]	26,000	569,000	47,000 to 126,000	642,000 to 722,000
Chemical Waste [g] **(pounds)**	9,997,000 to 27,500,000	4,425,000	50,000,000 to 97,000,000	64,000,000 to 129,000,000

DD&D = decontamination, decommissioning, and demolition; RCRA = Resource Conservation and Recovery Act; TSCA = Toxic Substances Control Act.

[a] Operations waste volumes are represented as a range, with the lower end represented by best-estimate values documented in the *Waste Volume Forecasts* (LANL 2003e, 2004g) and the upper end represented by the bounding *1999 SWEIS* projections (DOE 1999a), adjusted as detailed in Table 5–47. These wastes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] DD&D waste quantities include those under the No Action Alternative, as well as all DD&D wastes estimated to arise from new projects under the Expanded Operations Alternative, as detailed in Table 5–45.

[c] The low and high ends of the ranges correspond to the MDA Capping Option and Removal Option, respectively. See Appendix I for details.

[d] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High-activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides), which is not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[e] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe, and vegetative matter from land clearance.

[f] Construction debris quantities include those under the No Action Alternative, as well as all construction wastes estimated to arise from new projects under the Expanded Operations Alternative, as detailed in Table 5–46.

[g] Chemical waste includes waste regulated under RCRA, TSCA, or state hazardous waste regulations.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; for pounds to kilograms, multiply by 0.45359. Totals might not add because values have been rounded to the nearest hundred, thousand, or million.

DD&D activities also are expected to generate large quantities of waste, particularly low-level radioactive waste and uncontaminated debris. The quantities of low-level radioactive waste would exceed the Area G capacity and some portion would require offsite disposal. Uncontaminated debris would be sent offsite for disposal.

For remediation waste, the range is intended to reflect the uncertainty associated with site cleanups. Final decisions on cleanup of MDAs and other PRSs will be made after DOE and LANL investigate the sites and propose remedies to the New Mexico Environment Department, which will then solicit public comment on the proposed remedies and decide what remedies will be implemented. For many of LANL's MDAs and PRSs, investigation is still ongoing and the remedy selection process has not begun. Thus, the remediation process, including the amount of waste generated as a result of the process, is not clearly defined. To adequately address impacts, the remediation process was analyzed under a Capping Option, which would produce relatively small amounts of waste, and a Removal Option, which would involve significant excavations and would produce significantly more waste. These two options, Capping and Removal, represent the lower and upper values, respectively, in the remediation waste summary.

Under the MDA Capping Option, remedial actions would take place at PRSs such as high explosives testing sites and outfalls. Actions at most MDAs would be limited to installing an engineered cover, with the wastes remaining in place. Under this option, moderate quantities of bulk low-level radioactive waste, uncontaminated debris, and chemical wastes would be expected, as well as small quantities of transuranic waste. Offsite disposal of most waste could occur, although some portion of low-level radioactive waste could be disposed of onsite depending upon available capacity and disposal priorities.

Under the MDA Removal Option, the same remedial activities as those under the MDA Capping Option would take place, with one important addition: all MDAs would be exhumed, which would generate very large quantities of waste including transuranic, low-level radioactive, mixed low-level radioactive, uncontaminated debris, and chemical waste. For the uncontaminated debris (managed as solid waste) and chemical waste categories, offsite disposal capacity is expected to be adequate. Quantities of low-level radioactive waste would exceed the planned annual rate of disposal at Area G; decisions regarding onsite or offsite disposal would depend on available capacity, decisions about changes to disposal operations, if any, and disposal priorities.

The transuranic waste volumes projected for the MDA Removal Option involve waste, most of which DOE buried before 1970. These projected volumes are conservative, and may be smaller than that assumed depending on future regulatory decisions by the New Mexico Environment Department. Also, no credit was taken for use of waste volume reduction techniques such as sorting. It was assumed for this SWEIS that all transuranic waste would be disposed of at WIPP. WIPP disposal capacity is expected to be sufficient for disposal of all retrievably stored waste and all newly generated transuranic waste from the DOE complex over the next few decades, but not sufficient for this waste and all transuranic waste buried before 1970 across the complex (63 FR 3624). Decisions about disposal of transuranic waste generated by remediation at LANL, will be based on the needs of the entire DOE complex. If necessary, any transuranic waste that is generated without a disposal pathway would be safely stored until disposal capacity becomes available.

The large quantities of waste resulting from the Removal Option may exceed LANL's waste handling and processing capacity. As needed, additional, augmented, or mobile waste management equipment or facilities could be developed similar to those described in Appendix H, Section H.3.2.2, and Appendix I, Section I.3.3.2.8, of this SWEIS. Modular mobile facilities could be sited at appropriate LANL locations, and moved between remediation sites as needed. These modular facilities could include capacity for safety inspections of removed waste, waste processing and temporary storage, radioactive and chemical analyses, or other support services.

5.10 Transportation

This section summarizes the potential impacts associated with shipping materials to and from LANL to various locations (such as waste disposal sites and other DOE or commercial sites) under both incident-free and accident conditions. For incident-free transportation, the potential human health impacts from the radiation field surrounding the radioactive packages were estimated for transportation workers and populations along the route (off-traffic, or off-link), people sharing the route (in-traffic or on-link), and people at rest areas and stops along the route. The RADTRAN 5 computer program (Neuhauser and Kanipe 2003) was used to estimate the impacts for transportation workers and populations, as well as the impact to an MEI (for example, a person stuck in traffic, a gas station attendee, or an inspector), who may be a worker or a member of the public.

Human heath impacts could result from transportation accidents. The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing individual risks from all reasonably conceivable accidents. The analysis of accident risks accounts for a spectrum of accidents ranging from high-probability accidents of low severity (a fender bender) to hypothetical high-severity accidents that have a corresponding low probability of occurrence. Only as a result of a severe fire or a powerful collision, which are of extremely low probability, could a transportation package of the type used to transport radioactive material be damaged to the extent that radioactivity could be released to the environment with significant consequences.

In addition to calculating the radiological risks that would result from all reasonably conceivable accidents during transportation of radioactive wastes, NNSA assessed the consequences of maximum reasonably foreseeable accidents with a probability greater than 1×10^{-7} (1 in 10 million) per year. These latter consequences were determined for the atmospheric conditions that would likely prevail during accidents. The analysis used the RISKIND computer program to estimate doses to individuals and populations (Yuan et al. 1995).

Incident-free radiological health impacts are expressed as additional LCFs. Radiological accident health impacts are also expressed as additional LCFs, and nonradiological accident risks are expressed in terms of additional immediate (traffic) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by 6.0×10^{-4} LCFs per person-rem of exposure. Transportation impacts of radioactive wastes were calculated assuming that all wastes are transported by truck.

In determining the transportation risks, per-shipment risk factors were calculated for the incident-free and accident conditions using the RADTRAN 5 computer program (Neuhauser and Kanipe 2003) in conjunction with the Transportation Rating Analysis Geographic Information System (TRAGIS) computer program (Johnson and Michelhaugh 2003) to choose transportation routes in accordance with U.S. Department of Transportation regulations. The TRAGIS program provides population estimates based on the 2000 census along the routes for determining the population radiological risk factors. For incident-free operations, the affected population includes individuals living within 0.5 miles (800 meters) of each side of the road. For accident conditions, the affected population includes individuals living within 50 miles (80 kilometers) of the accident, and the MEI is assumed to be an individual located 330 feet (100 meters) directly downwind from the accident.

For determining traffic accident fatalities from offsite commercial truck transportation, separate accident rates and accident fatality risks were used for rural, suburban, and urban population zones. These accident and fatality rates were taken from data provided in *State-Level Accident Rates for Surface Freight Transportation: A Reexamination,* ANL/ESD/TM-150 (Saricks and Tompkins 1999). The values selected were the "mean" accident and fatality rates given in ANL/ESD/TM-150 for "interstate," "primary," and "total." These values were assigned to rural, suburban, and urban population zones, respectively. Accident rates are generically defined as the number of accident involvements (or fatalities) in a given year per unit of travel in that same year. Therefore, the rate is a fractional value, with accident involvement count as the numerator of the fraction and vehicular activity (total travel distance in truck-kilometers) as its denominator. The accident rates for rural, suburban, and urban zones were 3.15, 3.52, and 3.66 per 10 million truck-kilometers, respectively; and the fatality rates were 0.88, 1.49, and 2.32 per 100 million truck kilometers, respectively.

For determining traffic accident fatalities from safe secure trailer (SST) transport, DOE operational experience between 1984 and 1999 was used. The mean probability of an accident requiring towing of a disabled trailer truck was about 6 per 100 million kilometers (DOE 2000g). The number of historical SST accidents is too small to support allocating this overall rate among the various types of routes (interstate, primary, others) used in the accident analysis. Therefore, data for the relative rate of accidents on these route types, or influence factor, as provided in *Determination of Influence Factor and Accident Rates for Armored Tractor/Safe Secure Trailer* (Phillips, Clauss, and Blower 1994), were used to estimate accident frequencies for rural, urban, and suburban transports. Traffic accident fatalities for the SST transports were estimated using the commercial truck transport fatality per accident ratios within each zone.

For determining traffic accident fatalities from local and regional transportation of industrial and hazardous waste, New Mexico State accident and fatality rates, which also are given in ANL/ESD/TM-150, were used. The rates used were 1.13 accidents per 10 million truck-kilometers and 1.18 fatalities per 100 million truck-kilometers. For assessment purposes, the total number of expected accidents or fatalities was calculated by multiplying the total shipment distance for a specific waste by the accident or fatality rate. Additional details on the analysis approach and on modeling and parameter selection are provided in Appendix K.

In summary, at LANL, radioactive materials (special nuclear material, low-level radioactive waste, transuranic waste, etc.) are transported both onsite (between the TAs) and offsite to multiple locations. Onsite transportation constitutes the majority of activities that are part of routine operations in support of various programs. The radioactive materials transported onsite between TAs are mainly limited quantities that are transported over short distances and mostly on closed roads. The impacts of these activities are part of the impacts of normal 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 *1999 SWEIS* (DOE 1999a) indicated that the projected collective radiation dose for LANL drivers from a projected 10,750 onsite shipments was 10.3 person-rem per year, or on average, less than 1 millirem per transport. A review of recent onsite radioactive materials transportation indicates a much smaller number of shipments than those projected in the *1999 SWEIS*. Therefore, the *1999 SWEIS* projection of impacts would envelop the impacts for routine onsite transportation. The impacts of nonroutine onsite transportation activities, such as waste transportation associated with facility DD&D or MDA remediation, were evaluated and are presented in this SWEIS where applicable.

Offsite transportation of radioactive materials would occur using both trucks and airfreight. Materials transported by airfreight would be similar in number, type, and forms to those considered in the *1999 SWEIS*, and hence would result in similar impacts. The aircrew dose from airfreight radioactive transportation was estimated at 2.4 person-rem per year (DOE 1999a).

Truck (both commercial and DOE SST) transportation is analyzed further in this SWEIS. The *1999 SWEIS* provides a comprehensive list of various radioactive material types, forms, origins and destinations, and quantities, as well as a projected number of shipments. The radioactive materials transported included tritium, plutonium, uranium (both depleted and enriched), offsite source recovery materials, medical isotopes, small quantities of activation products, low-level radioactive waste, and transuranic waste. The specific origins and destinations, except for Rocky Flats, are expected to be applicable to future transports. For analyses purposes in this SWEIS, the destinations were limited to those that could be significantly affected, namely offsite waste disposal sites (such as the Nevada Test Site, a commercial waste disposal site in Utah, and WIPP in New Mexico) and the DOE and NNSA sites supporting nuclear weapons production and mixed oxide fuel fabrication (such as the Pantex Plant in Texas, Oak Ridge National Laboratory and Y-12 Complex in Tennessee, Lawrence Livermore National Laboratory in California, and Savannah River Site in South Carolina). Impacts from the transportation of other radioactive materials would remain similar to those projected in the *1999 SWEIS*.

Table 5–50 provides the estimated number of material shipments under each alternative over a 10-year period. This table also provides the estimated number of shipments resulting from activities for proposed MDA remediation options such as removal or capping, and those from activities related to increasing pit production from 20 to up to 80 pits per year.

Table 5–50 10-Year Total Number of Offsite Shipments under Each Alternative and Selected Activities

Alternative (Activities)	Number of Shipments										
	Radioactive Materials									Miscellaneous	
	LSA	DD&D Bulk	LLW [a]	High Activity [b]	LLW-RH [c]	Mixed LLW	TRU [d]	SNM	PuO_2	Hazardous	Others [e]
No Action	624	812	9,217	312	0	196	1,460	958	20	946	10,778
Reduced Operations	624	812	7,883	312	0	196	1,460	958	20	932	10,778
Expanded Operations [f]	1,436-49,940	9,538	9,919	3,418-36,521	196-856	297-9,019	2,405-5,044	1,558	50	2,781-4,749	35,419-41,506
Expanded Operations (without MDA Remediation) [g]	681	9,538	9,919	3,418	196	240	2,397	1,558	50	1,000	31,856
(MDA Remediation) [h]	755-49,259	0	0	0-33,103	0-660	57-8,779	8-2,647	0	0	1,781-3,749	3,563-9,650
(Increase in Pit Production) [i]	0	0	701	0	0	6	246	600	0	0	0

LSA = low specific activity, DD&D = decontamination, decommissioning, and demolition, LLW = low-level radioactive waste, RH = remote handled, TRU = transuranic waste, SNM = special nuclear material, PuO_2 = plutonium dioxide.

[a] Low-level radioactive waste transported in drums or Type A, B-25 boxes. The values here also include shipments of evaporator bottoms from Radioactive Liquid Waste Treatment Facility to an offsite location and the returned dried wastes.

[b] High activity low-level radioactive waste containing more than 10 nanocuries per gram of transuranic waste transported in Type A, B-25 boxes. This waste is comparable to Class B or Class C of 10 CFR Part 61 waste classification. This waste is generated during MDA waste retrieval, and from decontamination and demolishing of some of the buildings. The shipments also include one shipment of strontium-90 radioisotope thermoelectric generators under all alternatives.

[c] Remote-handled low-level radioactive waste transported in 55-gallon (208-liter) drums.

[d] The sum of remote-handled and contact-handled transuranic waste shipments.

[e] Others include industrial, sanitary, and asbestos wastes.

[f] The range of values represent the estimated number of shipments for options of capping and remediation and removal and remediation of all MDAs.

[g] Expanded Operations with baseline MDA remediation (without capping or removal).

[h] The range values represent the estimated number of shipments for options of capping and removal of all MDAs.

[i] The waste shipment values presented are based on the differences between the No Action Alternative and the Expanded Operations Alternative projected waste volumes for routine operation.

Table 5–51 summarizes the total transportation impacts, as well as the transportation impacts on two nearby LANL transportation routes: LANL to Pojoaque, New Mexico, the route segment that trucks from LANL use, and Pojoaque to Santa Fe, New Mexico, the route segment that all trucks using Interstate-25 (such as trucks traveling to WIPP) use. For analysis purposes in this SWEIS, two sites, the DOE Nevada Test Site 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 low-level radioactive waste offsite rather than onsite. 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 under each alternative. Transuranic waste was assumed to be disposed of at WIPP.

Table 5–51 Risks of Transporting Radioactive Materials under Each Alternative and Selected Activities

Transport Segments	Offsite Disposal Option [a]	Number of Shipments	Round Trip Kilometers Traveled (million)	Incident-Free				Accident	
				Crew		Population		Radiological Risk [b]	Nonradiological Risk [b]
				Dose (person-rem)	Risk [b]	Dose (person-rem)	Risk [b]		
No Action									
LANL to Pojoaque	NTS	13,599	0.85	5.0	0.0030	1.8	0.0011	3.9×10^{-6}	0.0093
Pojoaque to Santa Fe		13,599	1.15	8.8	0.0053	3.3	0.0020	7.1×10^{-6}	0.016
Total		13,599	31.9	163.8	0.098	58.4	0.0350	0.00017	0.30
LANL to Pojoaque	Commercial	13,599	0.85	5.0	0.0030	1.8	0.0011	3.9×10^{-6}	0.009
Pojoaque to Santa Fe		2,893 [c]	0.30	3.9	0.0023	1.9	0.0011	1.1×10^{-6}	0.003
Total		13,599	28.2	147.3	0.088	53.0	0.032	0.00014	0.26
Reduced Operations									
LANL to Pojoaque	NTS	12,265	0.76	4.6	0.0028	1.7	0.0010	3.4×10^{-6}	0.009
Pojoaque to Santa Fe		12,265	1.1	8.1	0.0049	3.1	0.0019	6.2×10^{-6}	0.015
Total		12,265	28.6	147.2	0.088	53.1	0.032	0.00015	0.27
LANL to Pojoaque	Commercial	12,265	0.76	4.63	0.0029	1.7	0.0010	3.4×10^{-6}	0.009
Pojoaque to Santa Fe		2,893 [c]	0.30	3.9	0.0023	1.9	0.0011	1.1×10^{-6}	0.0032
Total		12,265	25.3	133.1	0.08	48.5	0.029	0.00013	0.24
Expanded Operations (with MDA Removal Option)									
LANL to Pojoaque	NTS	122,439	7.6	25.9	0.016	8.1	0.0049	0.000032	0.089
Pojoaque to Santa Fe		122,439	9.7	43.5	0.026	13.3	0.0080	0.000047	0.11
Total		122,439	299.9	910.1	0.55	286.8	0.17	0.0016	2.96
LANL to Pojoaque	Commercial	122,439	7.6	25.9	0.016	8.1	0.0049	0.000032	0.089
Pojoaque to Santa Fe		44,205 [c]	3.5	30.4	0.018	9.8	0.0059	0.000024	0.040
Total		122,439	272.8	866.2	0.52	273.6	0.16	0.0014	2.66
Expanded Operations (with MDA Capping Option)									
LANL to Pojoaque	NTS	28,817	1.8	8.0	0.0048	2.8	0.0017	5.7×10^{-6}	0.021
Pojoaque to Santa Fe		28,817	2.3	13.5	0.0081	4.6	0.0028	9.8×10^{-6}	0.034
Total		28,817	69.3	255.9	0.15	89.1	0.053	0.00025	0.66
LANL to Pojoaque	Commercial	28,817	1.8	8.0	0.0048	2.8	0.0017	5.7×10^{-6}	0.021
Pojoaque to Santa Fe		7,803 [c]	0.7	7.7	0.0046	3.0	0.0018	3.1×10^{-6}	0.0085
Total		28,817	62.0	236.3	0.142	82.9	0.050	0.00022	0.58
Expanded Operations (without MDA Removal or Capping Options)									
LANL to Pojoaque	NTS	27,997	1.7	8.0	0.0048	2.8	0.0017	5.5×10^{-6}	0.020
Pojoaque to Santa Fe		27,997	2.2	13.4	0.0080	4.6	0.0028	9.6×10^{-6}	0.033
Total		27,997	67.2	254.0	0.15	88.6	0.053	0.00024	0.64
LANL to Pojoaque	Commercial	27,997	1.7	8.0	0.0048	2.8	0.0017	5.5×10^{-6}	0.020
Pojoaque to Santa Fe		7,795 [c]	0.6	7.6	0.0046	3.0	0.0018	3.1×10^{-6}	0.0065
Total		27,997	60.2	234.6	0.14	82.4	0.049	0.00021	0.57
MDA Removal Option Activities									
LANL to Pojoaque	NTS	94,448	5.9	18.0	0.011	5.3	0.0032	0.000026	0.070
Pojoaque to Santa Fe		94,448	7.5	30.1	0.018	8.7	0.0052	0.000037	0.088
Total		94,448	232.7	656.4	0.400	198.2	0.12	0.0013	2.32
LANL to Pojoaque	Commercial	94,448	5.9	18.0	0.011	5.3	0.0032	0.000026	0.070
Pojoaque to Santa Fe		36,410 [c]	2.9	22.8	0.014	6.8	0.0041	0.000021	0.034
Total		94,448	212.5	631.6	0.38	191.2	0.120	0.0012	2.10

Transport Segments	Offsite Disposal Option [a]	Number of Shipments	Round Trip Kilometers Traveled (million)	Incident-Free				Accident	
				Crew		Population			
				Dose (person-rem)	Risk [b]	Dose (person-rem)	Risk [b]	Radiological Risk [b]	Nonradiological Risk [b]
MDA Capping Option Activities									
LANL to Pojoaque	NTS	820	0.05	0.05	0.00003	0.01	0.00001	1.7×10^{-7}	0.0006
Pojoaque to Santa Fe		820	0.06	0.09	0.00005	0.02	0.00001	2.0×10^{-7}	0.0008
Total		820	2.04	1.9	0.0012	0.49	0.00029	0.00001	0.020
LANL to Pojoaque	Commercial	820	0.05	0.05	0.00003	0.01	0.00001	1.7×10^{-7}	0.00060
Pojoaque to Santa Fe		8	0.0006	0.02	0.00001	0.005	0.000003	3.9×10^{-11}	0.00001
Total		820	1.76	1.70	0.0010	0.042	0.00025	0.000008	0.017
Increase in Pit Production Activities									
LANL to Pojoaque	NTS	1,553	0.1	0.68	0.00041	0.36	0.00022	2.7×10^{-7}	0.00075
Pojoaque to Santa Fe		1,553	0.15	1.14	0.00068	0.59	0.00035	1.9×10^{-6}	0.0013
Total		1,553	3.63	18.0	0.011	8.95	0.0054	0.000011	0.024
LANL to Pojoaque	Commercial	1,553	0.1	0.68	0.00041	0.36	0.00022	2.7×10^{-7}	0.00075
Pojoaque to Santa Fe		879 [c]	0.08	0.79	0.00047	0.49	0.00029	1.4×10^{-6}	0.00043
Total		1,553	3.39	16.87	0.010	8.56	0.0051	9.6×10^{-6}	0.021

NTS = Nevada Test Site, MDA = material disposal area.

[a] Under this option, low-level radioactive waste would be shipped to either the Nevada Test Site or a commercial site in Utah. Transuranic wastes would be shipped to WIPP. Pantex, Y-12, Oak Ridge, Nevada Test site, Lawrence Livermore and the Savannah River Site would ship or receive special nuclear materials. Also note that the number of shipments along the Pojoaque to Santa Fe segment would be lower when the commercial site in Utah is used as an offsite disposal option for low-level radioactive waste.

[b] Risk is expressed in terms of latent cancer fatalities, except for the nonradiological risk, 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.

Note: The values in this table are rounded in comparison to those provided in Appendix K.

The following conclusions can be drawn from the results presented in Table 5–51. The maximum total 10-year dose to the public would be 287 person-rem from all shipments under the Expanded Operations Alternative – MDA Removal Option with all low-level radioactive waste being sent to the Nevada Test Site for disposal. The expected excess LCFs among the exposed population would be less than 1 (0.17 LCF). The total dose to the public along the LANL to Pojoaque route under this option would be 8.1 person-rem, with less than 1 excess LCF (0.0049 LCF) among the exposed population. The total dose to the public along the Pojoaque to Santa Fe route would be up to 13.3 person-rem, with less than 1 excess LCF (0.008 LCF) among the exposed population. The maximum dose to the transportation crew (truck drivers) would be 910 person-rem over 10 years, with a potential of less than 1 (0.55) LCF among the exposed crew. It should be noted 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, which would have an administrative control annual dose limit of 2 rem (DOE 1999e). The potential for a trained radiation worker to develop a fatal latent cancer from the maximum annual exposure is 0.0012. Therefore, an individual transportation worker would not be expected to develop a lifetime latent fatal cancer from exposures during these activities.

Table 5–51 also presents the risk of traffic accident fatalities for each of the alternatives. The risk of a traffic accident fatality is greater than the risk of an excess LCF for each of the alternatives. For instance, excess LCFs among the exposed population from all shipments under

the Expanded Operations Alternative-MDA Removal Option with all waste being sent to the Nevada Test Site for disposal would be less than 1 (0.17 LCF), while the number of traffic accident fatalities from these shipments would be nearly 3 (2.66).

Onsite traffic patterns were reviewed with respect to traffic flowing through the main access points onto the site. Based on the average traffic flows recorded in 2004 and 2005, an estimate of the daily number of trips per employee was made, assuming that 90 percent of all trips were related to employee trips and the remaining 10 percent were related to truck trips in support of normal LANL activities, not including construction or DD&D-related activities, which were calculated separately. The alternatives were then analyzed and traffic flows were assumed to fluctuate consistent with the employment levels estimated in Section 5.8.1. For example, under the Reduced Operations Alternative, employment at LANL is projected to decline; therefore, the number of daily trips associated with LANL activities are also projected to decline. Similarly, under the Expanded Operations Alternative, LANL employment is projected to increase; consequently, traffic would likely increase as well.

As shown in **Table 5–52**, local traffic flows would likely remain at current levels under the No Action Alternative because employment levels would stay at current levels. Under the Reduced Operations Alternative, a small decline in traffic through LANL would be expected mainly because of the projected decrease in employment under this alternative. Under the Expanded Operations Alternative, traffic would likely increase substantially due to the projected increases in employment and construction and remediation activities. This would be particularly true for Pajarito Road as remediation activities start on MDA G. The Expanded Operations Alternative – MDA Removal Option would have a larger traffic increase relative to the MDA – Capping Option due to the more numerous truck trips associated with MDA remediation and the greater number of remediation workers needed to implement this option.

Table 5–52 Summary of Changes in Annual Traffic Flow at the Entrances to Los Alamos National Laboratory

Alternative	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at NM 4***	***East Jemez Road at NM 4***	***West Jemez Road at NM 4***	***DP Road at Trinity Drive***
No Action	24,545	4,984	9,502	2,010	1,255
Reduced Operations - Estimated Daily Trips - Percent Change from No Action (%)	 23,600 -4	 4,800 -4	 9,100 -4	 1,900 -5	 1,200 -4
Expanded Operations – MDA Removal Option – Estimated Daily Trips - Percent Change from No Action (%)	 26,000 +6	 9,200 +85	 10,700 +13	 2,200 +9	 1,700 +35

MDA = material disposal area.

5.10.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, about 13,600 offsite shipments of radioactive materials would be made between 2007 and 2016 to the Nevada Test Site (or a commercial site in Utah), WIPP, and the

NNSA sites supporting nuclear weapons. Maximum transportation impacts would be realized if low-level radioactive waste were shipped to either the Nevada Test Site or a commercial site in Utah instead of being disposed of onsite. Transuranic waste would be shipped to WIPP, and special nuclear material would be shipped mainly between LANL and Pantex. The total projected (one-way) distance traveled on public roads transporting radioactive materials to various locations would range from about 8.5 million to 10 million miles (13.75 million to 16 million kilometers).

Impacts of Incident-free Transportation

The dose to the transportation crew from all offsite transportation activities under this alternative was estimated to range from about 147 person-rem for disposal at the commercial low-level radioactive waste disposal site in Utah to about 164 person-rem for disposal at the Nevada Test Site. The dose to the general population would range from 53 to 58 person-rem for the commercial site in Utah and the Nevada Test Site options, respectively. Accordingly, incident-free transportation would result in a maximum of 0.098 excess LCFs among the transportation workers and 0.035 excess LCFs in the affected population. The estimated dose associated with disposal of low-level radioactive waste at the Nevada Test Site is higher because of the longer distance traveled and larger affected population. The differences in estimated doses under either option are very small, however, as shown above.

It should be noted 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. Trained radiation workers have an administrative control dose level of 2 rem per year (DOE 1999e). 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 would not be 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 1.8 and 3.3 person-rem, respectively. These doses would result in 0 (0.0011 and 0.0020) excess LCFs among the exposed populations.

Impacts of Accidents during Transportation

As stated earlier, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of maximum reasonably foreseeable accidents (accidents with probabilities greater than 1 in 10 million per year [1×10^{-7}]) and impacts of all conceivable 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 of such an accident occurring would be about 1 in 5.3 million (1.9×10^{-7}) per year in an urban area. If such an accident were to occur, the consequences in terms of general population dose would be 310 person-rem. Such an exposure could result in 0.19 excess LCFs among the exposed population. This accident, if it occurred, would result in a dose of 6.2 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 270,000 (3.7×10^{-6}).

Under the No Action 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[5] to the general population of 0.28 person-rem, resulting in 0.00017 LCFs, and a maximum nonradiological accident risk of 0 (0.30) fatalities.

The maximum radiological transportation accident dose-risk to the general populations along the LANL to Pojoaque and the Pojoaque to Santa Fe routes would be 0.0065 and 0.012 person-rem, respectively. These doses would result in 0 (3.9×10^{-6} and 7.1×10^{-6}) excess LCFs among the exposed populations. The maximum expected traffic accident fatalities along these routes would be 0 (0.0093 and 0.016, respectively).

Impacts of Construction, Operations, and Hazardous Material Transportation

The impacts of transporting various nonradiological materials were evaluated. These impacts are presented in terms of distance traveled and numbers of expected traffic accidents and fatalities. The transportation impacts under this alternative would be, for 3.4 million miles (5.5 million kilometers) traveled, 1 (0.62) traffic accident and 0 (0.07) fatalities.

Local Traffic

Under the No Action Alternative, the impacts of LANL activities on local traffic flow and roadway infrastructure would be approximately the same as current conditions, as described in Chapter 4, Section 4.10.1. Efforts being undertaken to enhance site security, such as the Security Perimeter Project, would be implemented as planned. These modifications would alter traffic patterns in and around LANL, but would likely have only minor impacts on traffic flow during normal security conditions. In the case of heightened security, traffic entering the site would be delayed as vehicles were subjected to greater scrutiny.

Management of construction fill could result in up to 15,000 round trips on LANL roads from LANL construction sites to borrow areas for storage or to sites using construction fill. This traffic could be mitigated by scheduling trips during off-peak hours, as appropriate.

5.10.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, about 12,270 offsite shipments of radioactive materials would be made to the Nevada Test Site (or a commercial disposal site in Utah), WIPP, and the NNSA sites supporting nuclear weapons production between 2007 and 2016. Similar to the No Action Alternative, the maximum transportation impacts would result from shipments of low-level radioactive waste to either the Nevada Test Site or a commercial disposal site in Utah, transuranic waste to WIPP, and special nuclear material between LANL and Pantex. The total projected (one-way) distance traveled on public roads while transporting radioactive materials to

[5] *Dose-risk includes the probability of an accident occurring. Here, these values are calculated by dividing the radiological risks in terms of LCFs given in Table 5–51 (column 9) by 0.0006, which is a risk of an LCF per person-rem of exposure.*

various locations would range from 7.6 million to 8.9 million miles (12.3 million to 14.3 million kilometers).

Impacts of Incident-free Transportation

The dose to transportation workers from all offsite transportation activities under this alternative has been estimated to range from about 133 person-rem for the Utah commercial low-level radioactive waste disposal option to 147 person-rem for the Nevada Test Site disposal option. The dose to the general population would range from 49 to 53 person-rem for each option, respectively. Accordingly, incident-free transportation would result in a maximum of 0.088 excess LCFs among transportation workers and 0.032 excess LCFs in the affected population for the Nevada Test Site low-level radioactive waste disposal option because of the longer distance traveled and larger affected population.

The impact of this alternative on individual transportation workers would be the same as the impact discussed under the No Action Alternative. An individual transportation worker would not be 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 under this alternative were estimated to be a maximum of 1.7 and 3.1 person-rem, respectively. These doses would respectively result in 0.0011 and 0.0019 excess LCFs among the exposed populations.

Impacts of Accidents during Transportation

Similar to the estimate forecast for No Action Alternative, for radioactive materials transported under this alternative, the maximum reasonably foreseeable offsite truck transportation accident with the highest consequence would involve a truck carrying contact-handled transuranic waste. The probability of such an accident occurring would be 1 in 5.3 million (1.9×10^{-7}) per year in an urban area. Should such an accident occur, the consequences would be similar to those projected for the No Action Alternative.

Under the Reduced Operations Alternative, the estimated maximum radiological dose-risk to the general population for all projected accidents involving radioactive shipments, regardless of type, would be about 0.25 person-rem, resulting in 0.00015 LCFs and a maximum nonradiological accident risk of 0 (0.27) fatalities.

The maximum radiological transportation accident dose-risk to the general populations along the LANL to Pojoaque and the Pojoaque to Santa Fe routes would be 0.0057 and 0.010 person-rem, respectively. These doses would result in 0 (3.4×10^{-6} and 6.2×10^{-6}) excess LCFs among the exposed populations. The maximum expected traffic accident fatalities along these routes would be 0 (0.009) and 0 (0.015), respectively.

Impacts of Construction, Operations, and Hazardous Material Transports

The impacts of transporting various nonradiological materials were evaluated. These impacts are presented in terms of distance traveled and numbers of expected traffic accidents and fatalities.

The transportation impacts under this alternative would be 1 (0.62) traffic accident and 0 (0.07) fatalities, for 3.4 million miles (5.5 million kilometers) traveled.

Local Traffic

Under the Reduced Operations Alternative, the impacts of LANL activities on local traffic flow and roadway infrastructure would be somewhat smaller than those expected under the No Action Alternative. The relatively small reduction in the number of employees associated with the reduction in high explosives processing and testing, cessation of TA-18 activities, and shutdown of LANSCE (see Section 5.8.1.2) would likely result in small decreases in local traffic flow and the impacts of site activities on local roadway infrastructure, as shown in **Table 5–53**.

Table 5–53 Estimated Changes in Traffic at the Entrances to Los Alamos National Laboratory under the Reduced Operations Alternative

Activity	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at NM 4***	***East Jemez Road at NM 4***	***West Jemez Road at NM 4***	***DP Road at Trinity Drive***
No Action Alternative	24,545	4,984	9,502	2,010	1,255
Estimated Daily Vehicle Trips under Reduced Operations Alternative	23,600	4,800	9,100	1,900	1,200
Percent Change from Baseline	-4	-4	-4	-5	-4

5.10.3 Expanded Operations Alternative

The discussions in this section focus on the doses and risk impacts from activities under the Expanded Operations Alternative with the MDA Capping and Removal Options. For each receptor (transportation workers or population) a range of impacts is provided reflecting those activities associated with the MDA Capping and MDA Removal Options. Table 5–52 also provides similar information for the Expanded Operations Alternative without the MDA Capping or Removal Options; and those resulting from activities associated with the MDA Removal Option, the MDA Capping option, and increasing pit production from 20 to 80 pits per year.

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, under the MDA Capping and Removal Options respectively, approximately 28,820 to 122,440 offsite shipments of radioactive materials would be made between 2007 and 2016 to the Nevada Test Site (or a commercial disposal site in Utah), WIPP, and the NNSA sites supporting nuclear weapons production and mixed oxide fuel fabrication. Maximum transportation impacts would be realized if low-level radioactive waste were shipped to either the Nevada Test Site or a commercial site in Utah instead of being disposed of onsite. Transuranic waste would be shipped to WIPP, and special nuclear material would be shipped mainly between LANL and Pantex or Savannah River. The total projected (one-way) distance traveled on public roads while transporting radioactive materials to various locations would range from 18.9 million to 21.6 million miles (30.3 million to 34.7 million kilometers) under the MDA Capping Option, and 84.3 million to 93.2 million miles (135.6 million to 155 million kilometers) under the MDA Removal Option.

Impacts of Incident-free Transportation

The dose to transportation workers from all offsite transportation activities under this alternative would range from 223 to 770 person-rem for low-level radioactive waste disposal at a commercial facility in Utah, and from 256 to 910 person-rem for disposal at the Nevada Test Site for the MDA Capping and Removal Option. The corresponding dose to the general population would range from 82 to 274 person-rem for disposal at a commercial facility and from 89 to 287 person-rem for disposal at the Nevada Test Site. The doses for options involving disposal of low-level radioactive waste at the Nevada Test Site are larger because of the longer distances traveled and larger affected population. Accordingly, incident-free transportation would result in a maximum of 0.15 excess LCFs among transportation workers and 0.053 excess LCFs in the affected population for the MDA Capping Option, and a maximum of 0.55 LCFs among transportation workers and 0.17 excess LCFs in the affected population for the MDA Removal Option.

The impact of this alternative on individual transportation workers would be the same as the impact discussed under the No Action Alternative. An individual transportation worker would not be expected to develop a lifetime latent fatal cancer from exposure during these activities.

Under the MDA Capping Option, doses to the general populations along the LANL to Pojoaque and the Pojoaque to Santa Fe routes were estimated to be a maximum of 2.8 and 4.6 person-rem, respectively. These doses would result in 0 (0.0017 and 0.0028) excess LCFs among the exposed populations. Under the MDA Removal Option, doses to the general populations along the LANL to Pojoaque and the Pojoaque to Santa Fe routes were estimated to be a maximum of 8.1 and 13.3 person-rem, respectively. These doses would result in 0 (0.0049 and 0.0080) excess LCFs among the exposed populations.

Impacts of Accidents during Transportation

Similar to the projection under the No Action Alternative, for radioactive materials transported under this alternative, the maximum reasonably foreseeable offsite truck transportation accident with the highest consequence would involve a truck carrying contact-handled transuranic waste. The probability of such an accident occurring would be about 1 in 3.7 million (2.7×10^{-7}) per year in an urban area under the MDA Capping Option and 1 in 1.9 million (5.2×10^{-7}) per year in an urban area under the MDA Removal Option. If this accident occurred, the consequences would be similar to those projected for the No Action Alternative.

The estimated maximum radiological dose-risk to the general population for all projected accidents involving radioactive shipments, regardless of type, would be 0.42 person-rem, resulting in 0.00025 LCFs and a maximum nonradiological accident risk of 1 (0.66) fatality under the MDA Capping Option. Under the MDA Removal Option, the estimated maximum radiological dose-risk to the general population for all projected accidents involving radioactive shipments, regardless of type, would be 2.7 person-rem, resulting in 0.0016 LCFs, and a maximum nonradiological accident risk of 3 (2.96) fatalities.

The maximum radiological transportation accident dose-risk to the general populations along the LANL to Pojoaque and the Pojoaque to Santa Fe routes would be about 0.0095 and 0.016 person-rem under the MDA Capping Option, and about 0.053 and 0.078 person-rem under

the MDA Removal Option. These doses would result in excess LCFs among the exposed populations of 0 under either MDA remediation option (5.7×10^{-6} and 9.8×10^{-6} for the MDA Capping Option and 3.2×10^{-5} and 4.7×10^{-5} for the MDA Removal Option). The maximum expected traffic fatalities along these routes would be 0 (0.021 and 0.026, respectively) under the MDA Capping Option. Under the MDA Removal Option, the maximum expected traffic accident fatalities along these routes also would be 0 (0.089 and 0.11, respectively).

Impacts of Construction, Operations, and Hazardous Material Transports

The impacts of transporting various nonradiological materials were also evaluated. These impacts are presented in terms of distance traveled and numbers of expected traffic accidents and fatalities. The transportation impacts under this alternative for the MDA Capping Option would be, for 15.2 million miles (24.5 million kilometers) traveled, 3 (2.8) traffic accidents and 0 (0.29) fatalities. For the MDA Removal Option, the nonradiological transportation impacts would be, for 17.4 million miles (28.1 million kilometers) traveled, 3 (3.2) traffic accidents and 0 (0.33) fatalities.

Local Traffic

Under the Expanded Operations Alternative, the impacts of LANL activities on local traffic flow and roadway infrastructure could be substantial without changes to current conditions. The potential addition of thousands of new employees combined with an increased number of trucks traveling to and from the site associated with increased construction, DD&D, and MDA remediation activities could impact local transportation. As shown in **Table 5–54**, a number of intersections could see large increases in daily traffic flow.

Table 5–54 Estimated Changes in Traffic at the Entrances to Los Alamos National Laboratory under the Expanded Operations Alternative

Activity	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at NM 4***	***East Jemez Road at NM 4***	***West Jemez Road at NM 4***	***DP Road at Trinity Drive***
No Action Alternative	24,545	4,984	9,502	2,010	1,255
Estimated Daily Vehicle Trips under Expanded Operations Alternative	26,000	9,200	10,700	2,200	1,700
Percent Change from Baseline	+6	+85	+13	+9	+35

Areas of concern include increased truck traffic along East Jemez Road at NM 4 if it continues to be the route for trucks traveling to LANL or from the Los Alamos townsite. With the number of construction projects and MDA remediation efforts occurring along Pajarito Road that are expected to be underway in TA-18, TA-54, TA-55 and TA-3 under this alternative, it may be necessary to consider an alternate truck entry point for trucks working on these projects along Pajarito Road at NM 4 to alleviate some of the truck traffic on East Jemez.

Under the proposal to construct a new warehouse on East Jemez Road, a traffic study concluded that the level of service on East Jemez would lead to a breakdown in traffic flow during the afternoon rush hour without changes to the current road (LSC 2005). The study concluded that left turn lanes would be needed, as well as acceleration lanes for east- and west-bound traffic on

East Jemez Road (see Appendix G.9). These concerns would likely be further exacerbated by increased remediation activities under the Expanded Operations Alternative. For example, there would be a substantial increase in truck traffic into and out of the TA-61 borrow pit under the MDA Capping Option. Under this option, an average of about 60 truckloads of fill could be transported daily out of this borrow pit over a 10-year period. Trucks coming in and out of the pit would likely delay traffic flow on East Jemez Road and add to the noise level around this area.

The intersection of Trinity Drive and DP Road is already an area of concern. As discussed in Chapter 4, Section 4.10.2, the New Mexico Department of Transportation is planning improvements to this intersection that would improve the ability of trucks to leave DP Road and turn onto Trinity Drive. Expected increases in traffic during the period that TA-21 is undergoing DD&D and MDAs A, B, T, and U are being remediated would increase the need for these improvements. The concerns about additional trucks entering and leaving DP Road and the affect of increased truck traffic on the local road infrastructure may result in the need for another entry point to TA-21 during periods of heavy activity.

Large increases beyond those discussed under the No Action Alternative also are expected on Pajarito Road; however, usage of this road is much lower than that of other main access points into and out of LANL. Further traffic studies may be needed to determine whether any changes would be required if all of the planned projects progressed on the current schedules set under the Expanded Operations Alternative. Pajarito Road would experience the largest increase in traffic once remediation efforts start at MDA G. It may be necessary to regulate traffic flow at its intersection with NM 4 during peak travel hours under this alternative.

Furthermore, although some of the traffic on Pajarito Road is associated with staff that work in technical areas along Pajarito Road, other traffic is through traffic – for instance, people traveling from White Rock to TA-3 or the Los Alamos townsite. Implementation of the proposed Security-Driven Transportation Modifications to the Pajarito Corridor would occasionally restrict private vehicles from this section of Pajarito Road, and result in increased traffic on other local roads such as the Truck Route (NM 501) and NM 502. Additional traffic information would be needed to fully assess the impacts that the Security Driven Transportation Modification would have on local traffic.

5.11 Environmental Justice

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from normal operations resulting from implementing the alternatives considered in this SWEIS. In assessing the impacts, the following definitions of minority individuals and populations and low-income population were used:

- *Minority individuals:* Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African-American, Native Hawaiian or Other Pacific Islander, or two or more races (meaning individuals who identified themselves on the census form as being a member of two or more races, such as both Hispanic and Asian).

- *Minority populations*: Minority populations are identified where either: (1) the minority population of the affected area exceeds 50 percent, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

- *Low-income population*: Low-income populations in an affected area are identified using the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

Consistent with the impact analysis for the public and occupational health and safety, the affected populations are defined as those minority and low-income populations that reside within a 50-mile (80-kilometer) radius centered on the LANL LANSCE Facilities at TA-53 and the High Explosives Testing Sites at TA-36 (see **Table 5–55**). A 50-mile (80-kilometer) radius was chosen because impacts are not typically significant beyond 50 miles (80 kilometers). If it is determined that impacts could be significant beyond a 50-mile (80-kilometer) radius, additional analysis would be performed. In the case of this LANL SWEIS, it was determined that impacts beyond a 50-mile (80-kilometer) radius were not expected to be significant. For example, projected radiation doses drop dramatically with increasing distance from the source. For LANL, the highest projected dose to the public would be to persons residing north-northeast of LANSCE as discussed in Section 5.6.1. Under this scenario, individuals residing 0.5 miles (0.8 kilometers) from LANSCE would receive a dose of approximately 7.5 millirem annually while those residing 50 miles (80 kilometers) away in the same direction would receive a dose of 0.035 millirem annually. For additional information on the analysis of impacts beyond a 50-mile (80-kilometer) radius see Appendix C, Section C.1.3.3.

Table 5–55 Potentially Affected Populations

Source Location	*Total Population*	*Total Minority Population*	*Hispanic Population*	*American Indian Population*	*Low-Income Population*
TA-53	283,766	155,261	127,641	17,811	35,826
TA-36	375,495	185,474	151,110	21,263	39,206

Based on the analysis of impacts for other resource areas, NNSA expects no high and adverse impacts from the continued operation of LANL under any of the alternatives. NNSA also analyzed the potential risk due to radiological exposure through the consumption patterns of special pathways receptors, including subsistence consumption of native vegetation (pinyon nuts and Indian Tea [Cota]), locally grown produce and farm products, groundwater, surface water, fish (game and nongame), game animals, other foodstuffs, and incidental consumption of soils and sediments (on produce, in surface water, and ingestion of inhaled dust); absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathways receptors analysis is important to the environmental justice analysis because this consumption pattern may reflect the traditional or cultural practices of members of minority populations in the area. See Section 5.6.1.1 and Appendix C, Section C.1.4 for more information on special pathways receptors.

Subsistence Consumption of Fish and Wildlife

Section 4–4 of Executive Order 12898 directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that Federal governments communicate to the public the risks of these consumption patterns." In the *1999 SWEIS*, DOE considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors. Consideration of special pathways took into account the levels of contaminants in native vegetation (pinyon nuts and Indian Tea [Cota]), locally grown produce and farm products, groundwater, surface water, fish (game and nongame), game animals (including organ meats), and soils and sediments on or near LANL (DOE 1999a).

Based on recent monitoring results, concentrations of contaminants in native vegetation, produce, surface water, fish, game animals, other foodstuffs, soils and sediments in areas surrounding LANL have been quite low (at or near the threshold of detection) and seldom above background levels (see Appendix C, Section C.1.4). For a person whose diet and lifestyle reflect all of the special pathways considered, his or her annual dose would be expected to increase by between 4.5 millirem (0.0045 rem) and 10.7 millirem (0.0107 rem) annually. Using a risk estimator value of 0.0006 lifetime probability of fatal cancer per person-rem, an increased dose of between 4.5 millirem (0.0045 rem) and 10.7 millirem (0.0107 rem) per year would equate to an increased annual risk of developing a fatal cancer of between 1 in 370,000 (2.7×10^{-6}) and 1 in 156,000 (6.4×10^{-6}). By comparison, the average resident of New Mexico receives a dose of approximately 400 millirem (0.4 rem) per year from background sources. Therefore, for those individuals participating in all of the special pathways, their average annual dose and risk of developing a fatal cancer would increase by approximately 1.1 to 2.7 percent due to these special pathways.

Ingestion pathway calculations focused on concentrations of radionuclides in environmental media from natural background sources, weapons testing fallout, and previous radiological releases from LANL, as reported in LANL environmental surveillance reports for 2001 through 2004. The actual contribution from recent operations at LANL is only a small fraction of this value. The overall risk to the special pathway receptor would not differ among the alternatives considered in this new SWEIS because most of the risk would be attributed to the existing low levels of radiological contamination in water and soils in the area around LANL. Consequently, no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of fish and wildlife.

5.11.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

There would be no disproportionately high and adverse environmental impacts on minority and low-income populations due to construction activities at LANL under the No Action Alternative. This conclusion is a result of investigations in this SWEIS that determined there were no

significant impacts on human health, ecological, cultural, paleontological, socioeconomic, and other resource areas described in other subsections of this chapter.

Under the No Action Alternative, all current nuclear production operations would be conducted in existing or replacement facilities at LANL and no new nuclear operations would be conducted. As discussed in Sections 5.6.1 and 5.6.2, radiological and hazardous chemical risks to the public resulting from normal operations would be small and are not considered significant. In summary, implementation of the No Action Alternative would pose no disproportionately high and adverse health and safety risks to low-income or minority populations living in the potentially affected area surrounding LANL.

As shown in Table 5–18, the total population within 50 miles (80 kilometers) of LANL for the No Action Alternative is projected to receive an annual dose of about 30 person-rem. Because the majority of this dose results from operations at LANSCE, the environmental justice analysis for this alternative uses the 50-mile (80-kilometer) population centered on LANSCE in TA-53. As shown in **Table 5–56**, the dose from LANSCE along with the dose associated with High-Explosive Testing firing site operations ascribed to TA-36 would result in an annual dose of approximately 29.2 person-rem to the affected population and an average annual individual dose of 0.10 millirem. These two locations account for approximately 97 percent of the total estimated dose from all sites at LANL under the No Action Alternative.

Table 5–56 Comparison of Total Minority, Hispanic, American Indian and Low-Income Population and Average Individual Doses Under the No Action Alternative [a]

	Annual Dose in Person-rem	***Annual Dose in Millirem***
Total Population [b]	29.2	
Average Individual		0.10
White (non-Hispanic) Population	15.0	
Non-Minority Average Individual		0.11
Total Minority Population	14.1	
Minority Average Individual		0.088
Hispanic Population [c]	11.3	
Hispanic Average Individual		0.086
American Indian Population [d]	1.8	
American Indian Average Individual		0.092
Non-Low-Income Population	25.9	
Non-Low-Income Average Individual		0.10
Low-Income Population	3.0	
Low-Income Average Individual		0.082

[a] The total population dose displayed in this table, accounts for the estimated dose from LANSCE at TA-53 and the High-Explosive Testing firing site operations at TA-36 for the No Action Alternative.

[b] The total population dose for this environmental justice analysis differs by 3 percent from that in Table 5–18. This difference is due to different models used to estimate the populations; both estimates are based on data drawn from the 2000 decennial census. The SECPOP computer program used for the analysis for Table 5–18 does not allow for the identification of minority and low-income populations. Therefore an alternate method that uses a more refined distribution of the population is used for this analysis. The minor differences do not affect the conclusions supported by the analyses.

[c] The Hispanic population includes all Hispanic persons regardless of race.

[d] The American Indian population may include persons who also indicated that they were of Hispanic ethnicity in the 2000 census.

Similar population doses are estimated for the following populations: white (non-Hispanic), all (total) minorities, American Indians, and Hispanic of any race. The white (non-Hispanic) population would be expected to receive the largest annual collective dose (15 person-rem) and annual average individual dose (0.11 millirem). This compares to a total minority annual collective dose of 14.1 person-rem and an average annual dose of 0.088 millirem to a member of the minority population. American Indians living within 50 miles (80 kilometers) of LANL would receive a collective dose of 1.8 person-rem annually and an average annual individual dose of 0.092 millirem. The Hispanic population would receive a collective dose of 11.3 person-rem annually; the annual average dose to a member of the Hispanic population would be 0.086 millirem.

Population doses to persons living below the poverty level are also analyzed in Table 5–56. Low-income populations surrounding LANL would receive an annual dose of 3.0 person-rem and an annual average individual dose of 0.082 millirem. Persons living above the poverty level would receive an annual collective dose of 25.9 person-rem and an annual average individual dose of 0.10 millirem. These data show that the total minority, American Indian, Hispanic, and low-income populations would not be subjected to disproportionately high and adverse dose impacts from normal operations at LANL under the No Action Alternative.

As shown in Table 5–17, the MEI for the No Action Alternative is projected to receive a dose of 7.8 millirem (0.0078 rem). As explained in Chapter 4, Section 4.6.1.2, the offsite MEI is a hypothetical member of the public who would receive the largest dose from LANL operations. For this SWEIS, that person would be located at LANL's East Gate along NM 502. Since no one actually resides at this location, the MEI dose is considered a conservative estimate with all members of the public expected to receive a dose that would be smaller than the estimated MEI dose. Therefore, doses to members of minority or low-income populations would not be considered significant because the dose to the MEI under this Alternative is not considered significant. As discussed earlier in Section 5.11, the average resident of New Mexico receives a dose of approximately 400 millirem (0.4 rem) per year from background sources. Therefore, for any individual under the No Action Alternative, his or her average annual dose and risk of developing a fatal cancer from the dose received would be expected to increase by a maximum of approximately 2.0 percent as a result of LANL operations.

As discussed in Section 5.6.2.1, the maximum public risk of developing a cancer as a result of chemical releases under the No Action Alternative would be below the guideline value of 1 in a million (1.0×10^{-6}) for the major carcinogenic pollutants that could be released from LANL under normal operations. In other words, one person in a population of a million would develop cancer if this population were exposed to this concentration over a lifetime, a level of concern established in the Clean Air Act. Therefore, the impact of potential chemical releases on minority or low-income individuals under this alternative would not be considered significant.

For nonradiological air quality impacts, as shown in Table 5–8, the concentrations of criteria pollutants as a result of LANL operations under the No Action 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.

As shown in Table 5–62, the accident with the highest risk to the offsite MEI is a lightning strike at the Radioassay and Nondestructive Testing Facility in TA-54 that leads to a catastrophic fire. This accident represents the highest risk to an offsite MEI for all alternatives under consideration including the No Action Alternative. Under this accident scenario, the risk to the MEI of developing a fatal cancer as a result of radiation exposure from this accident is conservatively estimated to be 1 chance in 17 per year (0.06). For this accident, the MEI would be at the site boundary on the San Ildefonso Pueblo; however, the likelihood of an individual being at this location at the time of the accident would be highly unlikely since no one resides in the area adjacent to LANL. The accident with the highest risk to the offsite public for all alternatives under consideration, shown in Table 5–78, is a wildfire that would consume the waste storage domes in TA-54. Under this accident, the risk to the public is estimated to be 3 (2.7) latent cancer fatalities in the general public. Given the proximity of the more heavily populated areas of Los Alamos and White Rock to TA-54, these areas would be the most heavily impacted in the event of such an accident. Since neither of these is a minority or low-income community, this accident would not have a disproportionate high and adverse impact on low income or minority populations. For more information on the demographics of Los Alamos County, see Chapter 4, Section 4.8.1.2.

Key Facilities Impacts

Routine normal operations at Key Facilities would not be expected to cause fatalities or illness among the general population, including minority and low-income populations living within the potentially affected area.

The annual radiological risks to the offsite population that could result from the maximum potential accident at a Key Facility is estimated to be smaller than 0.76 LCFs (see Table 5–62). Thus, the risk of an excess LCF in the entire offsite population would be less than 1 under the No Action Alternative.

5.11.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Implementation of the Reduced Operations Alternative would pose no disproportionately high and adverse health and safety risks to low-income or minority populations living in the potentially affected area surrounding LANL. Under the Reduced Operations Alternative, the risks of disproportionately high and adverse environmental impacts on minority and low-income populations in the vicinity of LANL would be no higher than those described under the No Action Alternative; in some cases, they would be lower.

As shown in Table 5–18, the total population within 50 miles (80 kilometers) of LANL for the Reduced Operations Alternative is projected to receive an annual dose of about 6.4 person-rem. Because the majority of this dose results from operations at the High Explosive Testing firing sites in TA-36, the environmental justice analysis for this alternative uses the 50-mile (80-kilometer) population centered on TA-36. As shown in **Table 5–57**, the dose from High Explosive Testing would result in an annual dose of approximately 4.9 person-rem to the affected population and an average annual individual dose of 0.013 millirem. The High Explosive

Testing firing site operations account for approximately 77 percent of the total estimated dose from all sites at LANL under the Reduced Operations Alternative.

Table 5–57 Comparison of Total Minority, Hispanic, American Indian and Low-Income Population and Average Individual Doses Under the Reduced Operations Alternative [a]

	Annual Dose in Person-rem	*Annual Dose in Millirem*
Total Population [b]	4.9	
Average Individual		0.013
White (non-Hispanic) Population	2.7	
Non-Minority Average Individual		0.014
Total Minority Population	2.2	
Minority Average Individual		0.012
Hispanic Population [c]	1.9	
Hispanic Average Individual		0.012
American Indian Population [d]	0.20	
American Indian Average Individual		0.0094
Non-Low-Income Population	4.4	
Non-Low-Income Average Individual		0.013
Low-Income Population	0.44	
Low-Income Average Individual		0.011

[a] The collective population dose displayed in this table, accounts for the estimated dose from the High Explosive Testing firing site operations at TA-36 for the Reduced Operations Alternative.

[b] The collective population doses for this environmental justice analysis differs by 6 percent from that in Table 5–18. This difference is due to different models used to estimate the populations; both estimates are based on data drawn from the 2000 decennial census. The SECPOP computer program used for the analysis for Table 5–18 does not allow for the identification of minority and low-income populations. Therefore an alternate method that uses a more refined distribution of the population is used for this analysis. The minor differences do not affect the conclusions supported by the analyses.

[c] The total Hispanic population includes all Hispanic persons regardless of race.

[d] The American Indian population may include persons who also indicated that they were of Hispanic ethnicity in the 2000 census.

The white (non-Hispanic) population would be expected to receive the largest annual collective dose (2.7 person-rem) and annual average individual dose (0.014 millirem). This compares to a total minority annual collective dose of 2.2 person-rem and an average annual dose of 0.012 millirem to a member of the minority population. American Indians living within 50 miles (80 kilometers) of LANL would receive a collective dose of 0.20 person-rem annually and an annual average individual dose of 0.0094 millirem. The Hispanic population would receive a collective dose of 1.9 person-rem annually; the annual average dose to a member of the Hispanic population would be 0.012 millirem.

Population doses to persons living below the poverty level are also presented in Table 5–57. Low-income populations surrounding LANL would receive an annual dose of 0.44 person-rem and an average annual individual dose of 0.011 millirem. Persons living above the poverty level would receive an annual collective dose of 4.4 person-rem and an average annual individual dose of 0.013 millirem. These data show that the total minority, American Indian, Hispanic, and low-income populations would not be subjected to disproportionately high and adverse dose impacts from normal operations at LANL under the Reduced Operations Alternative.

As shown in Table 5–17, the MEI for the Reduced Operations Alternative is projected to receive a dose of 0.79 millirem (0.00079 rem), about 10 times smaller than the dose projected for the

MEI under the No Action Alternative. As discussed in Section 5.11.1, doses to members of minority or low-income populations would not be considered significant because the dose to the MEI under the No Action Alternative is not considered significant and this remains true for the Reduced Operations Alternative. As discussed earlier in Section 5.11, the average resident of New Mexico receives a dose of approximately 400 millirem (0.4 rem) per year from background sources. Therefore, for the MEI under the Reduced Operations Alternative, his or her average annual dose and risk of developing a fatal cancer from the dose received would be expected to increase by a maximum of approximately 0.2 percent as a result of LANL operations.

As discussed in Section 5.6.2.2, the maximum public risk of developing a cancer as a result of chemical releases under the Reduced Operations Alternative would be approximately the same as those cited for the No Action Alternative and below the guideline value of 1 in a million (6.4×10^{-6}) for the major carcinogenic pollutants that could be released from LANL under normal operations. In other words, one person in a population of a million would develop cancer if this population were exposed to this concentration over a lifetime, a level of concern established in the Clean Air Act. Therefore, the impact of potential chemical releases on minority or low-income individuals under this alternative would not be considered significant.

For nonradiological air quality impacts, as discussed in Section 5.4.1.2, the concentrations of criteria pollutants as a result of LANL operations under the Reduced Operations Alternative would likely be smaller than those expected under the No Action Alternative and 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.

The impact of potential accidents on the minority or low-income populations under the Reduced Operations Alternative would be the same as those discussed above for the No Action Alternative in Section 5.11.1.

5.11.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Based on the analysis of impacts for other resource areas in this chapter, there would be no high and adverse impacts from continued operation of LANL under the Expanded Operations Alternative. No disproportionately high and adverse environmental impacts on minority or low-income populations would occur due to construction activities at LANL or to the project-specific activities discussed in Appendices G, H, I, and J under this alternative. As stated in other subsections of this chapter, environmental impacts from construction under this alternative would be small and would not be expected to be significant and adverse beyond the LANL site boundary.

No disproportionately high and adverse environmental impacts on minority or low-income populations would occur under this alternative. This conclusion results from analyses presented in this SWEIS that determined there would be no significant impacts on human health, ecological, cultural, paleontological, socioeconomic, and other resource areas described in other subsections of this chapter.

As shown in Table 5–18, the total population within 50 miles (80 kilometers) of LANL for the Expanded Operations Alternative is projected to receive an annual dose of about 36 person-rem. Because the majority of this dose results from operations at LANSCE, the environmental justice analysis for this alternative uses the 50-mile (80-kilometer) population centered on LANSCE in TA-53. As shown in **Table 5–58**, the dose from LANSCE along with the dose associated with High Explosive Testing firing site operations ascribed to TA-36 would result in an annual dose of 29.2 person-rem to the affected population and an average annual individual dose of 0.10 millirem. These two locations account for approximately 81 percent of the total estimated dose from all sites at LANL under the Expanded Operations Alternative.

Table 5–58 Comparison of Total Minority, Hispanic, American Indian and Low-Income Population and Average Individual Doses Under the Expanded Operations Alternative [a]

	Annual Dose in Person-rem	***Annual Dose in Millirem***
Total Population [b]	29.2	
Average Individual		0.10
White (non-Hispanic) Population	15.0	
Non-Minority Average Individual		0.11
Total Minority Population	14.1	
Minority Average Individual		0.088
Hispanic Population [c]	11.3	
Hispanic Average Individual		0.086
American Indian Population [d]	1.8	
American Indian Average Individual		0.092
Non-Low-Income Population	25.9	
Non-Low-Income Average Individual		0.10
Low-Income Population	3.0	
Low-Income Average Individual		0.082

[a] The total population dose displayed in this table, accounts for the estimated dose from LANSCE at TA-53 and the High-Explosive Testing firing site operations at TA-36 for the Expanded Operations Alternative.

[b] The total population dose for this environmental justice analysis differs by 3 percent from that in Table 5–18. This difference is due to different models used to estimate the populations; both estimates are based on data drawn from the 2000 decennial census. The SECPOP computer program used for the analysis for Table 5–18 does not allow for the identification of minority and low-income populations. Therefore an alternate method that uses a more refined distribution of the population is used for this analysis. The minor differences do not affect the conclusions supported by the analyses.

[c] The total Hispanic population includes all Hispanic persons regardless of race.

[d] The American Indian population may include persons who also indicated that they were of Hispanic ethnicity in the 2000 census.

The white (non-Hispanic) population would be expected to receive the largest annual collective dose (15 person-rem) and annual average individual dose (0.11 millirem). This compares to a total minority annual collective dose of 14.1 person-rem and an average annual dose of 0.088 millirem to a member of the minority population. American Indians living within 50 miles (80 kilometers) of LANL would receive a collective dose of 1.8 person-rem annually and an annual average individual dose of 0.092 millirem. The Hispanic population would receive a collective dose of 11.3 person-rem annually; the annual average dose to a member of the Hispanic population would be 0.086 millirem.

Population doses to persons living below the poverty level are also analyzed in Table 5–58. Annually, low-income populations surrounding LANL would receive a collective dose of

3.0 person-rem and an average individual dose of 0.082 millirem. Persons living above the poverty level would receive an annual collective dose of 25.9 person-rem and an annual average individual dose of 0.10 millirem. These data show that the total minority, American Indian, Hispanic, and low-income populations would not be subjected to disproportionately high and adverse dose impacts from normal operations at LANL under the Expanded Operations Alternative.

As discussed in Sections 5.6.1 and 5.6.2, radiological and hazardous chemical risks to the public resulting from normal operations would be small and not considered significant. As shown in Table 5–17, the MEI for the Expanded Operations Alternative is projected to receive a dose of approximately 8.2 millirem (0.00082 rem), about a 5 percent increase in the dose projected for the MEI under the No Action Alternative. This increase in the MEI dose would not be considered significant and therefore doses to members of minority or low-income populations that would be lower than the increase in dose to the MEI would not be considered significant. As discussed earlier in Section 5.11, the average resident of New Mexico receives a dose of approximately 400 millirem (0.4 rem) per year from background sources. Therefore, for the MEI under the Expanded Operations Alternative, his or her average annual dose and risk of developing a fatal cancer from the dose received would be expected to increase by a maximum of approximately 2.1 percent as a result of LANL operations.

As discussed in Section 5.6.2.3, the maximum public risk of developing a cancer as a result of chemical releases under the Expanded Operations Alternative would be approximately the same as those cited for the No Action Alternative with the exception of a small increase in high explosives processing that would not be expected to substantially change the risks. Therefore, the impact of potential chemical releases on minority or low-income individuals under this alternative would not be considered significant.

For nonradiological air quality impacts, as discussed in Section 5.4.1.3, the concentrations of criteria pollutants as a result of LANL operations under the Expanded Operations Alternative would likely be larger than those expected under the No Action Alternative but would remain 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.

The impact of potential accidents on the minority and low-income populations under the Expanded Operations Alternative would be the same as those discussed above for the No Action Alternative in Section 5.11.1.

Key Facilities Impacts

Routine normal operations at Key Facilities would not be expected to cause fatalities or illness among the general population, including minority and low-income populations living within the potentially affected area.

Annual radiological risk to the offsite population that could result from the maximum potential accident at a Key Facility is estimated to be less than 0.76 LCFs (see Table 5–65). Thus, the risk

of an excess LCF in the entire offsite population under the Expanded Operations Alternative would be less than 1.

5.12 Facility Accidents

The estimated impacts of potential accidents are described in this section for the No Action, Reduced Operations, and Expanded Operations Alternatives. A summary of the risks from radiological and chemical operations, potential seismic events, and a potential wildfire is provided in **Table 5–59**. Radiological impacts from facility accidents are addressed in Section 5.12.1. Chemical impacts from facility accidents are addressed in Section 5.12.2. Impacts from postulated earthquake events that could simultaneously affect multiple facilities are addressed in Section 5.12.3. Wildfire, another natural event that can also impact multiple facilities, is addressed in Section 5.12.4. Additional accident analysis details are provided in Appendix D. For all accident scenarios, the noninvolved worker is a hypothetical individual located 110 yards (100 meters) from the site of the accident, the MEI is a hypothetical individual located at the nearest site boundary, and the population includes residents within 50 miles (80 kilometers) of the site of the accident.

Table 5–59 Summary of Worker and Public Radiological Risks and Chemical Consequences from Potential Accidents

Maximum Potential Accident	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Facility Radiological Release		Same as No Action Alternative	Same as No Action Alternative
• Offsite Population (LCF per year)	0.8		
• MEI (LCF per year)	0.06		
• Noninvolved Worker (LCF per year)	0.1		
Facility Chemical Release [a]		Same as No Action Alternative	Same as No Action Alternative
• Concentrations above which life-threatening health effects could result (ERPG-3 [t] limit)	5 parts per million		
• ERPG-3 distance	962 yards		
• Distance to the site boundary	537 yards		
Site-Wide Seismic Event Radiological		Same as No Action Alternative	Same as No Action Alternative
• Offsite Population (LCF per year)	0.009		
• MEI (LCF per year)	0.0003		
• Noninvolved Worker (LCF per year)	0.001		
Site-Wide Seismic Event Chemical [a]		Same as No Action Alternative	Same as No Action Alternative
• Concentrations above which life-threatening health effects could result (ERPG-3 [t] limit)	25 parts per million		
• ERPG-3 distance	122 yards		
• Distance to the site boundary	13 yards		
Wildfire Radiological		Same as No Action Alternative	Same as No Action Alternative
• Offsite Population (LCF per year)	2.7		
• MEI (LCF per year)	0.05		
• Noninvolved Worker (LCF per year)	0.05		
Wildfire Chemical [a]		Same as No Action Alternative	Same as No Action Alternative
• Concentrations above which life-threatening health effects could result (ERPG-3 [t] limit)	25 parts per million		
• ERPG-3 distance	97 yards		
• Distance to the site boundary	13 yards		

LCF = latent cancer fatality, MEI = maximally exposed individual, ERPG = Emergency Response Planning Guideline.

[a] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005e).

Note: To convert yards to meters, multiply by 0.9144.

5.12.1 Facility Radiological Impacts

Estimated radiological accident consequences and risks associated with the No Action, Reduced, and Expanded Alternatives are shown in Tables 5–60 through 5–65.

5.12.1.1 No Action Alternative

The accident with the highest estimated consequences to the offsite population, as shown in **Table 5–60**, is a lightning strike fire at the Radioassay and Nondestructive Testing Facility.[6] If this accident were to occur, there could be 6 additional LCFs in the offsite population. The accident with the highest estimated consequences to the MEI and a noninvolved worker is a waste storage dome fire at TA-54 as shown in Tables 5–60 and **5–61**. If this accident were to occur as modeled, the noninvolved worker and the MEI would receive large radiation doses. Depending on the specific radionuclides released and the route of human exposure, radiation doses of this magnitude would result in near-term health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose to the exposed individual, mitigating health impacts, or both. In addition to the conservative assumptions used to develop the source term (amount of radioactive material released) for this accident, the calculated doses are based on the assumptions that no protective action is taken during the entire time of exposure and that no subsequent medical intervention occurs. The MEI for all of the scenarios is located at the nearest site boundary.

The potential exists for exposures in excess of the above in the vicinity of the Chemistry and Metallurgy Research Building because of public access to Diamond Drive, which is approximately 50 meters from the building. The Chemistry and Metallurgy Building is expected to be operational until transition to the Chemistry and Metallurgy Research Replacement Facility is completed. The consequences to an individual at this Diamond Drive location during the HEPA Filter Fire would be 8.1 rem, resulting in an increased individual LCF risk of 0.0049 (approximately 1 in 210). Appendix D, Section D.3.2.1, contains further discussion of the Chemistry and Metallurgy Research Building exposures.

After accounting for the frequency of the postulated accidents (see Appendix D), the estimated highest risk accident would be a Radioassay and Nondestructive Testing Facility lightning strike fire (TA-54-38). **Table 5–62** shows the annual risk of an increased likelihood of an LCF for this accident to be 0.059 (about 1 in 17 years) for the MEI. The offsite population annual risk of additional LCFs is estimated to be 0.76 for an LCF in any one member of the total offsite population. Table 5–62 shows the annual risk of an increased likelihood of an LCF for this accident to be 0.12 (about 1 in 8 years) for a noninvolved worker.

[6] *The lightning fire accident scenario conservatively assumes that any lightning striking the Radioassay and Nondestructive Testing Facility would result in a fire that affects and releases radioactive material located inside the facility regardless of the lightning energy or the specific location at the facility subject to the lightning strike.*

Table 5–60 Radiological Accident Offsite Population Consequences for the No Action and Reduced Operations Alternatives

Accident Scenario	Maximally Exposed Individual		Population to 50 Miles (80 kilometers)	
	Dose [a] (rem)	Latent Cancer Fatality [b]	Dose (person-rem)	Latent Cancer Fatalities [c, d]
Radioassay and Nondestructive Testing Facility Lightning Strike Fire (TA-54-38)	410	0.49	11,000	6 (6.3)
Weapons Engineering Tritium Facility Fire (TA-16-205)	5.9	0.0036	190	0 (0.11)
Waste Characterization, Reduction, and Repackaging Facility Lightning Strike Fire (TA-50-69)	46	0.055	4,800	3 (2.9)
Waste Storage Dome Fire (TA-54)	420	0.50	4,200	3 (2.5)
Onsite Transuranic Waste Fire (TA-54)	190	0.22	5,700	3 (3.4)
Plutonium Facility Material Staging Area Fire (TA-55-4)	73	0.087	9,000	5 (5.4)
Decontamination and Volume Reduction System Operational Spill (TA-54-412)	20	0.012	190	0 (0.11)
Decontamination and Volume Reduction System Building Fire and Spill due to Forklift Collision (TA-54-412)	320	0.39	6,100	4 (3.7)
SHEBA Hydrogen Detonation (TA-18-168) [e]	0.88	0.00053	69	0 (0.041)
Chemistry and Metallurgy Research Building HEPA Filter Fire (TA-3-29)	0.77	0.00046	200	0 (0.12)

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, HEPA = high-efficiency particulate air (filter).

[a] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[b] Increased risk of an LCF to an individual, assuming the accident occurs.

[c] Increased number of LCFs for the offsite population, assuming the accident occurs; value in parentheses is the calculated result.

[d] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, TA-54-412, Domes), 301,900 (TA-55-4).

[e] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations Alternative.

Table 5–61 Radiological Accident Onsite Worker Consequences for the No Action and Reduced Operations Alternatives

Accident Scenario	Noninvolved Worker at 110 Yards (100 meters)	
	Dose [a] (rem)	Latent Cancer Fatality [b]
Radioassay and Nondestructive Testing Facility Lightning Strike Fire (TA-54-38)	1,900	1.0 [c]
Weapons Engineering Tritium Facility Fire (TA-16-205)	8.92	0.00535
Waste Characterization, Reduction, and Repackaging Facility Lightning Strike Fire (TA-50-69)	1,100	1.0 [c]
Waste Storage Dome Fire (TA-54)	2,000	1.0 [c]
Onsite Transuranic Waste Fire (TA-54)	760	0.91
Plutonium Facility Material Staging Area Fire (TA-55-4)	1,600	1.0 [c]
Decontamination and Volume Reduction System Operational Spill (TA-54-412)	51	0.062
Decontamination and Volume Reduction System Building Fire and Spill due to Forklift Collision (TA-54-412)	890	1.0 [c]

Accident Scenario	Noninvolved Worker at 110 Yards (100 meters)	
	Dose [a] (rem)	Latent Cancer Fatality [b]
SHEBA Hydrogen Detonation (TA-18-168) [d]	15	0.0092
Chemistry and Metallurgy Research Building HEPA Filter Fire (TA-3-29)	5.4	0.0032

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, HEPA = high-efficiency particulate air (filter).

[a] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[b] Increased risk of an LCF to an individual, assuming the accident occurs.

[c] The indicated dose yields a risk value greater than 1.0. This means that it is likely that an individual exposed to the indicated dose would develop a latent fatal cancer. For this reason, a value of 1.0 is shown.

[d] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations Alternative.

Table 5–62 Radiological Accident Offsite Population and Worker Risks for the No Action and Reduced Operations Alternatives

Accident Scenario	Frequency (per year)	Onsite Worker	Offsite Population	
		Noninvolved Worker at 110 Yards (100 meters) [a]	Maximally Exposed Individual [a]	Population to 50 Miles (80 kilometers) [b, c]
Radioassay and Nondestructive Testing Facility Lightning Strike Fire (TA-54-38)	0.12 [d]	0.12	0.059	0.76
Weapons Engineering Tritium Facility Fire (TA-16-205)	1.1×10^{-5}	5.9×10^{-8}	4.0×10^{-8}	1.3×10^{-6}
Waste Characterization, Reduction, and Repackaging Facility Lightning Strike Fire (TA-50-69)	0.14 [d]	0.14	0.0077	0.4
Waste Storage Dome Fire (TA-54)	0.001	0.001	0.0005	0.0025
Onsite Transuranic Waste Fire (TA-54)	0.001	0.00091	0.00022	0.0034
Plutonium Facility Material Staging Area Fire (TA-55-4)	0.01	0.01	0.00087	0.054
Decontamination and Volume Reduction System Operational Spill (TA-54-412)	0.02	0.0012	0.00024	0.0022
Decontamination and Volume Reduction System Building Fire and Spill due to Forklift Collision (TA-54-412)	0.001	0.001	0.00039	0.0037
SHEBA Hydrogen Detonation (TA-18-168) [e]	0.0054	0.00005	2.8×10^{-6}	0.00022
Chemistry and Metallurgy Research Building HEPA Filter Fire (TA-3-29)	0.01	0.000032	4.6×10^{-6}	0.0012

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, HEPA = high-efficiency particulate air (filter).

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4).

[d] The lightning strike fire accident scenarios conservatively assumes that any lightning strike on the facility would result in a source term equivalent to a structure fire.

[e] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations Alternative.

5.12.1.2 Reduced Operations Alternative

The accident impacts from the Reduced Operations Alternative are the same as those from the No Action Alternative and are presented in Tables 5-60 through 5-62. Activities at TA-18, including operation of SHEBA, would cease under this alternative. Inspection of the tables shows that SHEBA operations are a small component of the facility impacts at LANL; its elimination would not significantly alter the overall risk profile of individual facility operations. All other impacts in the tables are equally applicable for this alternative.

5.12.1.3 Expanded Operations Alternative

Accident impacts under the Expanded Operations Alternative are shown in **Tables 5–63** through **5–65**. SHEBA operations would cease under the Expanded Operations Alternative, so its impacts, although relatively small, have been eliminated from the tables below. Additional or replacement risks from accident impacts would result from expanded waste management activities. Transuranic waste storage would be consolidated in a new facility, the TRU Waste Facility located in TA-50 or a generic site along the Pajarito Road corridor. The impacts from this new facility would be smaller than those of the existing facilities because of its new location and because less material would be stored and the rest would be moved offsite. The entries in Tables 5–63 through 5–65 reflect present Decontamination and Volume Reduction System and waste storage domes operations because they would bound the impacts of the new facility. Accident impacts for the new facility are described in Appendix H.

MDA cleanup is a component of the Expanded Operations Alternative. A number of scenarios were considered for this activity and an explosion or fire during removal operations that breaches the MDA enclosure and bypasses the HEPA filtration was chosen. MDA G, because of its relatively large inventory, bounds the accident impacts from MDA removal. The consequences and risks from this scenario are included in Tables 5–63 through 5–65. As with the No Action Alternative, TA-54 operations generally dominate the accident risks from Expanded Operations. Possible removal of MDA G in TA-54 adds a component to this risk. Appendix I includes more details about MDA cleanup accident impacts.

The accident with the largest consequences to the offsite population is a fire at Chemistry and Metallurgy Research Building involving sealed sources, as shown in Table 5–63. If this accident were to occur, there could be 7 additional LCFs in the offsite population. The accident with the highest consequences to the MEI and the noninvolved worker is a waste storage dome fire at TA-54.

The potential exists for exposures in excess of those above at the Chemistry and Metallurgy Research Building because of public access to Diamond Drive, approximately 50 meters from the facility. The Chemistry and Metallurgy Research Building is expected to be operational until the transition to the Chemistry and Metallurgy Research Replacement Facility is completed. The consequences to an individual at this Diamond Drive location during a fire impacting sealed sources (applicable to only the Expanded Operations Alternative) or a HEPA filter fire would be 4.3 rem and 8.1 rem, respectively. These doses would result in an increased risk of a latent fatal cancer during the lifetime of the individual of 0.0026 (approximately 1 in 390) and 0.0049

(approximately 1 chance in 210), respectively. Appendix D, Section D.3.2.1, contains further discussion of the Chemistry and Metallurgy Research Building exposures.

Table 5–63 Radiological Accident Offsite Population Consequences for the Expanded Operations Alternative

Accident Scenario	*Maximally Exposed Individual*		*Population to 50 Miles (80 kilometers)*	
	Dose [a] *(rem)*	*LCF* [b]	*Dose (person-rem)*	*LCF* [c, d]
Radioassay and Nondestructive Testing Facility Lightning Strike Fire (TA-54-38)	410	0.49	11,000	6 (6.3)
Weapons Engineering Tritium Facility Fire (TA-16-205)	5.9	0.0036	190	0 (0.11)
Waste Characterization, Reduction, and Repackaging Facility Lightning Strike Fire (TA-50-69)	46	0.055	4,800	3 (2.9)
Waste Storage Dome Fire (TA-54)	420	0.50	4,200	3 (2.5)
Onsite Transuranic Waste Fire (TA-54)	190	0.22	5,700	3 (3.4)
Plutonium Facility Material Staging Area Fire (TA-55-4)	73	0.087	9,000	5 (5.4)
Decontamination and Volume Reduction System Operational Spill (TA-54-412)	20	0.012	190	0 (0.11)
Explosion at Material Disposal Area G (TA-54)	55	0.066	770	0 (0.46)
Decontamination and Volume Reduction System Building Fire and Spill due to Forklift Collision (TA-54-412)	320	0.39	6,100	4 (3.7)
Chemistry and Metallurgy Research Building Fire Involving Sealed Sources (TA-3-29)	0.099	0.000059	12,000	7 (7.0)
Chemistry and Metallurgy Research Building HEPA Filter Fire (TA-3-29)	0.77	0.00046	200	0 (0.12)

LCF = latent cancer fatality, TA = technical area, HEPA = high-efficiency particulate air (filter).

[a] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[b] Increased risk of an LCF to an individual, assuming the accident occurs.

[c] Increased number of LCFs for the offsite population, assuming the accident occurs; value in parentheses is the calculated result.

[d] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4).

After accounting for the frequency of the postulated accidents, the estimated highest risk accident would be a Radioassay and Nondestructive Testing Facility lightning strike fire (TA-54-38). Table 5–65 shows the annual risk of an increased likelihood of an LCF for this accident to be 0.059 (about 1 in 17 years) for the MEI. The offsite population annual risk of additional LCFs is shown to be 0.76 for any one member of the offsite population. Table 5–65 shows the annual risk of an increased likelihood of an LCF for this accident to be 0.12 (about 1 chance in 8 years) for a noninvolved worker.

Table 5–64 Radiological Accident Onsite Worker Consequences for the Expanded Operations Alternative

Accident Scenario	Noninvolved Worker at 110 Yards (100 meters)	
	Dose (rem) [a]	LCF [b]
Radioassay and Nondestructive Testing Facility Lightning Strike Fire (TA-54-38)	1,900	1.0 [c]
Weapons Engineering Tritium Facility Fire (TA-16-205)	8.9	0.0054
Waste Characterization, Reduction, and Repackaging Facility Lightning Strike Fire (TA-50-69)	1,100	1.0 [c]
Waste Storage Dome Fire (TA-54)	2,000	1.0 [c]
Onsite Transuranic Waste Fire (TA-54)	760	0.91
Plutonium Facility Material Staging Area Fire (TA-55-4)	1,600	1.0 [c]
Decontamination and Volume Reduction System Operational Spill (TA-54-412)	51	0.062
Explosion at Material Disposal Area G (TA-54)	410	0.49
Decontamination and Volume Reduction System Building Fire and Spill due to Forklift Collision (TA-54-412)	890	1.0 [c]
Chemistry and Metallurgy Research Building Fire Involving Sealed Sources (TA-3-29)	1.2	0.00073
Chemistry and Metallurgy Research Building HEPA Filter Fire (TA-3-29)	5.4	0.0032

LCF = latent cancer fatality, TA = technical area, HEPA = high-efficiency particulate air (filter).

[a] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[b] Increased risk of an LCF to an individual, assuming the accident occurs.

[c] The indicated dose yields a risk value greater than 1.0. This means that it is likely that an individual exposed to the indicated dose would develop a fatal latent cancer. For this reason, a value of 1.0 is shown.

Table 5–65 Radiological Accident Offsite Population and Worker Risks for the Expanded Operations Alternative

Accident Scenario	Frequency (per year)	Risk to Onsite Worker	Offsite Population	
		Noninvolved Worker at 110 Yards (100 meters) [a]	Maximally Exposed Individual [a]	Population to 50 Miles (80 kilometers) [b, c]
Radioassay and Nondestructive Testing Facility Lightning Strike Fire (TA-54-38)	0.12 [d]	0.12	0.059	0.76
Weapons Engineering Tritium Facility Fire (TA-16-205)	1.1×10^{-5}	6.0×10^{-8}	4.0×10^{-8}	1.3×10^{-6}
Waste Characterization, Reduction, and Repackaging Facility Lightning Strike Fire (TA-50-69)	0.14 [d]	0.14	0.0077	0.4
Waste Storage Dome Fire (TA-54)	0.001	0.001	0.0005	0.0025
Onsite Transuranic Waste Fire (TA-54)	0.001	0.00091	0.00022	0.0034
Plutonium Facility Material Staging Area Fire (TA-55-4)	0.01	0.01	0.00087	0.054
Decontamination and Volume Reduction System Operational Spill (TA-54-412)	0.02	0.0012	0.00024	0.0022
Explosion at Material Disposal Area G (TA-54)	0.01	0.0049	0.00066	0.0046
Decontamination and Volume Reduction System Building Fire and Spill due to Forklift Collision (TA-54-412)	0.001	0.001	0.00039	0.0037
Chemistry and Metallurgy Research Building Fire Involving Sealed Sources (TA-3-29)	0.00024	1.7×10^{-7}	1.4×10^{-8}	0.0017

Accident Scenario	Frequency (per year)	Risk to Onsite Worker	Offsite Population	
		Noninvolved Worker at 110 Yards (100 meters) [a]	Maximally Exposed Individual [a]	Population to 50 Miles (80 kilometers) [b, c]
Chemistry and Metallurgy Research Building HEPA Filter Fire (TA-3-29)	0.01	0.000032	4.6×10^{-6}	0.0012

TA = technical area, HEPA = high-efficiency particulate air (filter).

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4).

[d] The lightning strike fire accident scenarios conservatively assumes that any lightning strike on the facility would result in a source term equivalent to a structure fire.

5.12.2 Facility Hazardous Chemical Impacts

5.12.2.1 No Action Alternative

The chemicals of concern at LANL facilities under the No Action Alternative are shown in **Table 5–66**. They were selected from a database of chemicals used onsite based on their quantities, chemical properties, and human health effects. The table shows the Emergency Response Planning Guideline (ERPG) values. ERPG-2 and ERPG-3 values are the concentrations that, if an accident were to occur, could result in serious health effects or life-threatening implications for exposed individuals.

Table 5–66 also shows the risk of worker and public exposure in the event of a chemical release from site-wide events only (seismic- and wildfire-related releases are discussed in their respective sections). The cause of a chemical release could be mechanical failure, corrosion, mechanical impact, or natural phenomena. The estimated frequency of each accident is shown in the table. The direction traveled by the chemical plume, which would depend on meteorological conditions at the time of the accident, would determine what segment of the worker and offsite populations would be at risk of exposure.

For selenium hexafluoride located at TA-54-216, there is an annual risk of 0.0041 (1 in 240 years) that workers and the public within a distance of 962 yards (880 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers and the public within a distance of 3,062 yards (2,800 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

For sulfur dioxide located at TA-54-216, there is an annual risk of 0.00051 (1 in 1,950 years) that workers and the public within a distance of 755 yards (690 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers and the public within a distance of 1,804 yards (1,650 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

Table 5–66 Chemical Accident Risks under the No Action and Reduced Operations Alternatives

Chemical	Frequency (per year)	Quantity Released	ERPG-2 [a]		ERPG-3 [b]	
			Value (ppm)	Annual Risk	Value (ppm)	Annual Risk
Selenium hexafluoride from waste cylinder storage at TA-54-216	0.0041	19.8 gallons (75 liters)	0.6 [c]	1 chance in 240 years of workers or public within 3,062 yards (2,800 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).	5 [c]	1 chance in 240 years of workers or public within 962 yards (880 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Sulfur dioxide from waste cylinder storage at TA-54-216	0.00051	300 pounds (136 kilograms)	3	1 chance in 1,950 years of workers or public within 1,804 yards (1,650 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).	15	1 chance in 1,950 years of workers or public within 755 yards (690 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Chlorine gas released outside of Plutonium Facility Complex (TA-55-4)	0.063	150 pounds (68 kilograms)	3	1 chance in 15 years of workers within 1,181 yards (1,080 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).	20	1 chance in 15 years of workers within 416 yards (380 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).
Helium at TA-55-41	0.063	9,230,000 cubic feet (at STP) (261,366 cubic meters)	280,000 ppm [c]	1 chance in 15 years of workers within 203 yards (186 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,146 yards (1,048 meters).	500,000 ppm [c]	1 chance in 15 years of workers within 152 yards (139 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,146 yards (1,048 meters).

ERPG = Emergency Response Planning Guideline, ppm = parts per million, TA = technical area, STP = standard temperature and pressure.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005e).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005e).

[c] The Temporary Emergency Exposure Limit value is used. ERPGs have not been issued for this substance.

For chlorine gas located outside of TA-55-4, there is an annual risk of 0.063 (1 in 15 years) that workers within a distance of 416 yards (380 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. Workers and the public within a distance of 1,181 yards (1,080 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

For helium gas located at TA-55-41, there is an annual risk of 0.063 (1 in 15 years) that workers within 152 yards (139 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. Workers within a distance of 203 yards (186 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

5.12.2.2 Reduced Operations Alternative

The chemicals of concern that could be released in a facility accident are the same for the Reduced Operations Alternative as for the No Action Alternative. None of the chemicals identified for the latter is eliminated in this alternative. The information in Table 5–66, therefore, also applies to the Reduced Operations Alternative.

5.12.2.3 Expanded Operations Alternative

The chemicals of concern that could be released in a facility accident for the No Action Alternative apply equally to the Expanded Operations Alternative. In addition, MDA cleanup, a component of the Expanded Operations Alternative, also includes a potential for accidental releases of toxic chemicals. A fire during removal operations that breaches any MDA enclosure and bypasses the HEPA filtration was chosen for analysis. There is a great deal of uncertainty regarding how much and which chemicals were disposed of in the MDAs. For the most conservative analysis, MDA B, the MDA closest to the public (and thus with the potential for the greatest impact on the public), was chosen to represent the chemical accident impacts of MDA cleanup. Two chemicals, sulfur dioxide (a gas) and beryllium (assumed to be in powder form), were chosen based on their restrictive ERPG values to bound the impacts of an extensive list of possible chemicals disposed of in the MDAs. **Table 5–67** shows, if present in MDA B in the quantities assumed, both of these chemicals would dissipate to below the ERPG-3 value very close to the release, but would continue to be a risk to the public due to the short distance to the nearest public access point for this MDA. Appendix I includes more details about MDA cleanup chemical accident impacts.

5.12.3 Site-Wide Seismic Impacts

As addressed in more detail in Appendix D, Section D.4, two site-wide seismic events, referred to as Seismic 1 and Seismic 2, were postulated to estimate the potential effects of radiological and chemical releases during an earthquake. In the event of a site-wide seismic event, radiological and chemical hazardous materials could be simultaneously released. Seismic events are categorized by their performance category (PC), which is numbered from PC-0 through PC-4. A higher performance category has a smaller annual frequency of occurrence, but a larger associated ground acceleration. A higher performance category has more severe consequences and structures would require a more resilient engineering design to survive.

The seismic accident scenarios (Seismic 1 and 2) analyzed in the SWEIS were based on the February 24, 1995, *Seismic Hazards Evaluation of the Los Alamos National Laboratory*. Seismic 1 – the seismic event characterized by a peak horizontal ground acceleration of 0.22g (0.22 times the acceleration due to gravity) – had an estimated annual probability of exceedance of 0.001 (1 in 1,000). Seismic 2 – a more severe seismic event characterized by a peak ground acceleration of 0.31g – had an estimated annual probability of exceedance of 0.0005 (1 in 2,000).

Table 5–67 Chemical Accident Risks under the Expanded Operations Alternative

Chemical	Frequency (per year)	Quantity Released	ERPG-2 [a]		ERPG-3 [b]	
			Value	Annual Risk	Value	Annual Risk
Selenium hexafluoride from waste cylinder storage at TA-54-216	0.0041	19.8 gallons (75 liters)	0.6 ppm [c]	1 chance in 240 years of workers or public within 3,062 yards (2,800 meters) of facility receiving exposures in excess of limit. Public access is at 537 yards (491 meters).	5 ppm [c]	1 chance in 240 years of workers or public within 962 yards (880 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Sulfur dioxide from waste cylinder storage at TA-54-216	0.00051	300 pounds (136 kilograms)	3 ppm	1 chance in 1,950 years of workers or public within 1,804 yards (1,650 meters) of facility receiving exposures in excess of limit. Public access is at 537 yards (491 meters).	15 ppm	1 chance in 1,950 years of workers or public within 755 yards (690 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Chlorine gas released outside of Plutonium Facility Complex (TA-55-4)	0.063	150 pounds (68 kilograms)	3 ppm	1 chance in 15 years of workers within 1,181 yards (1,080 meters) of facility receiving exposures in excess of limit. Public access is at 1,111 yards (1,016 meters).	20 ppm	1 chance in 15 years of workers within 416 yards (380 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).
Helium at TA-55-41	0.063	9,230,000 cubic feet (261,366 cubic meters) (at STP)	280,000 ppm [c]	1 chance in 15 years of workers within 203 yards (186 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,146 yards (1,048 meters).	500,000 ppm [c]	1 chance in 15 years of workers within 152 yards (139 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,146 yards (1,048 meters).
Sulfur Dioxide (MDA B)	No frequency established; performed as an enveloping analysis	1 pound (0.45 kilogram)	3 ppm	Risk of workers or public within 90 yards (83 meters) of facility receiving exposures in excess of limit. Nearest public access is at 49 yards (45 meters).	15 ppm	Risk of workers or public within 37 yards (34 meters) of facility receiving exposures in excess of limit. Nearest public access is at 49 yards (45 meters).
Beryllium Powder (MDA B)	No frequency established; performed as an enveloping analysis	22 pounds [d] (10 kilograms)	0.025 milligram per cubic meter	Risk of workers within 25 yards (23 meters) of facility receiving exposures in excess of limit. Public access is at 49 yards (45 meters).	0.1 milligram per cubic meter	Risk of workers within 10 yards (9 meters) of facility receiving exposures in excess of limit. Nearest public access is at 49 yards (45 meters) and beyond this limit.

ERPG = Emergency Response Planning Guideline, TA = technical area, ppm = parts per million, MDA = material disposal area.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005e).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005e).

[c] The Temporary Emergency Exposure Limit value is used. ERPGs have not been issued for this substance.

[d] This quantity represents the total material at risk. A fraction of this solid (0.00006) would be released as respirable particles under the hypothesized scenario.

An updated probabilistic seismic hazard analysis providing an improved understanding of the seismic characteristics of LANL was completed in 2007 (LANL 2007a). The new study indicates that the seismic hazard is higher than previously understood; the annual probability of exceedance for the previously analyzed peak ground accelerations is now estimated to be about 1 in 700 (rather than 1 in 1,000) for the Seismic 1 event, and 1 in 1,250 (rather than 1 in 2,000) for the Seismic 2 event. The revised annual probabilities of exceedance are thus 0.0015 and 0.0008, respectively. Using these larger probabilities, however, the seismic accident risks for the MEI, the noninvolved worker, and the population are less than 1 percent of accident risks for other types of accidents in the SWEIS such as fires at the Radioassay and Nondestructive Testing Facility, the Waste Characterization, Reduction, and Repackaging Facility, and the TA-54 waste storage domes.

For many facilities involved in the SWEIS Seismic 1 and 2 accident scenarios, a conservative assumption was made that there was complete failure of structures, systems, and components (given the Seismic 1 and 2 ground shaking), thereby resulting in the maximum possible radioisotope or chemical release. Higher seismic accelerations at the same annual frequency of exceedance would result in identical consequences for these facilities. Therefore, the larger seismic peak ground accelerations associated with the updated probabilistic seismic hazard analysis would not increase the consequence of these accident scenarios.[7] Furthermore, structures are typically designed with considerable factors of safety that provide large margins before failure would occur. For those facilities that were not assumed to completely fail, it is not possible to state the impacts of different peak horizontal ground accelerations without detailed structural analyses of LANL facilities using the updated probabilistic seismic hazard analysis results. Therefore, a bounding analysis was used to estimate the maximum expected effect of the updated seismic hazard analysis on the SWEIS seismic accident risks.

Using the accident source terms that were developed for the SWEIS Seismic 1 and 2 accident scenarios, the effect of the revised estimates of annual probability of exceedance would be an increase in the radiological risk of 50 percent for Seismic 1 scenarios and 60 percent for Seismic 2 scenarios. For this assessment, no credit was taken for facilities for which complete failure was already assumed and therefore no larger accident source term would be expected at larger seismic ground accelerations. Furthermore, the number of LCFs calculated for these two postulated seismic events should be considered within the context of the nonradiological human health impacts expected from these seismic events, which would cause widespread failures of non-nuclear LANL structures and structures outside of LANL. A much larger number of fatalities and injuries from structure collapse would be expected for these seismic events in the area surrounding LANL.

Just as the updated probabilistic seismic hazards analysis used new data and advanced methods to calculate LANL seismic hazards, revised structural analysis methods tied to damage states

[7] *The facilities for which the consequences would be the same include: the Chemistry and Metallurgy Research Building, the Weapons Engineering Test Facility, the Tritium Science and Fabrication Facility, the Tritium System Test Assembly, and Radioactive Liquid Waste Treatment Facility, the Waste Characterization, Reduction, and Repackaging Facility, and the Radioassay and Nondestructive Testing Facility. Facilities for which the consequences of higher ground acceleration may be greater include: the Plutonium Facility, the TA-55 Storage Facility, the Decontamination and Volume Reduction System, Waste Storage Domes, and the Safe Secure Transport Facility.*

credited in safety assessment documents will be used to update the seismic structural integrity evaluation of LANL facilities. The effect of the higher values of peak horizontal ground acceleration on accident consequences and risks will be analyzed in future facility safety analyses and incorporated as appropriate into future NEPA documents. NNSA and the LANL management and operating contractor will undertake an evaluation of LANL facility performance in terms of the updated seismic hazard information. Until that revised analysis is completed, operations would be authorized based on NNSA approval of a contractor-prepared justification for continued operation.

The LANL management and operating contractor has developed and NNSA has accepted a site-wide justification for continued operation as a result of the estimates of increased seismic event frequency and acceleration associated with the updated probabilistic seismic hazards analysis. The justification for continued operation presents a qualitative evaluation of the effect of this increased seismic hazard on site-wide transportation and on the following LANL facilities: Chemistry and Metallurgy Research Building, Beryllium Technology Facility, Dual-Axis Radiographic Hydrodynamic Test Facility, Weapons Engineering Test Facility, Radioactive Liquid Waste Treatment Facility, Waste Characterization, Reduction, and Repackaging Facility, TA-53 underground spent resin tank, LANSCE, Area G waste operations, Radioassay and Nondestructive Testing Facility, Plutonium Facility, Safe and Secure Transport Facility, and the nuclear environmental sites (MDA A, MDA B, MDA C, MDA H, MDA T, MDA W, TA-35 Wastewater Treatment Plant, TA-35 Pratt Canyon, and MDA AB). The justification for continued operation determined that existing bounding seismic accident analyses; new facility safety analyses; compensatory measures of limiting radioactive material inventory, new programs, and procedures; and the low probability of a seismic event during the anticipated time period for detailed quantitative analysis of each facility's safety documentation provide the basis for an acceptable risk for continued operation of LANL (LANL 2007a, NNSA 2007c).

The Los Alamos Site Office directed the LANL management and operating contractor to develop a draft project execution plan to perform specific detailed facility seismic analyses; incorporate necessary changes to facility safety bases; and develop a list of potential facility modifications to address deficiencies identified in the seismic analyses (NNSA 2007c). If necessary, facility-specific justifications for continued operation will be developed as part of this process. This project will provide for the evaluation of each LANL facility using the updated probabilistic seismic hazard analysis seismic accelerations and frequencies and in accordance with appropriate LANL structural engineering standards for seismic events using all applicable industry, federal government, and international standards, codes, and criteria.

5.12.3.1 No Action Alternative

Site-Wide Seismic 1 – Radiological

Site-wide Seismic 1 is represented by a PC-2 seismic event. Referring to **Tables 5–68** through **5–70** and noting that all of the listed facilities could contribute to offsite population impacts, the facility with generally the highest contribution to worker and public risk is the Chemistry and Metallurgy Research Building. In the event of this seismic event, it is estimated that there would be four LCFs in the offsite population from a Chemistry and Metallurgy Research Building release. As a result of such a release, the noninvolved worker would receive a

large radiation dose. There is also a potential for an individual at publicly accessible Diamond Drive, approximately 55 yards (50 meters) from the Chemistry and Metallurgy Research Building, to receive an exposure in excess of the offsite MEI exposure. The calculated dose to such an individual is 6,400 rem, or about 100 times the MEI dose. Depending on the specific radionuclides released and the route of human exposure, radiation doses calculated for the individual on Diamond Drive and the noninvolved worker would result in near-term health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose to the exposed individual, mitigating health impacts, or both. In addition to the conservative assumptions used to develop the source term (the amount of radioactive material released) for this accident, the calculated dose is based on the assumptions that no protective action is taken during the entire time of exposure and that no subsequent medical intervention occurs. Since the annual probability of this seismic event is 0.001, the increased risk of an additional LCF occurring in the population is estimated to be 0.0037 per year; the increased risk of a health effect for an individual on Diamond Drive or the noninvolved worker is estimated to be 0.001 or 1 chance in 1,000.

Table 5–68 Site-Wide Seismic 1 Radiological Accident Offsite Population Consequences for the No Action, Reduced Operations, and Expanded Operations Alternatives

	Maximally Exposed Individual		*Population to 50 Miles (80 kilometers)*	
Facility Impacted by Seismic 1 Event	***Dose (rem)***	***Latent Cancer Fatality*** [a]	***Dose (person-rem)***	***Latent Cancer Fatalities*** [b, c]
Chemistry and Metallurgy Research Building (TA-3-29)	62	0.075	6,100	4 (3.7)
SHEBA (TA-18-168) [d]	0.03	0.000018	0.77	0 (0.00046)
Tritium System Test Assembly (TA-21-155)	0.0015	8.8×10^{-7}	0.049	0 (0.00003)
Tritium Science and Fabrication Facility (TA-21-209)	0.013	7.5×10^{-6}	0.43	0 (0.00026)
Radioactive Liquid Waste Treatment Facility (TA-50-1)	3	0.0018	520	0 (0.31)
Radioassay and Nondestructive Testing Facility (TA-54-38)	64	0.077	1,100	1 (0.67)
Storage Facility (TA-55-185)	6	0.0036	590	0 (0.35)
Decontamination and Volume Reduction System (TA-54-412) (PC-2 Seismic)	2.8	0.0017	49	0 (0.03)
	Max 64	Max 0.077	Total or sum 8,400	Total 5 (5.01)

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, PC = performance category.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] Increased number of LCFs for the offsite population, assuming the accident occurs.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1), 343,100 (TA-54-38, DVRS).

[d] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations and Expanded Operations Alternatives.

Table 5–69 Site-Wide Seismic 1 Radiological Accident Onsite Worker Consequences for the No Action, Reduced Operations, and Expanded Operations Alternatives

Facility Impacted by Seismic 1 Event	*Noninvolved Worker at 110 Yards (100 meters)*	
	Dose (rem) [a]	*Latent Cancer Fatality* [b]
Chemistry and Metallurgy Research Building (TA-3-29)	2,000	1.0 [c]
SHEBA (TA-18-168) [d]	1.1	0.00064
Tritium System Test Assembly (TA-21-155)	0.011	6.7×10^{-6}
Tritium Science and Fabrication Facility (TA-21-209)	0.097	0.000058
Radioactive Liquid Waste Treatment Facility (TA-50-1)	120	0.15
Radioassay and Nondestructive Testing Facility (TA-54-38)	580	0.69
Storage Facility (TA-55-185)	240	0.29
Decontamination and Volume Reduction System (TA-54-412) (PC-2 Seismic)	10	0.0061

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, PC = performance category.

[a] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[b] Increased risk of an LCF to an individual, assuming the accident occurs.

[c] The indicated dose yields a risk value greater than 1.0. This means that it is likely that an individual exposed to the indicated dose would develop a latent fatal cancer. For this reason, a value of 1.0 is shown.

[d] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations and Expanded Operations Alternatives.

Table 5–70 Site-Wide Seismic 1 Radiological Accident Offsite Population and Worker Risks for the No Action, Reduced Operations, and Expanded Operations Alternatives

Facility Impacted by Seismic 1 Event	*Frequency (per year)*	*Onsite Worker*	*Offsite Population*	
		Noninvolved Worker at 110 Yards (100 meters) [a]	*Maximally Exposed Individual* [a]	*Population to 50 Miles (80 kilometers)* [b, c]
Chemistry and Metallurgy Research Building (TA-3-29)	0.001	0.001	0.000075	0.0037
SHEBA (TA-18-168) [d]	0.001	6.4×10^{-7}	1.8×10^{-8}	4.6×10^{-7}
Tritium System Test Assembly (TA-21-155)	0.001	6.7×10^{-9}	8.8×10^{-10}	3×10^{-8}
Tritium Science and Fabrication Facility (TA-21-209)	0.001	5.8×10^{-8}	7.5×10^{-9}	2.6×10^{-7}
Radioactive Liquid Waste Treatment Facility (TA-50-1)	0.001	0.00015	1.8×10^{-6}	0.00031
Radioassay and Nondestructive Testing Facility (TA-54-38)	0.001	0.00069	0.000077	0.00067
Storage Facility (TA-55-185)	0.001	0.00029	3.6×10^{-6}	0.00035
Decontamination and Volume Reduction System (TA-54-412) (PC-2 Seismic)	0.001	6.1×10^{-6}	1.7×10^{-6}	0.00003
		Maximum 0.001	Maximum 0.000077	Total 0.0051

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, PC = performance category.

[a] Increased risk of an LCF to an individual per year; new seismic data increases the risk by about 50 percent.

[b] Increased number of LCFs for the offsite population per year; new seismic data increases the risk by about 50 percent.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1), 343,100 (TA-54-38, DVRS).

[d] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations and Expanded Operations Alternatives.

All site facilities containing hazardous radiological materials that are susceptible to structural failure during this event could potentially contribute to the exposure of LANL workers and the public in the event of a site-wide seismic event. As a result, the population risks given in Table 5–70 can be summed as shown to provide a meaningful estimate of worker and public impacts. The individual risks to the MEI and noninvolved worker cannot be summed, however, because the risk at a specific location depends on the meteorology during the event. The direction that the wind carries the release from each facility would not impact one location in the same manner for multiple accidents at the same time. As a result, Table 5–70 shows the maximum risk of the individual receptors. The total impact to these individuals could be somewhat greater than indicated if more than one release affects these locations. Table 5–70 only provides estimated impacts for facilities with the highest potential impacts. If all facilities were taken into account, the sum of offsite population impacts from all LANL facilities with radiological materials would be somewhat larger.

As discussed in Section 5.12.3, an updated seismic hazard analysis has been developed for the LANL site (LANL 2007a). Because it is not possible to state the impacts of the different peak horizontal ground accelerations indicated in the updated seismic hazard analysis without detailed structural analyses of LANL facilities, a bounding approach was used to estimate the expected effect of the updated seismic hazard analysis on the SWEIS seismic accident risks. The effect of the revised estimate on the annual probability of exceedance of the Seismic 1 accident would be an increase in radiological risk of 50 percent. This results in a maximum risk of an LCF of 0.00012 for the MEI, 0.0015 for the noninvolved worker, and 0.0077 for the population. These estimated higher seismic accident risks do not take credit for facilities in which complete failure has already been assumed (including the Chemistry and Metallurgy Research Building and Radioassay and Nondestructive Testing Facility in Tables 5–68 through 5–70) and therefore no larger accident source term would be expected at higher seismic ground accelerations. Although these seismic risks have increased due to the results of the updated seismic analysis, they remain less than 1 percent of the highest MEI, noninvolved worker, and population risks for other types of accidents analyzed in the SWEIS.

Site-Wide Seismic 2 – Radiological

Site-Wide Seismic 2 is represented by a PC-3 seismic event. Referring to **Tables 5–71** through **5–73** and noting that all of the listed facilities could contribute to offsite population impacts, the facility with the highest contribution to public consequence is the Plutonium Facility at TA-55. In the event of this seismic event, it is estimated that there would be 9 LCFs in the offsite population from this TA-55 release. The waste storage domes at TA-54 holding transuranic waste would result in the highest contribution to the MEI's radiological consequences. A TA-55 release would result in the highest contribution to the noninvolved worker's radiological consequences. As discussed above for the Seismic 1 scenario, depending on the specific radionuclides released and the route of human exposure, radiation doses calculated for the MEI and the noninvolved worker would result in near-term health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose to the exposed individual, mitigating health impacts, or both. In addition to the conservative assumptions used to develop the source term (the amount of radioactive material released) for this accident, the calculated dose is based on the assumptions that no protective action is taken during the entire time of exposure and that no subsequent medical intervention

occurs. The risk of additional LCFs from the TA-55 release would be estimated at 0.0035 per year in the offsite population. The next highest risk of an LCF to the general population would be from the waste storage domes. The increased risk of an LCF for the MEI and noninvolved worker are estimated at 1 in 3,600 (0.00028) and 1 in 2,000 (0.0005) per year, respectively.

Table 5–71 Site-Wide Seismic 2 Radiological Accident Offsite Population Consequences for the No Action, Reduced Operations, and Expanded Operations Alternatives

Facility Impacted by Seismic 2 Event	*Maximally Exposed Individual*		*Population to 50 Miles (80 kilometers)*	
	Dose (rem) [a]	*Latent Cancer Fatality* [b]	*Dose (person-rem)*	*Latent Cancer Fatality* [c, d]
Chemistry and Metallurgy Research Building (TA-3-29)	62	0.075	6,100	4 (3.7)
Weapons Engineering Tritium Facility (TA-16-205)	17	0.01	110	0 (0.063)
SHEBA (TA-18-168) [e]	0.03	0.000018	0.77	0 (0.00046)
Tritium System Test Assembly (TA-21-155)	0.0015	8.8×10^{-7}	0.049	0 (0.00003)
Tritium Science and Fabrication Facility (TA-21-209)	0.013	7.5×10^{-6}	0.43	0 (0.00026)
Radioactive Liquid Waste Treatment Facility (TA-50-1)	3	0.0018	520	0 (0.31)
Waste Characterization, Reduction, and Repackaging Facility (TA-50-69)	43	0.052	5,400	3 (3.1)
Radioassay and Nondestructive Testing Facility (TA-54-38)	64	0.077	1,100	1 (0.67)
Plutonium Facility (TA-55-4)	150	0.17	14,000	9 (8.6)
Storage Facility (TA-55-185)	6	0.0036	590	0 (0.35)
Decontamination and Volume Reduction System (TA-54-412) (PC-3 Seismic)	34	0.04	600	0 (0.36)
Waste Storage Domes (TA-54)	460	0.55	7,400	5 (4.5)
Safe, Secure Transport Facility (TA-55-355)	3.9	0.0024	290	0 (0.18)
	Max 460	Max 0.55	Total 36,000	Total 22

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, PC = performance category.

[a] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[b] Increased risk of an LCF to an individual, assuming the accident occurs.

[c] Increased number of LCFs for the offsite population, assuming the accident occurs.

[d] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1, -69), 343,100 (TA-54-38, 4-12, Domes), 301,900 (TA-55-4, -185, -355).

[e] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations and Expanded Operations Alternatives.

Table 5–72 Site-Wide Seismic 2 Radiological Accident Onsite Worker Consequences for the No Action, Reduced Operations, and Expanded Operations Alternatives

Facility Impacted by Seismic 2 Event	*Noninvolved Worker at 110 Yards (100 meters)*	
	Dose (rem) [a]	*Latent Cancer Fatality* [b]
Chemistry and Metallurgy Research Building (TA-3-29)	2,000	1.0 [c]
Weapons Engineering Tritium Facility (TA-16-205)	156	0.17
SHEBA (TA-18-168) [d]	1.1	0.00064
Tritium System Test Assembly (TA-21-155)	0.011	6.7×10^{-6}
Tritium Science and Fabrication Facility (TA-21-209)	0.097	0.000058
Radioactive Liquid Waste Treatment Facility (TA-50-1)	120	0.15
Waste Characterization, Reduction, and Repackaging Facility (TA-50-69)	1,100	1.0 [b]
Radioassay and Nondestructive Testing Facility (TA-54-38)	580	0.69
Plutonium Facility (TA-55-4)	2,700	1.0 [c]

Facility Impacted by Seismic 2 Event	Noninvolved Worker at 110 Yards (100 meters)	
	Dose (rem) [a]	Latent Cancer Fatality [b]
Storage Facility (TA-55-185)	240	0.29
Decontamination and Volume Reduction System (TA-54-412) (PC-3 Seismic)	120	0.15
Waste Storage Domes (TA-54)	2,200	1.0 [c]
Safe, Secure Transport Facility (TA-55-355)	130	0.16

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, PC = performance category.

[a] Individual radiation doses in excess of a few hundred rem would result in acute (near-term) health effects or even death from causes other than cancer. In some cases, medical intervention may be effective in reducing the dose, mitigating health impacts, or both. The listed doses are calculated assuming that the exposed individual takes no protective action during the period of exposure and that no subsequent medical intervention occurs.

[b] Increased risk of an LCF to an individual, assuming the accident occurs.

[c] The indicated dose yields a risk value greater than 1.0. This means that it is likely that an individual exposed to the indicated dose would develop a fatal latent cancer. For this reason a value of 1.0 is shown.

[d] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations and Expanded Operations Alternatives.

Table 5–73 Site-Wide Seismic 2 Radiological Accident Offsite Population and Worker Risks for the No Action, Reduced Operations, and Expanded Operations Alternatives

Facility Impacted by Seismic 2 Event	Frequency (per year)	Onsite Worker	Offsite Population	
		Risk to Noninvolved Worker at 110 Yards (100 meters) [a]	Maximally Exposed Individual [a]	Population to 50 Miles (80 kilometers) [b, c]
Chemistry and Metallurgy Research Building (TA-3-29)	0.0005	0.0005	0.000037	0.0018
Weapons Engineering Tritium Facility (TA-16-205)	0.0005	8.7×10^{-5}	5×10^{-6}	0.000032
SHEBA (TA-18-168) [d]	0.0005	3.2×10^{-7}	9×10^{-9}	2.3×10^{-7}
Tritium System Test Assembly (TA-21-155)	0.0005	3.3×10^{-9}	4.4×10^{-10}	1.5×10^{-8}
Tritium Science and Fabrication Facility (TA-21-209)	0.0005	2.9×10^{-8}	3.8×10^{-9}	1.3×10^{-7}
Radioactive Liquid Waste Treatment Facility (TA-50-1)	0.0005	0.000073	9.1×10^{-7}	0.00016
Waste Characterization, Reduction, and Repackaging Facility (TA-50-69)	0.0001 [e]	0.0001	5.2×10^{-6}	0.00031
Radioassay and Nondestructive Testing Facility (TA-54-38)	0.0005	0.00035	0.000039	0.00034
Plutonium Facility (TA-55-4)	0.0004 [e]	0.0004	7×10^{-5}	0.0035
Storage Facility (TA-55-185)	0.0005	0.00014	1.8×10^{-6}	0.00018
Decontamination and Volume Reduction System (TA-54-412) (PC-3 Seismic)	0.0005	0.000074	0.00002	0.00018
Waste Storage Domes (TA-54)	0.0005	0.0005	0.00028	0.0022
Safe, Secure Transport Facility (TA-55-355)	0.0005	0.000077	1.2×10^{-6}	0.000088
		Maximum 0.0005	Maximum 0.00028	Total 0.009

TA = technical area, SHEBA = Solution High-Energy Burst Assembly, PC = performance category.

[a] Increased risk of an LCF to an individual per year; new seismic data increases the risk by about 60 percent.

[b] Increased number of LCFs for the offsite population per year; new seismic data increases the risk by about 60 percent.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18, -168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1, -69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4, -185, -355).

[d] The SHEBA accident scenario is applicable only to the No Action Alternative. Operation of SHEBA would cease under the Reduced Operations and Expanded Operations Alternatives.

[e] Different frequency than other seismic events due to assumption of other addition failures.

All site facilities containing hazardous radiological materials that are susceptible to structural failure during this event could potentially contribute to the exposure of LANL workers and the public in the event of a site-wide seismic event. As a result, the offsite population risks given in Table 5–73 can be summed as shown to provide a meaningful estimate of worker and public impacts. The individual risks to the MEI and noninvolved worker cannot be summed because the risk at a specific location depends on the meteorology during the event. The direction that the wind carries the release from each facility would not impact one location in the same manner as for multiple accidents at the same time. As a result, Table 5–73 shows the maximum risk of the individual receptors. The total impact to these individuals could be somewhat greater than indicated if more than one release were to affect these locations. Table 5–73 only provides estimated impacts for facilities with the highest potential impacts. If all facilities were taken into account, the sum of worker and offsite population risks from all LANL facilities with radiological materials could be somewhat higher.

As discussed in Section 5.12.3, an updated seismic hazard analysis has been developed for the LANL site (LANL 2007a). Because it is not possible to state the impacts of the different peak horizontal ground accelerations indicated in the updated seismic hazard analysis without detailed structural analyses of LANL facilities, a bounding approach was used to estimate the expected effect of the updated seismic hazard analysis on the SWEIS seismic accident risks. The effect of the revised estimate of the probability of exceedance of the Seismic 2 accident would be an increase in radiological risk of 60 percent. This results in a maximum risk of an LCF of 0.00045 for the MEI, 0.0008 for the noninvolved worker, and 0.014 for the population. These estimated higher seismic accident risks do not take credit for facilities in which complete failure has already been assumed (including the Chemistry and Metallurgy Research Building and Radioassay and Nondestructive Testing Facility in Tables 5–71 through 5–73) and therefore no larger accident source term would be expected at higher seismic ground accelerations. Although these seismic risks have increased due to the results of the updated seismic analysis, they remain less than 1 percent of the highest MEI, noninvolved worker, and population risks for other types of accidents analyzed in the SWEIS.

Site-Wide Seismic 1 – Chemical

The facilities and chemicals of concern under site-wide Seismic 1 conditions are shown in **Table 5–74**. There are numerous chemicals in small quantities onsite that may be released under these conditions. The listed chemicals were selected from a complete set of chemicals used onsite, based on their larger quantities, chemical properties, and human health effects. Exposure to concentrations in excess of the ERPG values could result in serious health effects or life-threatening implications to the exposed individuals.

Table 5–74 also shows the estimated annual risks for workers and the public in the event of an accidental release of each chemical. The annual frequency of this accident is 0.001 based on the *Seismic Hazards Evaluation of the Los Alamos National Laboratory (February 24, 1995)*. Based on the 2007 update of the seismic hazard analysis (LANL 2007a), the annual frequency is estimated to be 0.0015. Because this accident is a site-wide seismic event, all of the chemicals shown in the table would be released almost simultaneously. The annual risk of exposure to workers and the public to chemical concentrations in excess of ERPG-2 and ERPG-3 values is 1 in 1,000 based on the previous seismic hazard analysis and 1 in 700 based on the 2007 update

of the seismic hazard analysis. The nearest public access relative to each facility is shown for each chemical. For some chemicals, the nearest public access point is beyond the distance at which concentrations would be at ERPG values. In these instances, there would likely be no serious health affects to the public in the event of an accident. For formaldehyde, as shown in Table 5–74, the nearest public access point is closer than the distance at which concentrations would be at the ERPG values. If this accident were to occur, members of the public could be exposed to harmful and possibly fatal concentrations of formaldehyde.

Table 5–74 Chemical Accident Risks under Seismic 1 Conditions for the No Action, Reduced Operations, and the Expanded Operations Alternatives

			ERPG-2 [a, b]		*ERPG-3* [a, c]	
Chemical	***Frequency*** [a] ***(per year)***	***Quantity Released***	***Value (ppm)***	***Annual Risk***	***Value (ppm)***	***Annual Risk***
Hydrogen cyanide at TA-3-66 (Sigma Complex)	0.001	13.5 pounds (6.1 kilograms)	10	1 chance in 1,000 years of workers within 150 yards (137 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).	25	1 chance in 1,000 years of workers within 94 yards (86 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).
Phosgene at TA-9-21	0.001	1 pound (0.45 kilograms)	0.2	1 chance in 1,000 years of workers within 302 yards (276 meters) of facility receiving exposures in excess of limit. Nearest public access is at 900 yards (823 meters).	1	1 chance in 1,000 years of workers within 129 yards (118 meters) of facility receiving exposures in excess of limit. Nearest public access is at 900 yards (823 meters).
Formalde-hyde at TA-43-1 (Bioscience Facilities)	0.001	3.7 gallons (14.1 liters)	10	1 chance in 1,000 years of workers or public within 195 yards (178 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).	25	1 chance in 1,000 years of workers or public within 122 yards (112 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).

ERPG = Emergency Response Planning Guideline, ppm = parts per million, TA = technical area.

[a] A conservative estimate of the frequency based on the 2007 probabilistic seismic hazard analysis (LANL 2007a) is 0.0015. The corresponding annual risk would be 1 chance in 700 years.

[b] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005e).

[c] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005e).

Site-Wide Seismic 2 - Chemical

The facilities and chemicals of concern under Site-Wide Seismic 2 conditions are shown in **Table 5–75**. There are numerous chemicals in small quantities onsite that could be released under these conditions. The listed chemicals were selected from a complete set of chemicals used onsite based on their larger quantities, chemical properties, and human health effects.

Table 5–75 Chemical Accident Risks under Seismic 2 Conditions for the No Action, Reduced Operations, and Expanded Operations Alternatives

Chemical	Frequency [a] (per year)	Quantity Released	ERPG-2 [a, b]		ERPG-3 [a, c]	
			Value (ppm)	Annual Risk	Value (ppm)	Annual Risk
Hydrogen cyanide at TA-3-66 (Sigma)	0.0005	13.5 pounds (6.1 kilograms)	10	1 chance in 2,000 years of workers within 150 yards (137 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).	25	1 chance in 2,000 years of workers within 94 yards (86 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).
Phosgene at TA-9-21	0.0005	1 pound (0.45 kilograms)	0.2	1 chance in 2,000 years of workers within 302 yards (276 meters) of facility receiving exposures in excess of limit. Nearest public access is at 900 yards (823 meters).	1	1 chance in 2,000 years of workers within 129 yards (118 meters) of facility receiving exposures in excess of limit. Nearest public access is at 900 yards (823 meters).
Formaldehyde at TA-43-1 (Bioscience Facilities)	0.0005	3.7 gallons (14.1 liters)	10	1 chance in 2,000 years of workers or public within 195 yards (178 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).	25	1 chance in 2,000 years of workers or public within 122 yards (112 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).
Chlorine gas released outside of Plutonium Facility Complex (TA-55-4)	0.0005	150 pounds (68 kilograms)	3	1 chance in 2,000 years of workers within 1,181 yards (1,080 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).	20	1 chance in 2,000 years of workers within 416 yards (380 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).
Nitric acid spill at Plutonium Facility Complex (TA-55-4)	0.0005	6,100 gallons (23,090 liters)	6	1 chance in 2,000 years of workers within 53.6 yards (49 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).	78	1 chance in 2,000 years of workers within 7.2 yards (6.6 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).
Hydrochloric acid spill at TA-55-249	0.0005	5,200 gallons (19,684 liters)	20	1 chance in 2,000 years of workers or public within 220 yards (185 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,221 yards (1,117 meters).	150	1 chance in 2,000 years of workers or public within 70 yards (64 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,221 yards (1,117 meters).
Beryllium at TA-3-141 (Beryllium Technology Facility)	0.0005	110 pounds (49 kilograms) (powder) [d]	0.025 [d]	1 chance in 2,000 years of workers or public within 309 yards (282 meters) of facility receiving exposures in excess of limit. Nearest public access is at 963 yards (880 meters).	0.1 [d]	1 chance in 2,000 years of workers or public within 127 yards (116 meters) of facility receiving exposures in excess of limit. Nearest public access is at 963 yards (880 meters).

ERPG = Emergency Response Planning Guideline, ppm = parts per million, TA = technical area.

[a] A conservative estimate of the frequency based on the 2007 probabilistic seismic hazard analysis (LANL 2007a) is 0.0008. The corresponding annual risk would be 1 chance in 1,250 years.

[b] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005e).

[c] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005e).

[d] Units for beryllium are in milligrams per cubic meter.

Table 5–75 also shows the estimated annual risks for workers and the public in the event of an accidental release of each chemical. The annual frequency of this accident is 0.0005 based on the *Seismic Hazards Evaluation of the Los Alamos National Laboratory (February 24, 1995)*. Based on the 2007 update of the seismic hazard analysis (LANL 2007a), the annual frequency is estimated to be 0.0008. As this accident is a site-wide seismic event, all of the chemicals shown in the table would be released almost simultaneously. The annual risk of exposure to workers and the public to chemical concentrations in excess of ERPG-2 and ERPG-3 values is 1 in 2,000 per year based on the previous seismic hazard analysis and 1 in 1,250 based on the 2007 update of the seismic hazard analysis. The nearest public access point relative to each facility is shown for each chemical. For some chemicals, the nearest public access point is beyond the distance at which concentrations would be at ERPG values. In these instances, there would likely be no serious health affects to the public in the event of an accident. As shown in Table 5–75, for formaldehyde at the Bioscience Facilities and chlorine gas at the Plutonium Facility Complex, the nearest public access points are closer than the distance at which concentrations would be at the ERPG values. If these accidents were to occur, members of the public could be exposed to harmful and possibly fatal concentrations of these chemicals.

5.12.3.2 Reduced Operations Alternative

Site-Wide Seismic 1 and 2 – Radiological

The site-wide Seismic 1 and 2 radiological accident impacts under the Reduced Operations Alternative are similar to those under the No Action Alternative, as shown in Tables 5–68 through 5–73. Activities at TA-18, including operation of SHEBA, would cease under this alternative. SHEBA operations are a small component of the site-wide seismic accident impacts at LANL; its elimination would not significantly alter the overall site risk profile from such an event. All other impacts in the tables are equally applicable for this alternative.

Site-Wide Seismic 1 and 2 – Chemical

The chemicals of concern that could be released in a site-wide Seismic 1 or 2 event are the same under the Reduced Operations Alternative as those under the No Action Alternative. None of the chemicals identified for the latter is eliminated in this alternative. The information in Tables 5–74 and 5–75, then, is applicable to the Reduced Operations Alternative.

5.12.3.3 Expanded Operations Alternative

Site-Wide Seismic 1 and 2 – Radiological

The Seismic 1 and 2 accident impacts under the Expanded Operations Alternative are similar to those under the No Action Alternative, as shown in Tables 5–68 through 5–73. SHEBA operations would cease under the Expanded Operations Alternative. Because the potential impacts are relatively small, deleting this accident does not change the overall risk profile of this alternative. Additional accident risks would result from expanded waste management activities. Transuranic waste storage would be consolidated in a new facility, the TRU Waste Facility, which would be located in TA-50 or a generic site along the Pajarito Road corridor. The TRU Waste Facility would carry fewer potential accident impacts than the existing facility because of

its new location and because less material would be stored onsite. The entries in Tables 5–68 through 5–73 reflect present Decontamination and Volume Reduction System Facility operations because the system would be active for most of the period of interest. Present accident impacts bound the impacts of the replacement facility. The potential accident impacts for the new facility are described in Appendix H.

Site-Wide Seismic 1 and 2 – Chemical

The chemicals of concern that could be released in a site-wide Seismic 1 or 2 event are the same under the Expanded Operations Alternative as those under the No Action Alternative. No additional chemicals were identified under this alternative that would have impacts exceeding those under the No Action Alternative. The information in Tables 5–74 and 5–75, therefore, also applies to the Expanded Operations Alternative.

5.12.4 Wildfire Accident Impacts

Wildfire accident scenarios were postulated as a method of evaluating potential impacts to onsite workers and the offsite population. Details of these scenarios are provided in Appendix D, including a discussion of the LANL buildings that could be affected by wildfire, an inventory of hazardous radiological materials, and the source term factors and estimated source terms.

5.12.4.1 Wildfire – Radiological

The estimated radiological consequences of a wildfire to workers and the public are shown in **Tables 5–76** and **5–77** for each listed facility. The values shown assume that a wildfire has occurred and therefore do not reflect any credit for the probability of a wildfire occurrence. The estimated annual risks for each wildfire scenario are shown in **Table 5–78**. These values take credit for the probability of a wildfire's occurrence. The wildfire accident scenario consequences and risks in Table 5–76 through 5–78 apply to the No Action, Reduced Operations and Expanded Operations Alternatives.

As shown in Table 5–76, the results indicate that radiological releases from the TA-54 waste storage domes dominate the impacts to workers and the public. In the event of this accident, the consequence to the MEI is a likelihood of developing an LCF during his or her lifetime and an additional 55 LCFs for the population. As shown in Table 5–77, an onsite worker located 110 yards (100 meters) from the facility would be likely to develop an LCF as a result of this accident occurring at TA-54.

The risks for this accident, which takes credit for its low frequency of occurrence, are estimated to be about 1 chance in 20 (0.05) of an increased likelihood of an LCF per year for the MEI and an additional 2.7 LCFs per year of operations in the offsite population. An onsite worker located 110 yards (100 meters) from the facility would experience an increased likelihood of an LCF of about 1 chance in 20 (0.05) per year of operations. These risks assume that the receptors do not take evasive action in the event of a wildfire. Because releases from the TA-54 domes dominate the consequences and risks from a wildfire, they represent the total impacts on the offsite and worker populations.

Table 5–76 Radiological Accident Offsite Population Consequences for a Wildfire Accident for the No Action, Reduced Operations, and Expanded Operations Alternatives

Facility Impacted by Wildfire	*Maximally Exposed Individual*		*Population to 50 Miles (80 kilometers)*	
	Dose (rem)	*Latent Cancer Fatality Risk* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b, c]
Sigma Complex (TA-3-66/451)	0.0039	2.3×10^{-6}	4.8	0 (0.0029)
Weapons Engineering Tritium Facility (TA-16-205)	0.061	0.000036	110	0 (0.067)
Radiochemistry Facility (TA-48-1)	0.0011	6.4×10^{-7}	0.44	0 (0.00026)
Waste Storage Domes (TA-54)	1,900	1.0 [d]	91,000	55 (54.8)
Device Assembly (TA-16-411)	1.6×10^{-6}	8.9×10^{-10}	0.00017	0 (1×10^{-7})
Decontamination and Volume Reduction System (TA-54-412)	4.9	0.003	1,200	0 (0.7)
Radiography (TA-8-23)	0.00033	2×10^{-7}	0.56	0 (0.00034)
Waste Characterization, Reduction, and Repackaging Facility (TA-50-69)	27	0.032	6,900	4 (4.2)

TA = technical area.
[a] Increased risk of an LCF to an individual, assuming the accident occurs.
[b] Increased number of LCFs for the offsite population, assuming the accident occurs; value in parentheses is the calculated result.
[c] Offsite population size is approximately 297,030 for TA-3-66/451; 404,913 for TA-16-205 and TA-16-411; 299,508 for TA-48-01; 343,069 for Domes, and TA-54-412; and 349,780 for TA-8-23.
[d] The indicated dose yields a risk greater than 1.0. This means that it is likely that an individual exposed to the indicated dose would develop a latent fatal cancer. For this reason, a value of 1.0 is shown.

Table 5–77 Radiological Accident Onsite Worker Consequences for a Wildfire Accident for the No Action, Reduced Operations, and Expanded Operations Alternatives

Accident	*Noninvolved Worker at 110 Yards (100 meters)*	
	Dose (rem)	*Latent Cancer Fatality* [a]
Sigma Complex (TA-3-66/451)	0.076	0.000046
Weapons Engineering Tritium Facility (TA-16-205)	0.33	0.0002
Radiochemistry Facility (TA-48-1)	0.016	9.3×10^{-6}
Waste Storage Domes (TA-54)	8,700	1.00 [b]
Device Assembly (TA-16-411)	0.000017	1×10^{-8}
Decontamination and Volume Reduction System (TA-54-412)	16	0.0098
Radiography (TA-8-23)	0.0019	1.2×10^{-6}
Waste Characterization, Reduction, and Repackaging Facility (TA-50-69)	440	0.53 [b]

TA = technical area.
[a] Increased risk of an LCF to an individual, assuming the accident occurs.
[b] The indicated dose yields a risk greater than 1.0. This means that it is likely that an individual exposed to the indicated dose would develop a latent fatal cancer. For this reason, a value of 1.0 is shown.

Table 5–78 Radiological Accident Offsite Population and Worker Risks for a Wildfire Accident for the No Action, Reduced Operations, and Expanded Operations Alternatives

Accident	Frequency (per year)	Onsite Worker	Offsite Population	
		Noninvolved Worker at 110 Yards (100 meters) [a]	Maximally Exposed Individual [a]	Population to 50 Miles (80 kilometers) [b, c]
Sigma Complex (TA-3-66/451)	0.05	2.3×10^{-6}	1.2×10^{-7}	0.00014
Weapons Engineering Tritium Facility (TA-16-205)	0.05	1×10^{-5}	1.8×10^{-6}	0.0034
Radiochemistry Facility (TA-48-1)	0.05	4.7×10^{-7}	3.2×10^{-8}	1.3×10^{-5}
Waste Storage Domes (TA-54)	0.05	0.05	0.05	2.7
Device Assembly (TA-16-411)	0.05	5.2×10^{-10}	4.4×10^{-11}	5.2×10^{-9}
Decontamination and Volume Reduction System (TA-54-412)	0.05	0.00049	0.00015	0.035
Radiography (TA-8-23)	0.05	5.7×10^{-8}	1×10^{-8}	1.7×10^{-5}
Waste Characterization, Reduction, and Repackaging Facility (TA-50-69)	0.01 [d]	0.0053	0.00032	0.042

TA = technical area.
[a] Increased risk of an LCF to an individual per year.
[b] Increased number of LCFs for the offsite population per year; value in parentheses is the calculated result.
[c] Offsite population size is approximately 297,030 for TA-3-66/451; 404,913 for TA-16-205 and TA-16-411; 299,508 for TA-48-01; 343,069 for Domes and TA-54-412; and 349,780 for TA-8-23.
[d] Assumes additional failures.

5.12.4.2 Wildfire – Chemical

The chemicals of concern at LANL facilities under wildfire conditions are shown in **Table 5–79**. They were selected from a database of chemicals used onsite based on their quantities, chemical properties, and human health effects. The table shows the ERPG-2 and ERPG-3 values for which, were an accident to occur, concentrations in excess of these values could result in serious health effects or life-threatening implications for exposed individuals.

Table 5–79 also shows the risks of worker and public exposure in the event of a chemical release, as well as the estimated frequency of each release. The direction traveled by the chemical plume would depend on the meteorological conditions at the time of the accident and would determine which segment of the worker and offsite populations would be at risk of exposure. The wildfire chemical accident impacts in Table 5–79 apply to the No Action, Reduced Operations, and Expanded Operations Alternatives.

For formaldehyde at TA-43-1, there is an annual risk of 0.05 (once in 20 years) that workers and the public within a distance of 97 yards (89 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers and public within a distance of 154 yards (141 meters) of the release would face the same risk of being exposed to concentrations in excess of ERPG-2 values.

Table 5–79 Chemical Accident Risks under Wildfire Conditions for the No Action, Reduced Operations, and Expanded Operations Alternatives

Chemical	Frequency (per year)	Quantity Released	ERPG-2 [a]		ERPG-3 [b]	
			Value (ppm)	Annual Risk	Value (ppm)	Annual Risk
Formaldehyde at TA-43-1	0.05	3.7 gallons (14.1 liters)	10	1 chance in 20 years of workers or public within 154 yards (141 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).	25	1 chance in 20 years of workers or public within 97 yards (89 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).
Hydrogen cyanide from TA-3-66	0.05	13.5 pounds (6.1 kilograms)	10	1 chance in 20 years of workers within 118 yards (108 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).	25	1 chance in 20 years of workers within 77 yards (70 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).

ERPG = Emergency Response Planning Guideline, ppm= parts per million, TA = technical area.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005e).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005e).

For hydrogen cyanide released from TA-3-66, there is an annual risk of 0.05 (once in 20 years) that workers within a distance of 77 yards (70 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers within a distance of 118 yards (108 meters) of the release would face the same risk of being exposed to concentrations in excess of ERPG-2 values. There would be no risk that the public would receive an exposure in excess of ERPG-2 or ERPG-3 values because the nearest public access is 260 yards (238 meters) from the location of this chemical release.

5.12.5 Construction Accidents

The construction of new facilities includes the risk of accidents that could impact workers. Because construction activities do not involve radioactive materials, there would be no radiological impacts. The presence of hazardous flammable, explosive, and other chemical substances, however, could initiate accident conditions that could impact the health and safety of workers. In addition, in the course of their work, construction and site personnel could receive serious or fatal injuries as a result of incidents that fall in the category of industrial accidents. DOE's construction contractors are required to adhere to strict safety standards and procedures to promote a working environment that minimizes the possibility of such accidents.

5.12.6 Terrorist Incidents

The analysis of the impacts of terrorist incidents is described in a classified appendix to this SWEIS. 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.

This section describes how NNSA assesses the vulnerability of its sites to terrorist threats and then designs its response systems.

5.12.6.1 Assessment of Vulnerability to Terrorist Threats

In accordance with DOE Order 470.3A, "Design Basis Threat Policy," and DOE Order 470.4, "Safeguards and Security Program," NNSA conducts vulnerability assessments and risk analyses of the facilities and sites under its management to evaluate the possible threats and the protection elements, technologies, and administrative controls used to protect against these threats. DOE Order 470.4 establishes the roles and responsibilities for the conduct of DOE's Safeguards and Security Program. DOE Order 470.3A establishes requirements designed to prevent unauthorized access, theft, diversion, or sabotage (including unauthorized detonation or destruction) of all nuclear weapons, nuclear weapons components, and special nuclear material under DOE's control. Among other provisions, the Order (a) specifies those national security assets that require protection; (b) outlines threat considerations for safeguards and security programs to provide a basis for planning, design, and construction of new facilities or modifications to existing facilities; and (c) provides an adversary threat basis for evaluating the performance of safeguards and security systems. NNSA also protects against espionage, sabotage, and theft of radiological, chemical, or biological materials; classified matter; non-nuclear weapon components; and critical technologies.

NNSA's safeguards and security programs and systems employ state-of-the-art technologies to:

- Deny access to nuclear weapons, nuclear test devices, and completed nuclear assemblies;
- Prevent theft, sabotage, or an unauthorized nuclear yield (criticality) of special nuclear materials and credible rollup quantities of special nuclear materials.
- Protect the public and employees from unacceptable impacts resulting from an adversary's use of radiological, chemical, or biological materials; and
- Protect classified matter and designated critical facilities and activities from sabotage, espionage, and theft.

NNSA's vulnerability assessments employ a rigorous methodology based on guidance from the *DOE Vulnerability Assessment Process Guide* (September 2004), and the Vulnerability Assessment Certification course. Typically, a vulnerability assessment involves analyses of modeling, simulation, and performance testing results by subject matter experts to determine the effectiveness of a safeguard and security system against an adversary's objectives. Vulnerability assessments generally include the following activities.

Characterizing the threat. Threat characterization provides a detailed description of a physical threat by a malevolent adversary to a site's physical protection systems. Usually the description includes information about potential adversary types, motivations, objectives, actions, physical capabilities, and site-specific tactical considerations. Much of the information required to develop a threat characterization is described in DOE Order 470.3A and the Adversary Capabilities List. DOE also issues additional site-specific threat clarification and guidance.

Determining the target. Target determination involves identifying, describing, and prioritizing potential targets among NNSA's security interests that meet the criteria outlined in DOE Order 470.3A. Target determination results are used to help characterize potential threats and target facilities, as well as protective force and neutralization requirements.

Defining the scope. The scope of a vulnerability assessment is determined by agreement among DOE Headquarters and Field staff and contractor personnel. In addition to defining the threat and applicable targets to be assessed, the scope establishes the key assumptions and interpretations that will guide the analyses, as well as the objectives, methods, schedule, personnel responsibilities, and format for documenting the results of the assessment.

Characterizing the facility or site. This activity requires defining and documenting aspects of the facility or site, particularly existing security programs (personnel security, information security, physical security, material control and accountability, etc.), to assist in identifying strengths and weaknesses. Results are used as inputs to the pathway analyses used to develop representative case scenarios for evaluating the security system. Facility and site characterization modeling tools include Analytical System and Software for Evaluating Safeguards and Security (ASSESS), Adversary Time-Line Analysis System (ATLAS), VISA, tabletop analysis, and others.

Characterizing the protective force. To assess a facility or site's vulnerability, analysts must accurately characterize the associated protective force's capabilities against a defined threat and objective, particularly the force's ability to detect, assess, respond to, interrupt, and neutralize an adversary. Specific data used for this activity include special nuclear materials categorization; configuration, flow, and movement of special nuclear materials within or from a facility or site; defined threats; detection and assessment times; and adversary delay and task time. The protective force's equipment, weapons, number, and locations also are considered in the characterization. The characterization information is validated and verified via observation, alarm response assessments, limited scope performance tests, force-on-force exercises, joint conflict and tactical simulations (JCATS), and tabletop analyses. The JCATS software tool is used for training, analysis, planning, and mission rehearsal, as well as characterization of the protective force. It employs detailed graphics and models of buildings, natural terrain features, and roads to simulate realistic operations in urban and rural environments.

Analyzing adversary pathways. This activity identifies and analyzes base case adversary pathways based on the results of threat, target, facility, and protective force characterization, as well as ancillary analyses such as explosives analysis. ASSESS and ATLAS are two primary tools that are used in this analysis. Analysts also conduct insider analysis as part of this activity.

Developing base case scenarios. Base case scenarios are developed for use in performance testing and to determine the effectiveness of the security system in place against a potential adversary's capabilities and objectives. As part of this activity, data from the base case adversary pathways analyses are used to identify applicable threats, threat strategies, and objectives, and combined with protective force strategies and capabilities to develop scenarios that include specific adversary resources, capabilities, and projected task times to successfully complete their objectives. Specialists also work with the vulnerability assessment team to develop realistic

scenarios that provide a structured, intellectually honest analysis of the strengths and weaknesses of the terrorist adversary.

Determining the probability of neutralization. The probability of neutralization is a numeric value representing the probability that the protective force can prevent an adversary from achieving their objectives. The calculated number is derived from more than one source, one of which must be based on Joint Tactical Simulation, JCATS analysis, or force-on-force exercises.

Determining system effectiveness. System effectiveness is determined by applying an equation that reflects the capabilities of a multi-layered protection system. Analysis data derived from the various vulnerability assessment activities are used to calculate this equation, which reflects the security system's effectiveness against each of the scenarios developed for the vulnerability assessment. If system effectiveness is unacceptable for a scenario, the root cause of the weakness must be analyzed and security upgrades must be identified. The scenarios are reanalyzed with the upgrades, and the successful upgrades are documented in the vulnerability analysis report.

Implementation. The culmination of the vulnerability assessment is development of a report documenting the analyses and results and a plan for implementing any necessary upgrades to achieve the required security system effectiveness. NNSA verifies the results of the vulnerability assessment report and the conclusions of the implementation plan. NNSA also provides management oversight of the actual implementation of security system upgrades.

5.12.6.2 Terrorist Impacts Analysis

Substantive details of terrorist attack scenarios and security countermeasures are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Depending on the malevolent, terrorist, or intentionally destructive acts, impacts may be similar to or could exceed bounding accident impact analyses prepared for the SWEIS. A separate classified appendix to this Final SWEIS has been prepared that considers the underlying facility threat assumptions with regard to malevolent, terrorist, or intentionally destructive acts. Based on these threat assumptions, the classified appendix evaluates the potential human health impacts using appropriate analytical models, similar to the methodology used in this SWEIS to analyze accident impacts. These data provide NNSA with information upon which to base, in part, decisions regarding activities at LANL.

5.13 Cumulative Impacts

In accordance with the Council on Environmental Quality regulations, a cumulative impact 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 impact analysis for this SWEIS includes (1) an examination of cumulative impacts presented in the *1999 SWEIS*; (2) impacts since the *1999 SWEIS* was issued, which are presented in this chapter; and (3) a review of the environmental impacts of past, present, and reasonably foreseeable actions for other Federal and non-Federal agencies in the region.

Reasonably foreseeable future actions that are likely to occur at LANL are described in Chapter 3, Section 3.3 under the Expanded Operations Alternative. Additional DOE or NNSA actions that could impact LANL include consolidation of nuclear operations related to production of radioisotope power systems; proposed operation of a Biosafety Level 3 Facility; a potential advanced fuel cycle facility; implementation of NNSA's complex transformation planning; and a disposal facility for Greater-Than-Class C waste.

Consolidation of DOE plutonium-238 activities at the Idaho National Laboratory as proposed in the *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems* (DOE/EIS-0373D) (*Consolidation EIS*) (DOE 2005c) would reduce plutonium-238 operations at LANL. Regardless of the decision on the *Consolidation EIS*, some plutonium-238 operations would continue at LANL. Therefore, very small changes in the impacts from plutonium-238 activities at LANL would be realized.

If current plutonium-238 operations were continued at the LANL Plutonium Facility Complex, as described under the *Consolidation EIS* No Action Alternative, manufacturing of up to 80 pits per year could still be accomplished within the LANL Plutonium Facility Complex. This production rate would be accomplished by consolidating a number of plutonium processing and support activities (such as analytical chemistry and materials characterization at the Chemistry and Metallurgy Research Replacement Facility). The impacts of the 80-pit-per-year production rate and plutonium-238 processing (at levels far above the level identified in the *Consolidation EIS*) were evaluated in both the LANL *1999 SWEIS* and this new SWEIS. These evaluations indicate there would be no additional cumulative effects from these activities.

NNSA is preparing an *Environmental Impact Statement for the Operation of a Biosafety Level-3 Facility at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EIS-0388D). Operation of the Biosafety Level 3 Facility would be consistent with the land use designation of Research & Development for Experimental Science. The facility is visually compatible with surrounding structures, therefore there are no impacts to visual resources. There would be no impacts to geology and soils and water resources from operations. Air emissions from the Biosafety Level 3 Facility laboratories would be HEPA-filtered, resulting in very minor air quality effects. Noise impacts would be limited to sounds from heating, ventilation, and air conditioning operations, consistent with other buildings in the area. Facility operations would have no effect upon ecological resources or prehistoric, historic, traditional or paleontological resources in the area. Facility personnel would come primarily from the existing LANL workforce, resulting in no socioeconomic impacts. Operations would be well within LANL infrastructure capability to provide utilities requirements such as electricity, water, and natural gas. There would be no discernable effects on local traffic conditions. There have been no reported cases of illnesses in the United States due to the release of diagnostic specimens during transport (Cummings 2007).

There would be a low potential risk of illness to site workers or visitors from routine operations involving biohazardous material and no public human health effect. Accident conditions would result in minimal or no impact to the public primarily because there would be severely limited opportunity for transport of an infectious dose of a biohazardous material to the public. Biohazardous material would be handled in open cultures only in a biosafety cabinet, where a

spill would be contained. In addition, biohazardous material would be handled in a liquid or solid culture container that would release very few organisms to the air if dropped or spilled. This means that one of the most critical risk factors, public exposure to an infectious dose from a biohazardous material, is greatly minimized, and therefore, the potential risk of disease would be very low. The EIS will evaluate slope stability at the Biosafety Level 3 Facility based on the recent update to the LANL probabilistic seismic hazard analysis (Cummings 2007, LANL 2007a).

DOE issued a Notice of Intent (NOI) to prepare the *Global Nuclear Energy Partnership Programmatic Environmental Impact Statement (GNEP PEIS)* (DOE/EIS-0396) on January 4, 2007 (72 FR 331). The Global Nuclear Energy Partnership (GNEP) would encourage expansion of domestic and international nuclear energy production while reducing nuclear proliferation risks, and reduce the volume, thermal output, and radiotoxicity of spent nuclear fuel before disposal in a geologic repository. The *GNEP PEIS* includes evaluation of a proposed advanced fuel cycle facility that would support research and development associated with the GNEP program. LANL is one of the DOE sites being considered for the research facility. The advanced fuel cycle facility would be a large shielded facility (approximately 1 million square feet [92,900 square meters]) (DOE 2008). Construction would begin in about 2014 with full operations planned for 2020. Potential cumulative impacts at LANL associated with the proposed advanced fuel cycle facility were addressed in the *Complex Transformation SPEIS* cumulative impacts analysis based on preliminary data (DOE 2007b). Where available, the cumulative impacts analyses in this SWEIS are based on more recent, but still preliminary data (DOE 2008). Impacts analyses for the *GNEP PEIS* are still underway so data for some resource areas are not available at this time and data that are included in this SWEIS could change prior to public release of the draft *GNEP PEIS*.

In 2006, NNSA outlined a comprehensive proposal, called Complex Transformation, for a smaller, more efficient nuclear weapons complex that would be better able and more suited to respond to future national security challenges (NNSA 2006b). On October 19, 2006, NNSA issued an NOI (71 FR 61731) to prepare a *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement - Complex 2030* (now called the *Complex Transformation Supplemental Programmatic Environmental Impact Statement* [*Complex Transformation SPEIS*]). This NOI also announced the cancellation of NNSA's previous proposal to build a modern pit facility for which NNSA issued a draft Supplemental EIS in June 2003 (68 FR 33487). LANL had been one of the sites under consideration for a modern pit facility. The NOI outlined some alternatives for transforming the nuclear weapons complex to better meet future national security requirements, including a proposal to construct and operate a consolidated plutonium center within the complex. Another proposal, to construct and operate a consolidated nuclear production center, was added during the scoping period, which ended in January 2007. Both of these proposals are analyzed in the Draft *Complex Transformation SPEIS* (DOE 2007b).

Implementation of the alternatives analyzed through the *Complex Transformation SPEIS* could result in changes to facilities and operations at LANL; for instance, NNSA is reconsidering construction of the nuclear facility portion of the Chemistry and Metallurgy Research Replacement project, and the impacts of not constructing that facility have been addressed in the Reduced Operations Alternative in this SWEIS. LANL is one of the sites under consideration for

a consolidated plutonium center or a consolidated nuclear production center. The Preferred Alternative in the Draft *Complex Transformation SPEIS* is to site a consolidated plutonium center at LANL with a capacity of up to 80 pits per year, based on the use of the existing and planned infrastructure already described in the SWEIS Expanded Operations Alternative. This SWEIS cumulative impacts analysis addresses the impacts of construction and operation of a consolidated nuclear production center at LANL; the center would include primarily new plutonium, highly enriched uranium, and weapons assembly/disassembly facilities.

On July 23, 2007, DOE issued an NOI to prepare an *Environmental Impact Statement for the Disposal of Greater-Than-Class-C Low-Level Radioactive Waste (GTCC EIS)* (72 FR 40135). The *GTCC EIS* will address the disposal of low-level radioactive waste that contains radionuclides in concentrations exceeding 10 CFR Part 61 Class C limits, generated by activities licensed by the U.S. Nuclear Regulatory Commission or an Agreement State, as well as DOE waste having similar characteristics. Certain sealed sources that would be managed at LANL under the Off-Site Source Recovery Project would be addressed in the *GTCC EIS*. LANL is being considered as one of eight candidate DOE disposal sites for Greater-Than-Class C waste, along with generic commercial disposal facility options in arid and humid environments. In addition, DOE is evaluating several disposal technologies in the *GTCC EIS* including geologic repositories, intermediate depth boreholes, and enhanced near-surface disposal facilities. The alternatives in the *GTCC EIS* could result in changes to facilities or operations at LANL, but because the changes have yet to be developed and evaluated, they are not included in the cumulative impacts analysis.

Primary sources of information on LANL contributions to cumulative impacts, other than the current and the *1999 SWEIS*, are listed below:

- *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada,* DOE/EIS-0250 (DOE 2002b).

- *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*, DOE/EIS-0026-S-2 (DOE 1997a).

- *Environmental Surveillance at Los Alamos during 2005*, LA-14304-ENV (LANL 2006h).

- *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems*, DOE/EIS-0373D (DOE 2005c).

- *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/EIS-0293 (DOE 1999d).

- 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.

- *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, DOE/EIS-0250F-S1D (*Draft Yucca Mountain SEIS*) (DOE 2007a)

- *Draft Complex Transformation Supplemental Programmatic Environmental Impact Statement*, DOE/EIS-0236-S4 (DOE 2007b).

It is also necessary to consider activities implemented by other Federal, state, and local agencies and individuals outside LANL, but within the its region of influence, 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 from LANL. Due to this distance, cumulative impacts other than air emissions are not expected to be influenced by Sandia National Laboratories. For air emissions, the 2005 Sandia National Laboratories dose to the offsite MEI is estimated to be 0.0001 millirem and the 2005 population dose is estimated to be 0.00017 person-rem (SNL 2006). The Sandia National Laboratories MEI dose is 0.0012 percent of the LANL MEI dose, and the Sandia National Laboratories population dose is 0.00047 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; Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, and Taos Counties; the Santa Clara and San Ildefonso Pueblos; the New Mexico Department of Transportation; the Bureau of Land Management; 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, Sandoval, and San Miguel Counties did not identify any major future actions (Gallegos 2006, Pino 2006, Scales 2006, Tafoya 2006). Rio Arriba 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.

- Los Alamos County identified residential, commercial, and industrial development on areas transferred from DOE to the county. Residential development will include about 120 homes on 70 acres (28 hectares) in White Rock, with a goal to build approximately 1,000 new homes in Los Alamos County within the next 5 years (Jeppson 2006).

- Taos County identified about 20 subdivisions scheduled for review this year, including 150 to 750 new homes on 300 to 1,500 acres (121 to 607 hectares) (Trujillo 2006). Many of these homes would be located more than 50 miles (80 kilometers) from LANL.

In addition, Los Alamos County is closing the Los Alamos County Landfill and considering use of the San Juan-Chama water allotment. The existing Los Alamos County Landfill will close in 2008. Solid wastes will be shipped out of the county via a new transfer station (LAC 2007). The Bayo Wastewater Treatment Facility in Santa Fe County was replaced in 2007 with an advanced wastewater treatment facility in Pueblo Canyon (Glasco 2008). The San Juan-Chama Project

includes examining the feasibility of pumping 1,200 acre-feet of Rio Grande water up the mesa to Los Alamos County (LAC 2004b).

A number of projects were identified that would affect the Santa Fe National Forest, including invasive plant control, road closure, thinning and prescribed fire, fire salvage, mineral extraction; and grazing allotment (USFS 2005b).

The Bureau of Land Management identified smaller projects that would affect the Bureau of Land Management lands such as continued road maintenance, timber harvesting, and grazing permit renewals, as well as larger projects such as the Power Project; New Mexico Products Pipeline; Mid-America Pipeline Western Expansion Project; Santa Domingo Pueblo-Bureau of Land Management land exchange; San Pedro Rock Quarry; treatment of saltcedar and other noxious weeds; and the Buckman Water Diversion Project (BLM 2006a). These larger projects are described below.

- The Power Project involves upgrading and enhancing the electrical power transmission line system in the Santa Fe and Las Vegas, New Mexico, area and widening the existing right-of-way (BLM 2004b).

- The New Mexico Products Pipeline involves adding two additional segments to an existing petroleum products pipeline. Neither of the new segments would be within 50 miles (80 kilometers) of LANL (BLM 2006b).

- 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 2006c). This segment would be constructed parallel to and 25 feet (7.6 meters) away from the existing pipeline right-of-way.

- The Santa Domingo Pueblo-Bureau of Land Management land exchange involves an equal-value exchange of approximately 7,376 acres (2,985 hectares) of the Bureau of Land Management lands for 645 acres (261 hectares) of Santa Domingo Pueblo land in Santa Fe and Taos Counties (BLM 2002). A record of decision has not been issued for this land exchange.

- The San Pedro Mountains Rock Quarry Project has been delayed and will be incorporated into the revised Taos Field Office Resource Management Plan (BLM 2006a).

- The treatment of saltcedar and other noxious weeds is an ongoing adaptive management program for control of exotic weeds. An EA was prepared for this project that resulted in a Finding of No Significant Impact (FONSI) (BLM undated). The project area is approximately 40 miles (64 kilometers) from the LANL boundary.

- The Buckman Water Diversion Project would divert water from the Rio Grande for use by the city of Santa Fe and Santa Fe County (BLM 2006a). The diversion project would withdraw water from the Rio Grande approximately 3 miles downstream from where Route 4 crosses the river. The pipelines for this project would largely follow existing

roads and utility corridors. Decreased water withdrawals from the Buckman Well Field would benefit groundwater levels. Potential impacts on fish and aquatic habitats below the proposed project due to effects on water flow would be minimal (BLM and USFS 2007).

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 2006).

No new Federal highways are planned within 50 miles (80 kilometers) of LANL (CFLHD 2005). 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 (NMDOT 2007):

- U.S. Route 84 reconstruction - Pojoaque to Española
- NM 502 reconstruction
- NM 344 four-lane road construction near Interstate 40
- NM 585 Reconstruction Project.

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 2005b).

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 include the following sources:

Bureau of Land Management

- *Final Environmental Impact Statement for the Buckman Water Diversion Project* (BLM and USFS 2007).
- Factsheet: "San Juan Public Lands (San Juan Field Center & San Juan National Forest) Draft Environmental Impact Statement (EIS) Northern San Juan Basin Coalbed Methane Project," (BLM 2004a).

- *Farmington Proposed Resource Management Plan and Final Environmental Impact Statement*, BLM-NM-PL-03-014-1610 (BLM 2003b).

- *Farmington Resource Management Plan with Record of Decision* (BLM 2003c).

- Final Air Dispersion Analysis Technical Report, "Revision to the BLM Farmington Resource Management Plan and Amendment of the Rio Puerco Resource Management Plan," (BLM 2003a).

U.S. Forest Service

- "Schedule of Proposed Action 01/01/2006 to 03/31/2006, Santa Fe National Forest," (USFS 2006).

- *Record of Decision for Invasive Plant Control Project Carson and Santa Fe National Forests in Colfax, Los Alamos, Mora, Rio Arriba, San Miguel, Santa Fe, Sandoval, and Taos Counties, New Mexico* (USFS 2005a).

U.S. Bureau of Reclamation

- *Upper Rio Grande Basin Water Operations Review Draft Environmental Impact Statement* (ACE, Reclamation, and ISC 2006).

- *Final Environmental Impact Statement City of Albuquerque Drinking Water Project* (Reclamation 2004).

National Park Service

- "Fire Management Plan for Bandelier National Monument," (NPS 2005b).

State of New Mexico

- *2004-2006 State of New Mexico Integrated Clean Water Act §303(d) §305(b) Report* (NMED 2004a).

- *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (NMAC 20.6.4).

Each resource area in this SWEIS was reviewed to identify potential cumulative impacts and the analyses are summarized in the following paragraphs. The level of detail provided for each resource area depends on the extent of the potential cumulative impacts.

Land Resources

Land resources include impacts to land use and the visual environment. LANL actions proposed under this SWEIS would not likely result in any incompatible land uses. Under the *Land Conveyance and Transfer Environmental Impact Statement (Land Conveyance and Transfer EIS)* (DOE/EIS-0293), land conveyed and transferred by LANL to Los Alamos County and conveyed to the U.S. Department of the Interior in trust for the San Ildefonso Pueblo, could be developed.

Up to 826 acres (334 hectares) of this land could be developed after the transfer and conveyance, representing a potential introduction of incompatible land uses (land in adjacent areas that have land use designations that interfere with or restrict one another) and a loss of recreational opportunities such as hiking or fishing. Under the Expanded Operations Alternative, cumulative impacts would include fewer restrictions on future use of lands remaining part of LANL under the MDA Removal Option than the MDA Capping Option. For the Removal Option, the wastes currently buried in the MDAs would be removed completely and shipped offsite or consolidated in onsite disposal areas, which would allow use of some of these MDAs for other purposes. The Expanded Operations Alternative also would include the Security-Driven Transportation Modification Project, which would not conflict with current land use designations except for an option to construct a bridge over Sandia Canyon. Construction of the Sandia Canyon Bridge would depart from current site development plans. Overall cumulative impacts to land use in the region, however, would be small.

Transfer and conveyance of LANL land could result in visual impacts such as diminished viewsheds and increased ambient light from residential, industrial, and commercial development on previously undeveloped land. For example, Los Alamos County has indicated there are proposals to develop approximately 1,000 new residences on land adjacent to LANL and to develop land for light industry along the Los Alamos Canyon rim across from the airport.

LANL is one of the sites under consideration for a consolidated nuclear production center in the *Complex Transformation SPEIS.* Construction of the consolidated nuclear production center facilities could require up to 545 acres (221 hectares) of land in TA-16 or in TA-16 and TA-55. This proposal is consistent with current land use plans for these TAs. The total land area required for the GNEP advanced fuel cycle facility would be approximately 373 acres (151 hectares) with 144 acres (58 hectares) inside a property protection fence, including approximately 62 acres (25 hectares) within a perimeter intrusion, detection, and assessment system (DOE 2008).

Geology and Soils

Projects proposed under the Expanded Operations Alternative in this SWEIS combined with the *Complex Transformation SPEIS* consolidated nuclear production center facilities and GNEP advanced fuel cycle facility would impact mineral resources at LANL and the surrounding region. Primary impacts would be due to the proposed closures of the MDAs under the Consent Order through either waste containment in place (the MDA Capping Option) or waste removal by excavation and subsequent disposal (the MDA Removal Option).

If the waste at the MDAs remains in place, and some small contaminated areas in TA-49 are capped, the final covers would require 750,000 to 2,000,000 cubic yards (570,000 to 1,500,000 cubic meters) of crushed tuff through fiscal year (FY) 2016. Up to 460,000 cubic yards (350,000 cubic meters) of additional rock, gravel, topsoil, and other bulk materials would be required for the final surface and erosion control. The total quantity of crushed tuff, rock and other bulk materials would range from 1.2 to 2.5 million cubic yards (0.92 to 1.9 million cubic meters). If the waste were removed, approximately 1,300,000 cubic yards (1,000,000 cubic meters) of backfill would be needed to replace the excavated waste and contaminated soil, as well as 61,000 cubic yards (47,000 cubic meters) of rock, gravel, topsoil, and other bulk

materials for erosion control and site restoration. In addition, from 220,000 to 600,000 cubic yards (170,000 to 460,000 cubic meters) of crushed tuff and about 160,000 cubic yards (120,000 cubic meters) of topsoil, rock, and other bulk materials would be needed for capping the remaining disposal units at Area G in TA-54, and for capping other landfills and contaminated areas such as those in TA-49. A total of 1.8 to 2.2 million cubic yards (1.4 to 1.7 cubic meters) of crushed tuff, rock, and other bulk materials would be needed.

For economic and feasibility reasons, these materials would need to be excavated from borrow pits and quarries in the LANL area (Stephens and Associates 2005). Obtaining the materials locally would minimize transportation impacts. The only borrow pit now in use at LANL is the East Jemez Road Borrow Pit in TA-61. There would be sufficient tuff available at the pit to provide the needed volumes of crushed tuff. Other sources, however, would be required to provide the other materials (such as soil and coarse material for erosion control) needed to complete the MDA remediation. There are 24 stone and aggregate mines or quarries in the surrounding counties (Rio Arriba, Sandoval, and Santa Fe Counties) producing sand, gravel, base course, caliche, crushed rock, rip-rap, scoria, fill dirt and top soil (Pfeil et al. 2001). Borrow materials also could be collected from onsite areas of opportunity such as facility construction or DD&D areas where excess uncontaminated soils that meet the backfill or capping criteria have been excavated. Use of excavated soils as fill or cap material would minimize the need to import geologic materials from outside the immediate LANL area.

Water Resources

Activities at LANL, in combination with other activities in the vicinity, could affect regional water resources. To assess the cumulative effects on surface water, current and reasonably foreseeable future activities within the watersheds and streams that receive surface water from LANL were considered. The effects of past projects are reflected in the description of the affected environment and current surface water conditions. Most watersheds have headwaters on Santa Fe National Forest or Bandelier National Monument land. The region of consideration for cumulative impacts on groundwater extends from LANL further east toward Santa Fe and focuses on impacts on the regional aquifer due to the activities of landowners and managers other than LANL.

Past effluent discharges from LANL activities, in some cases occurring at least 50 years ago, have contaminated sediments in several canyons and continue to affect the quality of stormwater runoff and stream flows (LANL 2005h). As described in Chapter 4, Section 4.3.1, of this SWEIS, however, current monitoring documents that regional water quality does not exceed state standards downstream from LANL and the existing contamination is expected to diminish over time regardless of the SWEIS alternative selected. The reach of the Rio Grande between San Ildefonso Pueblo and Cochiti Reservoir, which receives surface water flows from LANL, has been identified by the New Mexico Environment Department (NMED 2004a) as impaired because it does not support its designated uses as a cold water or warm water fishery. Turbidity is identified as the probable cause of impairment, but the impairment stems from unknown natural sources. Although turbidity could be exacerbated by earthmoving activities anywhere in the watershed, planned mitigation measures for Federal and state projects would keep soil erosion to a minimum and ensure that additional turbidity is not a reasonably foreseeable cumulative impact.

Fire and Vegetation Management

Fire and fuels management is an annual activity within the Santa Fe National Forest and Bandelier National Monument. Management of the areas within the watersheds upstream from LANL are of primary interest because activities such as prescribed burns, mechanical and manual thinning, native plant revegetation, and establishment of fire breaks could accelerate erosion and sediment delivery to streams, which would affect surface water quality and quantity.

Since 1981, areas within Bandelier National Monument along the southern LANL boundary have been treated with prescribed burns. An area parallel to the southern LANL boundary was thinned from 2002 to 2004 (NPS 2005b). The Fire Management Plan (NPS 2005b), the working document for guiding wildland fire management actions and activities in Bandelier National Monument, identifies two primary fire management areas. Most of the area near LANL falls within the Wildland Fire Use unit where most natural ignitions will be allowed to burn. A small area including the entire Upper Frijoles watershed near the southern LANL boundary and the detached Tsankawi unit located east of State Highway 4 and near San Ildefonso Pueblo fall within the Fire Suppression unit. In the Fire Suppression unit, all natural ignitions are declared unwanted wildland fires and are suppressed, but prescribed burns are utilized as needed.

The Santa Fe National Forest Schedule of Planned Operations does not list specific fire management or other actions in the watersheds that cross LANL over the next year (USFS 2006), but some actions are likely to occur within the next 5 to 10 years. The Santa Fe National Forest and Bandelier National Monument fire management policies and procedures include requirements for mitigation and stabilization measures to ensure that vegetation is re-established and offsite erosion and sedimentation are minimized. For this reason, fire management activities in the region, together with those planned at LANL, are not expected to adversely affect surface water quality or quantity. Instead, these actions may benefit surface water bodies by reducing the potential for the impacts of severe wildfires like the Cerro Grande Fire.

An estimated 300 to 800 acres (121 to 324 hectares) will be treated annually in the Santa Fe National Forest to control invasive weeds (USFS 2005a). Treatments will combine biological, chemical, and mechanical methods. Some of the areas to be treated are likely to be within watersheds that cross LANL, but mitigation measures will be implemented to ensure that there are no adverse effects to water resources. These activities, combined with those planned for LANL, will not affect surface water resources.

Cerro Grande Fire Structures

Structures installed in and around LANL after the Cerro Grande Fire altered surface water flows to retain sediment. The Northern Rio Grande Resource Conservation and Development Council led an effort to rebuild fences, bridges, culverts, and other structures on private land that were destroyed by the Cerro Grande Fire (NRCS 2004). On the Santa Clara and San Ildefonso Pueblos, 15 flood prevention projects were implemented by the U.S. Army Corps of Engineers, including strengthening an existing levee system, installing grade control structures, upgrading water crossings, and installing protection around facilities (ACE 2000). Most private structures are likely to remain in place, but removal of some structures is planned by the U.S. Army Corps of Engineers, in addition to removal of those at LANL; their removal could increase sediment

loads temporarily. Where structures are removed, the responsible agencies will likely install temporary sediment traps to minimize downstream sediment transport that would adversely affect surface water quality.

Land Conveyance and Transfer

The *Land Conveyance and Transfer EIS* projected minor increases in the amount of surface water runoff entering the stream system and an approximate 30 percent increase in groundwater withdrawals from the regional aquifer due to new residential development (DOE 1999d).

Rio Grande Flows

Proposed changes in the operations of Abiquiu Dam, Cochiti Dam, and other water structures downstream are currently under consideration by the U.S. Army Corps of Engineers, Bureau of Reclamation, and New Mexico Interstate Stream Commission (ACE, Reclamation, ISC 2006). These changes would slightly affect stream flows in the Rio Chama and Rio Grande, depending on which alternative is selected for implementation, but none would affect the surface water flows of the tributaries that flow through and immediately downstream of LANL. Changes to flows below Abiquiu Dam are not projected to affect hydropower generation used to supplement electricity in Los Alamos County (ACE, Reclamation, ISC 2006).

The city of Albuquerque is currently constructing a dam across the Rio Grande at Albuquerque to divert as much as 94,000 acre-feet per year (11,600 hectare-meters per year) to fully consume their San Juan-Chama Project water. A Final EIS evaluating the impacts of this action was published on March 5, 2004 (Reclamation 2004) and the ROD was issued on June 1, 2004. Direct effects on hydrology from any of the action alternatives were projected to include a constant increase of about 60 to 70 cubic feet per second (1.7 to 2.0 cubic meters per second) from flows of the city's San Juan-Chama Project water between Abiquiu Reservoir and Albuquerque at any time the diversion system is operating (Reclamation 2004). Contamination from canyons flowing through LANL that outlet into the Rio Grande and any potential changes in Rio Grande flows from proposed changes at LANL under any action alternative are not likely to affect Albuquerque's water quality or quantity because any contaminated sediments would be trapped behind the dam and flows would be regulated by water operations at Cochiti Dam.

The city of Santa Fe is proposing to install a diversion dam on the east bank of the Rio Grande across from San Ildefonso Pueblo and upstream from White Rock. The purpose of this project is to seek "sustainable means of accessing surface water supplies that would use the applicants' water rights by diverting San Juan-Chama Project water and native Rio Grande water while reducing their reliance on over-taxed ground water resources" (BLM and USFS 2007). The Buckman Well Field currently consists of thirteen wells that draw from the regional aquifer, but well yields have been reduced and groundwater levels have declined since its inception, depleting nearby streamflows (BLM and USFS 2007). The diversion, which would divert up to 5,230 acre-feet per year from the river (BLM and USFS 2007), would be located in the Rio Grande near the area where Mortandad Canyon outlets on the west side of the river and downstream from the outlets of Pueblo, Sandia, and Los Alamos Canyons.

Santa Fe proposes to continue providing residual offsets from past pumping of the Buckman Well Field (currently about 2,500 acre-feet per year). Under this proposal, pumping from the

Buckman Well Field would be scaled back to a long-term average of approximately 1,000 acre-feet per year. The cone of depression in the regional aquifer from current pumping of the well field has been modeled to extend to the west side of the Rio Grande, encompassing White Rock and the eastern part of LANL (BLM and USFS 2007). The *Final Environmental Impact Statement for the Buckman Well Field Project* predicts that, if the proposed project were implemented, direct diversions with reduced pumping from the Buckman Well Field would result in a 1 percent reduction in Rio Grande flows below the diversion and a significantly smaller cone of depression after the diversion project is established because pumping and aquifer depletions would be greatly reduced (BLM and USFS 2007). The projected reductions of aquifer depletions from reduced pumping of the Buckman Well Field would help offset projected increases in water use by LANL and Los Alamos County.

Under the Radioactive Liquid Waste Treatment Facility action to construct liquid effluent evaporation tanks with the goal of zero discharges from the facility into Mortandad Canyon, reduction of contaminant contributions by eliminating the outfall would positively impact surface water quality and possibly benefit Santa Fe's project. Improved water quality monitoring would also have positive impacts.

Los Alamos County and the San Ildefonso Pueblo are considering diverting Rio Grande water. There also may be other projects similar to the Buckman Project that would divert San Juan-Chama and native waters from the Rio Grande in the vicinity of LANL. The San Ildefonso Pueblo installed a single unit infiltration collector well as a pilot project in 2001. These projects may contribute to cumulative effects on the regional surface water system, but are less well defined, so the effects are impossible to predict at this time (BLM and USFS 2007).

Groundwater Quality

Additional modeling and monitoring wells are being installed to determine the foreseeable future impacts on the regional aquifer from radionuclides and other contaminants that are thought to be migrating through the bedrock. Questions about the rate and direction of contaminant movement must be more thoroughly investigated before the cumulative effects on water resources can be evaluated. LANL will conduct future data collection activities and analyze existing data to better define the interaction between groundwater and the rock matrix. This understanding of the hydrologic and chemical components at the site will aid in developing sound conceptual models of flow and transport through the fractures and matrix of the vadose zone into the saturated zone. The new data, coupled with improvements in numerical flow and transport models and improved calculational techniques, will enable better prediction of flow and transport of groundwater in the LANL region and more accurately define the ultimate impacts on the regional groundwater resources below LANL. Recent news of chromium in the regional aquifer (Snodgrass 2006) also will require additional research to determine the source of the contaminant.

The North Railroad Avenue groundwater contamination plume located over 12 miles (19 kilometers) from the LANL boundary is undergoing remediation. Tetrachloroethylene (perchloroethylene) is the leading concern from this plume because it is the most widespread and is found in the highest concentrations in groundwater. Other contaminants present with possible health effects include trichloroethylene, cis-1,2dichloroethylene, and trans-1,2dichloroethylene (EPA 2006b). For this plume, bioremediation pilot testing began in May 2007 (NMED 2007a).

Because this contamination plume will be remediated to protect drinking water and the Rio Grande from future chlorinated groundwater solvents, it is not expected to migrate into groundwater and surface water impacted by past or present LANL operations.

Air Quality and Noise

Table 5–80 presents the estimated maximum cumulative air quality concentrations offsite or at the site boundary from operations of both the Expanded Operations Alternative and the Complex Transformation consolidated nuclear production center. No data are available at this time related to operation of the GNEP advanced fuel cycle facility. Cumulative concentrations of all of the criteria pollutants except the 24-hour standard for nitrogen dioxide and total suspended particulates are expected to remain in compliance with Federal and state ambient air quality standards. The 24-hour standard for nitrogen dioxide and total suspended particulates could be exceeded on occasion. Based on these potential exceedances, more detailed site-specific analyses would need to be performed if LANL is selected as the site for construction of the consolidated nuclear production center. Cumulative air quality impacts for the No Action Alternative or the Reduced Operations Alternative in combination with the proposed consolidated nuclear production center would be lower than those shown in the table.

Table 5–80 Estimated Maximum Cumulative Air Quality Concentrations at the Site Boundary (micrograms per cubic meter)

Criteria Pollutant	*Averaging Period*	*LANL SWEIS Expanded Operations and Consolidated Nuclear Productions Center* [a]	*Most Stringent Standard or Guideline* [a]
Carbon monoxide	8 Hours 1 Hour	286 1,349	7,900 11,900
Nitrogen dioxide	Annual 24 Hours	26 161	75 150
Sulfur dioxide	Annual 24 Hours 3 Hours	13 93 480	42 209 1,050
Total suspended particulates	Annual 24 Hours	9.7 202	60 150
PM_{10}	Annual 24 Hours	26 143	50 150

PM_{10} = particulate matter less than or equal to 10 microns in diameter, TA = technical area.

[a] Data from Table 5–8 of this *LANL SWEIS* and Table 5.1.4-12 of the Draft *Complex Transformation SPEIS* (DOE 2007b). Criteria pollutants released from LANL operations are emitted primarily from combustion sources such as boilers and emergency generators. Although motor vehicle emissions have an impact on local air quality, no quantitative analysis of vehicle emissions was performed as part of the *LANL SWEIS*. The contribution of vehicle emissions was assumed to be included in the background monitoring concentrations discussed in the current and *1999 SWEIS*. The results of the modeling demonstrate that simultaneous operation of LANL's air emission sources at maximum capacity as described in the Title V permit application would not exceed any state or Federal ambient air quality standards. All of the equipment at the TA-3 Co-Generation Complex, including additional combustion turbine generators that would be constructed in the 2007 to 2013 timeframe, would operate within the emission limits specified in the air quality permit.

Effects on air quality from construction, excavation, and remediation activities could result in temporary increases in air pollutant concentrations at the site boundary and along roads to which the public has access. These impacts would be similar to the impacts that would occur during construction of a housing project or a commercial complex. Emissions of fugitive dust from these activities would be controlled with water sprays and other engineering and management

practices as appropriate. The maximum ground-level concentrations offsite and along roads to which the public has regular access would be below the ambient air quality standards, except for possible short-term concentrations of nitrogen oxides and carbon monoxide for certain projects that could occur near the site boundary. Appropriate management controls and scheduling would be used to minimize impacts on the public and to meet regulatory requirements. The impact on the public would likely be minor.

The increase in employee vehicles and the increase in other vehicles resulting from the population increase projected by the state would result in increases in vehicle emissions along the routes used to access the site. As discussed in Section 4.4.2.1 the area around Los Alamos and most of New Mexico is designated as attaining for the National Ambient Air Quality Standards for carbon monoxide, nitrogen oxides, ozone, and the other criteria pollutants (40 CFR 81.332). Even with the continuing growth in population there has been a decreasing or steady trend in concentrations in the region of carbon monoxide, nitrogen oxides, and ozone. Carbon monoxide and nitrogen oxides concentrations are well below the ambient standards (EPA 2006a).

The impacts of toxic air pollutants were assessed based on the analysis in the *1999 SWEIS* and the emission estimates in the LANL Yearbooks. In all but two cases, the estimated toxic pollutant emissions were below the corresponding guideline values established for the screening analysis in the *1999 SWEIS*. Guideline values are the levels established to screen emission rates for further analysis. The two cases where estimated emission rates were above guideline values and were referred to the human health and ecological risk assessment processes were: (1) emissions from High Explosives Firing Facilities operations at TA-14, TA-15, TA-36, TA-39, and TA-40; and (2) additive emissions from all pollutants from all TAs on receptor sites located near the Los Alamos Medical Center. The risk assessment analysis demonstrated that the pollutants released for these two cases would not be expected to cause air quality impacts that would affect human health and the environment.

Cumulative air quality impacts from offsite construction and operation activities were also evaluated. The maximum impacts from construction activities (including fugitive dust) for oil and gas development in the region were shown to occur very close to the source, with concentrations decreasing rapidly with distance (BLM 2003b). Therefore, it is expected that offsite air emissions from disturbance and construction would not contribute substantially to cumulative impacts at LANL.

Impacts of inert pollutants (pollutants other than ozone and its precursors) are generally limited to a few miles downwind from a source (BLM 2003b). For emissions from the well fields analyzed in the *Farmington Proposed Resource Management Plan and Final Environmental Impact Statement* (BLM 2003b), the distance where the nitrogen dioxide concentrations drop below their significance levels would be 15.6 to 24.9 miles (25 to 40 kilometers). Therefore, it is expected that emissions from operation of offsite facilities would not contribute substantially to cumulative impacts at LANL, which is about 100 miles (160 kilometers) away.

In contrast, the maximum effects of volatile organic compounds and nitrogen oxides emissions on ozone levels usually occur several hours after they are emitted and many miles from the sources (BLM 2003b). Although LANL is outside the study areas for the Northern San Juan Basin Coalbed Methane Project, the EIS for this project (BLM 2004a) determined that the

cumulative impacts of oil and gas development combined with regional emissions from other sources could exceed visibility thresholds (9 to 25 days annually) in the Class I Areas of the Weminuche Wilderness and Mesa Verde National Park. These impacts could be reduced to 1 to 17 days annually if stricter emissions controls are required for new emission sources of nitrogen oxide (BLM 2004a). LANL is approximately 100 miles (161 kilometers) from the Bloomfield Farmington and San Juan Basin Coalbed Methane Project areas, and it is unclear whether such distant emissions could contribute to cumulative visibility impacts at the Bandelier National Monument.

The air quality analysis in the *Farmington Proposed Resource Management Plan and Final Environmental Impact Statement* (BLM 2003b) included consideration of air emissions from the highly industrialized Bloomfield gas corridor, El Paso Blanco compressor station, Conoco San Juan Gas Plant, and Four Corners and San Juan Power Plants (BLM 2003a). Although LANL is outside the study areas for the *Farmington Proposed Resource Management Plan and Final Environmental Impact Statement* (BLM 2003b), the ROD for this study (BLM 2003c) included a number of mitigation measures designed to reduce cumulative air quality impacts from gas and oil wells and pipelines. One of the more significant mitigation measures requires that new and replacement wellhead compressors limit nitrogen oxide emissions to levels less than 10 grams per horsepower-hour, and that each pipeline compressor station limit its total nitrogen oxide emissions to levels less than 1.5 grams per horsepower-hour. This requirement would apply to all new and replacement compressor engines unless the proponent can demonstrate (using air pollutant dispersion modeling) that a specific higher emission rate would not cause or contribute to exceedance of any ambient air quality standard. This measure is intended to substantially reduce the level and extent of emissions that form ozone throughout the region and to reduce visibility impacts on Class I Areas such as Mesa Verde National Park and Bandelier National Monument (BLM 2003b).

The incremental increase in criteria and toxic pollutant emissions identified in the *Conveyance and Transfer EIS* would not be major and would not cause or contribute to exceedance of any ambient air quality standard.

Ecological Resources

The continuing conveyance and transfer of LANL land would result in the cumulative impacts of the conveyance and transfer of 770 acres (312 hectares) of undeveloped habitat that could be developed. A transfer of resource protection responsibility may also result in a less rigorous environmental protection review process. Electrical power system upgrades would have minimal effects on vegetation and temporary impacts on wildlife. The Wildfire Hazard Reduction Program would have short-term impacts on wildlife, create historic forest conditions, and positively affect the Mexican spotted owl by providing a healthier habitat. Disposition of flood retention structures would have short-term impacts on wildlife and its habitat and potentially on downstream wetlands as well due to possible habitat disturbance and changes in the water flow rate. The Trails Management Program would have short-term impacts on wildlife and increase the diversity of wildlife where trails are closed. Section 5.5 of this SWEIS has a detailed discussion of the effects of each alternative on ecological resources.

Impacts associated with construction of the *Complex Transformation SPEIS* consolidated nuclear production center or the GNEP advanced fuel cycle facility at LANL would include the loss of habitat and of less mobile wildlife, such as reptiles and small mammals. More mobile species, such as birds or large mammals, would be displaced as a result of construction activities; however, these species could relocate to adjacent less developed areas. Successful relocation of more mobile species may not occur due to competition for resources and the carrying capacity limitations of areas outside the proposed development. Best management practices and implementation measures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* would be used during construction activities to minimize the potential for adverse effects to plant and animal communities and on threatened and endanger or special interest species. Proposed construction sites would be surveyed for the presence of special status species before construction begins, and mitigation actions would be developed. After construction, temporary structures would be removed and the sites reclaimed.

Human Health

Table 5–81 presents the estimated cumulative impacts from radiological emissions and radiation exposure from the LANL SWEIS alternatives and the Complex Transformation consolidated nuclear production center (the GNEP advanced fuel cycle facility is not represented in the table because available preliminary data do not include offsite radiological impacts). Cumulative impacts to the public would likely remain within the maximum level of impacts forecast under the SWEIS Expanded Operations Alternative. The offsite impacts from the addition of the consolidated nuclear production center would be essentially unchanged due to the assumed closure of existing LANL facilities whose functions would be included in the new center. No LCFs would be expected for the MEI or in the general population. The dose to the offsite MEI would be expected to remain within the 10 millirem per year limit required by 40 CFR 61, Subpart H, National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities. There would be no increase in the risk of LCFs among the general public.

Collective worker doses would increase if the Expanded Operations Alternative MDA Removal Option were to be implemented. Collective worker doses would increase from about 280 person-rem per year to an annual average of 540 person-rem per year. The 540 person-rem dose 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 was completed. Individual worker dose would be maintained ALARA and within applicable regulatory limits. Worker doses would be expected to increase from operation of the consolidated nuclear production center at LANL. The net increase in collective worker dose would be approximately 105 person-rem per year. The increased annual risk of an LCF in the worker population would be 0.06 (or for each 17 years of operation, 1 additional LCF might be expected in the worker population). The most recent preliminary data for the GNEP advanced fuel cycle facility do not include a worker population dose estimate.

Table 5–81 Estimated Cumulative Radiological Impacts

Activity	General Public				Worker Population	
	MEI		Population Within 50 Miles			
	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 Alternatives						
No Action	7.8	4.7×10^{-6}	30	0.018	280	0.17
Reduced Operations	0.78	4.7×10^{-7}	6.1	0.0037	257	0.15
Expanded Operations	8.2	4.9×10^{-6}	36	0.022	543	0.33
Complex Transformation SPEIS [a]						
Consolidated Nuclear Production Center	NC	NC	0.38	2.3×10^{-4}	386	0.23
Minus Plutonium Facilities Complex	NC	NC	-0.20	-1.2×10^{-4}	-220	-0.13
Minus CMR Building	NC	NC	-0.43	-2.6×10^{-4}	-61	-0.04
Total (SPEIS and Expanded Operations)	8.2	4.9×10^{-6}	36	0.022	648	0.39
Dose Limit [b]	10	NA	NA	NA	NA	NA

MEI = maximally exposed individual, LCF = latent cancer fatality, NA = not applicable, NC = no change, CMR = Chemistry and Metallurgy Research.

[a] *Complex Transformation SPEIS*, Tables 5.1.11-2 and 5.1.11-3 (DOE 2007b).

[b] 10 millirem per year limits as required by 40 CFR 61, Subpart H.

Monitoring results for radioisotopes and chemicals in groundwater, surface water, sediments, and soil in and around LANL (see Appendix F, Section F.3) account for any contaminants that have accumulated since the beginning of operations at LANL. Appendix C presents detailed LANL radiological emissions and radiation dose data; all doses are a very small fraction of the normal background dose received by the population in and around LANL. Section 4.6.1 of this SWEIS provides detailed information on cancer mortality and incidence rates in New Mexico and all counties surrounding LANL. These data, along with the final LANL Public Health Assessment, issued on August 31, 2006 by the U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR 2006), show that, "there is no evidence of contamination from LANL that might be expected to result in ill health to the community" and "[o]verall, cancer rates in the Los Alamos area are similar to cancer rates found in other communities." The Centers for Disease Control and Prevention is in the early phase of the dose reconstruction efforts at LANL. As described in their January 2006 publication titled *Interim Report of the Los Alamos Historical Document Retrieval and Assessment Project* (CDC 2006), dose reconstruction is a five phase process involving: (1) retrieval and assessment of data; (2) initial source term development and pathway analysis; (3) screening dose and exposure calculations; (4) development of methods for assessing environmental doses; and (5) calculation of environmental exposures, doses, and risks. The Centers for Disease Control and Prevention project at LANL is still in the initial information gathering phase. Therefore, this information is not available to include in the cumulative impacts analysis.

Cultural Resources

Actions proposed under the *Land Conveyance and Transfer EIS* would result in the cumulative impacts of the conveyance and transfer of cultural resources out of the responsibility and protection of the DOE. A consequence of this conveyance and transfer would be potential

damage to cultural resources due to future development and impacts to the protection and accessibility of Native American sacred sites. The environmental justice cumulative impacts section contains additional information regarding cultural resources with respect to environmental justice.

Proposed sites for the *Complex Transformation SPEIS* consolidated nuclear production center facilities in TA-16 or TA-55 and the GNEP advanced fuel cycle facility in TA-36 that involve undisturbed lands are likely to contain archaeological resources due to the high density of these resources in the region. The potential impacts to cultural resources would not be known until a specific footprint on the ground is selected for the proposed facilities. Prior to any ground-disturbing activity, DOE would identify and evaluate any cultural resources that could potentially be impacted by construction activities. Methods for identification could include archival research and consultation with interested Native American tribes. DOE would determine the possibility for impacts to National Register of Historic Places-eligible resources and implement appropriate measures to avoid, reduce, or mitigate the impacts. Identification, evaluation, determination of impact, and implementation of measures would be conducted in consultation with the New Mexico State Historic Preservation Officer and in accordance with *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (LANL 2006f). If previously unknown cultural or paleontological resources, such as subsurface resources, were discovered during construction, activities in the area of the discovery would stop and the discovery would be evaluated and treated appropriately, as determined by DOE in consultation with the New Mexico State Historic Preservation Officer and other interested parties.

Socioeconomics

Important cumulative socioeconomic impacts occur when the net effect of regional projects or activities would substantially alter the location and distribution of regional populations, substantially raise the unemployment rate, substantially affect the local housing market, or result in the need for new social services. Past and present economic conditions associated with continued operations of LANL are described in Chapter 4, Section 4.8.1, of this SWEIS.

As shown in **Table 5–82**, there are four other major activities that could have significant socioeconomic impacts on the region in the future. These include operation of the Los Alamos Research Park, the conveyance and transfer of land from LANL in accordance with the provisions of Public Law 105-119, the potential siting of a new consolidated nuclear production center, and the potential siting of a GNEP advanced fuel cycle facility at LANL.

By 2011, LANL operations under the No Action Alternative could account for approximately 20 percent of employment in the tri-county area (Los Alamos, Rio Arriba, and Santa Fe Counties) and an even higher percentage of wages due to the large difference in average wages for LANL employees versus the county averages. Under the Expanded Operations Alternative, direct employment at LANL could increase by another 14 percent by 2011 leading to the creation of approximately 1,890 direct and 2,000 indirect jobs. About 1,600 direct jobs and 1,700 indirect jobs would be held by residents of the tri-county area, increasing the estimated percentage of the population employed in the tri-county area as a result of LANL operations activities to 22 percent.

Table 5–82 Estimated Cumulative Socioeconomic Impacts

Activity	*Direct Employment Residing in the Tri-County Area*	*Projected Indirect Jobs*	*LANL-Related Jobs*	*Projected Employment in the Tri-County Area in 2011*
LANL Operations (through 2011)				
– No Action Alternative	11,564	12,236	23,800	120,609
– Reduced Operations Alternative	11,138	11,785	22,923	119,732
– Expanded Operations Alternative	13,182	13,948	27,130	123,939
Research Park [a]	1,600	1,693	3,293	+ 3,293
Conveyance & Transfer of Lands [b]	6,080	6,433	12,513	+ 12,513
Consolidated Nuclear Production Center [c]	1,528	1,617	3,145	+ 3,145
Advanced Fuel Cycle Facility [d]	1,138	1,204	2,342	+ 2,342
Maximum LANL-Related Activity	23,528	24,895	48,423	145,232

[a] DOE 1997b.
[b] DOE 1999d.
[c] DOE 2007b.
[d] DOE 2008.

The Los Alamos Research Park was created on land within LANL that has been leased to Los Alamos County for private sector use as discussed in the *Research Park EA* (DOE 1997b). Under this proposal, one 83,000-square-foot building was completed in 2001, and industry has been leasing space in the building and collaborating with LANL on research activities in the hopes of accelerating economic development in the region. As estimated in the Research Park EA, up to 1,600 direct jobs could eventually be created at the Park (DOE 1997b). If this were to happen, it could lead to the creation of another 1,700 indirect jobs in the region. As of January 2007, there were 19 companies employing approximately 150 individuals working in the Research Park (Holsapple 2007). There is land available within the Research Park for additional buildings and other buildings are expected to be constructed as the demand for available space increases.

In addition, LANL is conveying land to Los Alamos County that may be used for commercial and residential uses as discussed in Section 4.1.1 of this LANL SWEIS. As estimated in the *Land Transfer and Conveyance EIS*, approximately 6,100 direct jobs could be created on these lands (DOE 1999d). This could lead to the creation of another 6,400 indirect jobs in the region. To date, 152 acres of approximately 1,803 acres of land to be conveyed to the County have been conveyed.

If the maximum number of jobs estimated to be created under the *Research Park EA* and the *Land Transfer and Conveyance EIS* were also created by 2011, there could be additional socioeconomic impacts in the region of influence. Cumulatively, the Expanded Operations Alternative and these activities could result in nearly 21,000 direct and 22,000 indirect jobs in the region. This scenario would increase the estimated percentage of the population employed by LANL-related activity to 31 percent of the region of influence. Under this scenario, the rate of population growth in the region would likely exceed current rates placing additional strain on regional infrastructure and social services. For example, additional demand would be placed on regional water and electrical systems, roads would be more heavily traveled, additional housing would need to be constructed, and there may be demands for additional schools and hospitals.

There would also be beneficial gains in terms of average wages and benefits flowing into the local economy since many of these jobs should be relatively higher paying jobs (for example, research jobs), and the unemployment rate would be likely to fall.

At this time, the level of direct employment related to the Research Park and the land conveyances is very low compared to the estimates analyzed in the earlier NEPA documents and it is too early to accurately predict whether these estimates will actually be reached. If they are not reached, the cumulative socioeconomic impacts for the region would be closer to those described in Section 5.8.1 for LANL operations.

It is assumed that approximately 86 percent of the new employees needed to operate the consolidated nuclear production center (1,785) and the advanced fuel cycle facility (1,330) would reside in Los Alamos, Rio Arriba, or Santa Fe County in keeping with current LANL employee preferences. Together with the Research Park and the jobs that could be created as a result of the land transfer and conveyance, these activities could result in the addition of up to 10,300 new direct employees related to LANL and another 10,900 indirect jobs in the tri-county area. Cumulatively these activities could increase the LANL-related jobs in the tri-county area by 78 percent over the levels expected under the Expanded Operations Alternative. Employment in the tri-county area could increase by approximately 17 percent over the levels projected under the Expanded Operations Alternative and the LANL-related jobs would increase to 33 percent of the worker population in the region of influence.

Increases in employment related to the proposed consolidated nuclear production center and the advanced fuel cycle facility would occur further in the future because these facilities would need to be constructed and are not expected to begin operating until at least 2020. In the meantime, regional planning could be undertaken in anticipation of projected increases associated with these facilities to alleviate potential shortfalls such as the need for additional housing, schools, or improved public transportation.

Infrastructure

Table 5–83 presents the estimated cumulative infrastructure requirements within the LANL region of influence for electricity, natural gas, and water. Cumulative infrastructure requirements include usage projections through 2011 for LANL and other Los Alamos County users that rely on the same utility system. Therefore, the projections provided in Section 5.8.2 and adopted here already consider cumulative future usage of these utilities by DOE and non-DOE entities. Projections of future utility use in Los Alamos County are largely related to increased usage due to population growth and associated industrial and commercial development.

As shown in Table 5–83, total combined electric power and water demands under the Expanded Operations Alternative could approach the electric-peak load capacity and total available water rights, respectively. Electrical energy capacity at LANL would not be exceeded under any of the proposed SWEIS alternatives. If the consolidated nuclear production center facilities were sited at LANL, the system capacities for electric-peak load and water could be exceeded and additional resources might need to be identified to satisfy the projected demand. The additional 45 megawatts electric-peak load and 117 million gallons of water usage from the GNEP advanced fuel cycle facility (DOE 2008) would further exacerbate the availability issues. The

projection of electric-peak load system capacity does not take into account completion of a new transmission line and other ongoing power grid upgrades that could help offset potential deficits in peak load capacity and ensure electrical energy availability for operations. Also, LANL has provisions to install a second new turbine at the TA-3 Co-Generation Complex that would add an additional 20 megawatts (175,200 megawatt-hours per year) of generating capacity, if needed. A study of the Los Alamos County water system would be required to determine whether the current water supply and distribution systems are adequate to meet additional projected annual water demand due to consolidated nuclear production center operations, the GNEP advanced fuel cycle facility, or both. It is likely that significant modifications would be required and LANL would need to obtain greater water resources, or significantly reduce its potable water use through mitigative measures. Overall LANL work assignments might have to be revamped, reduced, or eliminated so that existing potable water supplies would be adequate to support the assigned LANL work load.

Table 5–83 Estimated Cumulative Infrastructure Requirements for the Los Alamos National Laboratory Region of Influence

Activity	*Electricity*		*Natural Gas (decatherms per year)*	*Water (millions of gallons per year)*
	(megawatt-hours per year)	*Peak load (megawatts)*		
LANL SWEIS Alternatives Projected through 2011 [a]				
No Action	645,000	111	2,215,000	1,621
Reduced Operations	516,000	80.6	2,181,000	1,544
Expanded Operations	827,000	144	2,331,000	1,763
Complex Transformation SPEIS				
Consolidated Nuclear Production Center [b]	264,000	41	Information not available	395
Minus 80 pit manufacturing capability [c] under Expanded Operations	-9,000	- 1	- 28,000	- 8
GNEP PEIS				
Advanced Fuel Cycle Facility [d]	Information not available	45	Information not available	117
Total (Expanded Operations, Consolidated Nuclear Production Center, and Advanced Fuel Cycle Facility)	Information not available	229	Information not available	2,267
System Capacity [e]	1,314,000	150	8,070,000	1,806

[a] Data from Table 5–34, 5–35, and 5–36. Projections through 2011 for electrical energy, peak load, natural gas, and water also include projected usage for other Los Alamos County users that rely upon the same utility system.
[b] Data from Draft *Complex Transformation SPEIS* Tables 5.1.3-2 and 5.1.5-2.
[c] Rounded estimates from Section 5.8.2.3.
[d] Preliminary data for GNEP advanced fuel cycle facility (DOE 2008).
[e] Data from Table 5–33. Electrical energy and peak load capacity reflect the current import capacity of the electric transmission lines that deliver electric power to the Los Alamos Power Pool and completion of upgrades at the TA-3 Co-Generation Complex adding 40 megawatts (350,400 megawatt-hours) of generating capacity. Water system capacity reflects the total water rights from the regional aquifer managed by Los Alamos County.
Note: A decatherm is equivalent to 1,000 cubic feet.

Los Alamos County, as owner and operator of the Los Alamos Water Supply System, is currently pursuing the use of San Juan-Chama Transmountain Diversion Project water to secure additional water rights and supply for its water customers, including LANL. This would supply the Los Alamos area with up to an additional 391 million gallons (1,500 million liters) of water per year. Without the San Juan-Chama water, demand could exceed the available water supply in the future.

In the near term, no infrastructure capacity constraints are anticipated. LANL operational demands on key infrastructure resources, including electricity and water, have been below projected levels and within site capacities. Any potential shortfalls in available capacity would be addressed as increased site requirements are more fully understood.

Waste Management

Table 5–84 presents the estimated amount of radioactive and chemical waste that would be generated by the LANL SWEIS Alternatives (through 2016). Cumulative waste generation rates for all waste types are expected to be substantial, largely due to future remediation and DD&D of facilities. Although this is the case under all of the proposed LANL SWEIS Alternatives, the quantities of wastes projected under the Expanded Operations Alternative are significantly greater than those projected under the other alternatives due to the extensive environmental restoration cleanup projects associated with the MDAs and DD&D activities. Actual waste volumes from environmental remediation may be smaller, depending on regulatory decisions by the New Mexico Environment Department, and on use of waste volume reduction techniques.

Table 5–84 Estimated Cumulative Waste Generation at Los Alamos National Laboratory (2007 to 2016)

Activity	*Transuranic (cubic yards)*	*Low-Level Radioactive (cubic yards)*	*Mixed Low-Level Radioactive (cubic yards)*	*Construction and Demolition Waste (cubic yards)*	*Chemical (pounds)*
LANL SWEIS Alternatives (2007-2016) [a]					
No Action	3,500 to 5,900	72,000 to 167,000	1,800 to 2,800	198,000	19,000,000 to 37,000,000
Reduced Operations	3,500 to 5,900	72,000 to 148,000	1,800 to 2,800	197,000	19,000,000 to 36,000,000
Expanded Operations	5,300 to 33,000	277,000 to 1,414,000	3,900 to 183,000	642,000 to 722,000	64,000,000 to 129,000,000
Total (range) [c]	3,500 to 33,000	72,000 to 1,414,000	1,800 to 183,000	198,000 to 722,000	19,000,000 to 129,000,000

[a] Data rounded from Table 5–37.
[b] The total range includes the minimum and maximum values from the LANL SWEIS Alternatives. The total may not equal the sum of the contributions due to rounding.

The waste estimates under the Expanded Operations Alternative in this SWEIS include waste generated from expanding pit production to up to 80 pits per year from 20 pits per year under the No Action Alternative.

Increases in the cumulative waste generation rate may require construction of additional facilities and assignment of additional staff to manage the wastes. All waste categories are expected to increase generation rates, including solid, chemical, low-level radioactive, transuranic, and mixed wastes. Substantial quantities of low-level radioactive wastes and solid wastes (primarily uncontaminated debris from excavation, construction, and demolition activities) are projected. Efforts will be made to recycle as much of the uncontaminated fill as reasonably possible to reduce the need to bring additional fill from offsite sources to satisfy LANL's ongoing requirement. Most wastes, with the exception of some low-level radioactive wastes, are disposed of offsite at permitted facilities.

Low-level radioactive waste generation rates would increase under all alternatives, but the most significant increase would be under the Expanded Operations Alternative if all waste from MDAs were removed. Depending on the actual volumes generated by remediation, the expansion of TA-54 Area G into Zone 4, and eventually Zone 6, is expected to provide onsite low-level radioactive waste disposal capacity for operations waste through the 2016 timeframe and beyond. In addition, offsite disposal options for low-level radioactive waste include NNSA's Nevada Test Site and commercial facilities. 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. Mixed low-level radioactive waste generation also is expected to increase, but the quantity is projected to be less than two percent of the quantity of low-level radioactive waste. Mixed low-level radioactive wastes may be sent offsite for treatment of the hazardous component and possibly returned to LANL (or disposed of elsewhere) as low-level radioactive waste.[8]

The ROD for the *WIPP SEIS* allows for disposal of 175,600 cubic meters (229,667 cubic yards) of transuranic waste at WIPP (63 FR 3624), of which 21,000 cubic meters (27,466 cubic yards) of contact-handled transuranic waste and 230 cubic meters (301 cubic yards) of remote-handled transuranic waste were anticipated to originate from LANL (DOE 1997a). Transuranic waste generated under the Expanded Operations Alternative and the total cumulative transuranic generation shown in Table 5–84 could exceed the amount assumed to come from LANL. About two-thirds of the projected transuranic waste in Table 5–84, however, is from the assumed removal of transuranic waste, most of which was buried before 1970 in certain MDAs. As noted above, actual transuranic waste volumes will depend on regulatory decisions and on implementation of volume reduction techniques. WIPP disposal capacity is expected to be sufficient for disposal of all retrievably stored waste and all newly generated transuranic waste from the DOE complex over the next few decades, but not sufficient for this waste plus all transuranic waste buried before 1970 across the DOE complex (63 FR 3624). Decisions about disposal of transuranic waste from full removal of LANL MDAs, if generated, will be based on the needs of the entire DOE complex.

Transuranic waste from MDA removal without a disposal pathway would be safely stored onsite until additional disposal capacity at WIPP or elsewhere was identified. The impacts of disposal of transuranic waste at WIPP are evaluated in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997a).

Although routine generation of chemical wastes is expected to decline under all alternatives compared to current operations at LANL, significant quantities of this waste type are expected due to environmental restoration activities, and to a lesser extent, DD&D activities. This increase would be particularly evident under the Expanded Operations Alternative, if all wastes were removed from MDAs. Offsite treatment options are available at commercial facilities across the country, including treatment and disposal facilities in Nevada, Colorado, Utah, and Texas (ACE 2006).

[8] *Mixed waste that is successfully treated for a characteristic would no longer be mixed waste. Listed mixed waste is always mixed. No mixed waste is currently disposed of onsite at LANL.*

Significant quantities of nonradioactive solid wastes, including construction and demolition debris, would be generated under all alternatives. The most significant increase would occur under the Expanded Operations Alternative, if all wastes were removed from MDAs. The planned closure of the Los Alamos County Landfill by the end of 2008 means that, in the future, solid wastes will be disposed of via the Los Alamos County Transfer 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. Los Alamos County is currently evaluating regional solid waste landfills within 120 miles of LANL for a possible contract for disposal of LANL and Los Alamos County waste, including the Rio Rancho, Sandoval County, and Torrance County/Bernalillo County Landfills. In 2006, the New Mexico Environment Department Solid Waste Bureau estimated that the state had approximately 30 years of landfill capacity remaining (NMED 2006b).

Wastes would be generated during construction of the consolidated nuclear production center if it were sited at LANL. Wastes anticipated from proposed construction would include up to 10,000 cubic yards (7,600 cubic meters) of low-level waste that would be processed and packaged for disposal at TA-54. Other construction wastes that could be generated include hazardous waste and nonhazardous solid and liquid waste. The quantities of hazardous waste that could be generated from construction are small compared to the amount of hazardous waste disposal capacity available in the region. Nonhazardous solid wastes would be recycled to the extent practicable and the remainder would be shipped offsite for disposal at approved commercial landfills located within the state. Nonhazardous liquid waste generated during construction would be processed at the TA-46 Sanitary Wastewater System Plant.

Operation of the consolidated nuclear production center at LANL would result in the generation of additional radioactive waste. Up to 850 cubic yards (650 cubic meters) of transuranic waste and 310 cubic yards (240 cubic meters) of mixed transuranic waste could be generated annually. This waste would be packaged in accordance with the WIPP WAC, placed in TRUPACT-II shipping containers, and shipped to WIPP for disposal. In addition, operations would generate up to 11,640 cubic yards (8,900 cubic meters) of low-level radioactive waste and up to 72 cubic yards (55 cubic meters) of mixed low-level radioactive waste annually. Low-level radioactive waste would be processed and packaged for disposal at TA-54. Mixed low-level radioactive waste could require permitted treatment and disposal in an appropriate facility. Treatment could occur at one of the new facilities that is proposed to have a RCRA-permitted mixed waste treatment capability. Operations could also generate up to 8,925 gallons (33,785 liters) of liquid low-level radioactive waste and up to 3,622 gallons (13,710 liters) of liquid mixed low-level radioactive waste annually. These wastes would be solidified, processed, and packaged for disposal at the waste processing portion of the proposed new consolidated nuclear production center, or at existing facilities in TA-54, and then disposed of in accordance with their regulatory status. Approximately 1,370 cubic yards (1,050 cubic meters) of solid hazardous waste and 8,850 gallons (33,500 liters) of liquid hazardous waste could be generated annually at LANL as a result of consolidated nuclear production center operation. The capacity to collect these wastes, accumulate them at existing storage facilities, solidify the liquid waste, and ship these wastes offsite for treatment and disposal at a commercial facility, presently exists and would be sufficient to handle these volumes. Because operation of the proposed consolidated nuclear

production center would not be expected to start until after 2016, these waste quantities have not been included in Table 5–84.

The volumes of low-level (up to 3,450 cubic yards [2,640 cubic meters]) and mixed low-level radioactive waste (up to 4.4 cubic yards [3.4 cubic meters]) projected to be generated annually by the GNEP advanced fuel cycle facility (DOE 2008) would be managed within the current waste management program. The facility could generate up to 928 cubic yards (710 cubic meters) annually of nondefense transuranic waste (DOE 2008), which is not eligible for disposal at WIPP. Transuranic waste without a disposal pathway would be safely stored until a disposal facility became available. The project could also generate up to 34 cubic yards (26 cubic meters) of high-level radioactive waste annually (DOE 2008). Facilities to safely manage high-level radioactive waste until it could be sent to a geologic repository would have to be provided by the project since no high-level radioactive waste is currently managed at LANL.

Transportation

The collective doses, cumulative health effects, and traffic fatalities resulting from approximately 130 years of radioactive material and waste transport across the United States are estimated in **Table 5–85**. The total collective worker doses from all types of shipments (general transportation, historical DOE shipments, reasonably foreseeable actions, and the LANL SWEIS Alternatives) were estimated to be 381,700 to 382,400 person-rem, which would result in about 229 LCFs among the affected transportation workers. The total collective doses to the general public were estimated to be 343,680 to 343,900 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 are associated with the general transportation of radioactive material. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level waste to commercial disposal facilities. The majority of the traffic fatalities are due to the general transportation of radioactive materials (28 fatalities) and reasonably foreseeable actions (85 fatalities).

Table 5–85 presents the transportation impacts over ten years for each of the SWEIS alternatives. The data show that the impacts of each of the alternatives evaluated in this LANL SWEIS are quite small compared with the overall transportation impacts associated with radioactive materials and waste shipments across the United States. LANL SWEIS Alternatives are expected to result in no worker or public cancer deaths (LCFs) and no more than three traffic fatalities (through 2016); therefore, they would not substantially contribute to cumulative impacts. For perspective, in 2004, there were 522 traffic fatalities in New Mexico and 58 in the three neighboring counties (Los Alamos, Rio Arriba, and Santa Fe) (see Chapter 4, Table 4–56). Nationwide, in 2004, there were more than 42,000 traffic fatalities (NCSA 2006).

Table 5–85 Cumulative Impacts of Radioactive Material and Waste Transport (1943 to 2073) [a]

Activity	Worker		General Public		Traffic Fatalities
	Collective Dose (person-rem)	Latent Cancer Fatality	Collective Dose (person-rem)	Latent Cancer Fatality	
LANL SWEIS Alternatives [b]					
No Action	Up to 164	0.098	53 to 58	0.035	0.27
Reduced Operations	Up to 147	0.088	49 to 53	0.032	0.24
Expanded Operations	Up to 910	Up to 0.15	Up to 287	Up to 0.17	Up to 2.7
Other Past, Present, and Reasonably Foreseeable Future Actions					
General Transportation (1943 to 2073) [c]	350,000	210	300,000	180	28
Historical DOE Shipments [c]	330	0.20	230	0.14	No data
Reasonably Foreseeable Actions [c]	25,300	15.2	42,200	25.3	85
High Level Waste and Spent Nuclear Fuel Disposal at Yucca Mountain (up to 2073) [c, d]	5,900	3.5	1,200	0.72	2.8
Total [e]	381,700 to 382,400	229	343,680 to 343,900	206	~119

[a] Collective dose, health effects, and traffic fatalities associated with transporting radioactive materials and waste.
[b] From Table 5–51.
[c] From *Draft Yucca Mountain SEIS* (DOE 2007a) and Table K–10 of this SWEIS.
[d] From *Draft Yucca Mountain SEIS* (DOE 2007a), Proposed Action; mostly rail alternative.
[e] Total is a range that includes the minimum and maximum values from the LANL SWEIS Alternatives. Total may not equal the sum of the contributions due to rounding.
Note: LCFs calculated using a conversion of 0.0006 LCFs per person-rem.

The major radiological transportation actions involving Category I/II special nuclear material related to the Complex Transformation consolidated nuclear production center at LANL would be:

- Pits currently stored at the Pantex Plant would be transported to LANL; and
- Highly enriched uranium currently stored at the Y-12 Complex would be transported to LANL.

After completion of these shipments, there would be no annual shipment of pits and secondaries. The estimated radiological health impacts of the one-time transportation of pits from Pantex, and highly enriched uranium from Y-12, to LANL under this proposal would:

- The general public would receive a collective dose of approximately 118 person-rem from incident-free transportation, resulting in approximately 0.071 LCFs.
- The collective dose to workers handling pits and highly enriched uranium materials for transportation would be about 1,100 and 4,420 person-rem, respectively; this corresponds to an estimated 3.3 LCFs. It should be noted that the annual maximum individual dose is administratively limited to 2 rem (DOE 1999e); this would be a risk of 0.001 of developing an LCF.

Nonradiological impacts associated with this transportation would be expected to result in zero fatalities (0.018) as a result of traffic accidents.

The major transportation actions involving radioactive materials related to the *GNEP PEIS* advanced fuel cycle facility at LANL would be (DOE 2008):

- 39 shipments of light-water reactor spent fuel;
- 50 shipments of transmutation fuel;
- 50 shipments of fast reactor spent fuel; and
- approximately 1,430 waste shipments.

Local Transportation

Potential impacts to traffic at the main access points to LANL are estimated in **Table 5–86**. The No Action Alternative would not be expected to result in an increase in traffic over current levels. If the Reduced Operations Alternative were chosen for this SWEIS, traffic would be expected to decrease by 4 percent compared to the No Action Alternative. The largest estimated daily traffic increase would occur if the SWEIS Expanded Operations Alternative – MDA Removal Option were selected. Under this scenario, daily traffic could increase by up to 18 percent (averaged across all LANL entrances).

Table 5–86 Summary of Changes in Traffic Flow at the Entrances to Los Alamos National Laboratory

Alternative	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at NM 4***	***East Jemez Road at NM 4***	***West Jemez Road at NM 4***	***DP Road at Trinity Drive***
Baseline	24,545	4,984	9,502	2,010	1,255
LANL SWEIS					
Reduced Operations Alternative	-900	-200	-400	-90	-50
Expanded Operations – MDA Removal Option – Increase in Daily Trips	+1,400	+4,200	+1,200	+200	+440
Total Change in Daily Vehicle Trips	-900 to +1,400	-200 to +4,200	-400 to +1,200	-90 to +200	-50 to +440
Percent Change from Baseline	-4 to + 6	- 4 to +84	-4 to +13	-4 to +10	-4 to +35

MDA = material disposal area.
Note: Incremental changes for LANL SWEIS Alternatives may not match earlier tables due to rounding.

Some temporary and intermittent disruption of traffic flow is expected to occur during construction of the Security Driven Transportation Modification Project (DOE 2002k) as well as under the Expanded Operations Alternative of this SWEIS. These traffic disruptions are not expected to affect recreation, habitat management, or timber production in U.S. Forest Service and Bandelier National Monument areas adjacent to LANL.

Development of land conveyed under the *Land Conveyance and Transfer EIS* ROD could, after the land was remediated, increase traffic in the vicinity of the airport and TA-21 based on current Los Alamos County plans for light industry, retail, and residential development on these tracts. This action, combined with increased traffic due to DD&D activities at TA-21, could cause excessive traffic loads on NM 502. Similarly, increases in employment levels at the Los Alamos Research Park could increase traffic, but currently only 150 are employed there.

The addition of proposed facilities and an increased number of workers for the consolidated nuclear production center in TA-16 as analyzed in the *Complex Transformation SPEIS* would likely result in increased traffic along NM 4 from White Rock to West Jemez Road and on West Jemez Road to the center of the LANL. The option to consolidate the facilities in TA-16 would help to alleviate current concerns related to increased traffic along Pajarito Road under the Expanded Operations Alternative somewhat, because there could be a corresponding decrease in traffic along Pajarito Road from NM 4 to TA-55 if the activities at the TA-55 Plutonium Facilities Complex were relocated to TA-16. Conversely, the proposed location of the GNEP advanced fuel cycle facility in TA-36 could lead to increased traffic along Pajarito Road from NM 4.

Environmental Justice

Environmental justice impacts would occur when the net effect of regional projects or activities would result in disproportionately high adverse human and environmental effects to minority or low-income populations. The previous analysis indicates no high and adverse cumulative human health and environmental impacts, including economic impacts and impacts from special pathways. Therefore, no disproportionately high and adverse human and environmental effects to minority or low-income populations are expected as a result of implementing any of the three alternatives under consideration for continued LANL operations in the SWEIS.

Under the Expanded Operations Alternative, as discussed in Section 5.8.1, employment at LANL and in the surrounding region is expected to increase thus creating additional employment opportunities for local individuals. As additional funding flows into the regional economy, increased opportunities for low-income and minority populations should be realized. Also, under the *Land Conveyance and Transfer EIS*, lands currently considered part of LANL would be transferred to the U.S. Department of the Interior to be held in trust for the Pueblo of San Ildefonso, thus benefiting these people.

As discussed in the *Land Conveyance and Transfer EIS*, there is the possibility that transfer activities may impact traditional cultural properties that could be present on the tracts of land being transferred or in adjacent areas (DOE 1999d). This is also true for areas that LANL is cleaning up under its ongoing environmental restoration program. In 2005 and 2006 the Los Alamos Site Office reaffirmed the 1992 accords with the four Pueblos (the Santa Clara, San Ildefonso, Jemez and Cochiti Pueblos) that recognize the Pueblos as sovereign entities that can interact with the Los Alamos Site Office on a government-to-government basis. Los Alamos Site Office has also signed the LANL Pueblo Cooperative Agreements which provide a procedural framework for consultation, as well as committing to provide information and input in long-term planning and decision making. In addition, the LANL management and operating contractor has prepared *A Plan for the Management of the Cultural Heritage at Los Alamos National*

Laboratory, New Mexico (LANL 2006f) in which specific aspects of the consultation process are spelled out. NNSA is committed to continuing to interface with the Pueblos in accordance with these agreements and plan. When a project is planned at LANL, archaeological records are searched to determine if any cultural resource sites are known to exist at the project area. If archaeological records do not exist for the project area, LANL personnel conduct the necessary surveys prior to any work taking place. If it is determined that traditional cultural properties are present on any of the lands to be transferred or those being cleaned-up, the consultations called for under the appropriate accord and the management plan will be undertaken.

Based on the impacts for resource areas, few high and adverse impacts are expected from the construction and operation of a consolidated nuclear production center or the GNEP advanced fuel cycle facility at LANL. To the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally (DOE 2007b).

5.14 Mitigation Measures

The regulations promulgated by the Council on Environmental Quality to implement the procedural provisions of NEPA (42 U.S.C. §4321) require that an EIS include a discussion of appropriate mitigation measures (40 CFR 1502.14[f]; 40 CFR 1502.16[h]). The term "mitigation" includes the following:

- Avoiding an impact by not taking an action or parts of an action;
- Minimizing impacts by limiting the degree of magnitude of an action and its implementation;
- Rectifying an impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact by preservation and maintenance operations during the life of the action; and
- Compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

This section describes mitigation measures that are built into the alternatives analyzed as well as additional measures that will be considered by DOE to further mitigate the adverse impacts identified earlier in this chapter. These measures address the range of potential impacts of continuing to operate LANL (including those areas where lack of information regarding resources and mechanisms for assessing impacts to resources result in substantial uncertainty in the impact analyses). The mitigation measures built into the alternatives analyzed (see Section 5.14.1 and 5.14.2) are of two types: (1) existing programs and controls (including regulations, policies, contractual requirements, and administrative procedures); and (2) specific measures built into the alternatives that serve to minimize the effects of activities under the alternatives. The existing programs and controls are too numerous to list here; but a general description is provided, as well as the role of existing programs in operating LANL and pertinent examples of how these programs mitigate adverse impacts. Additional mitigation measures that could further reduce the adverse impacts identified in this chapter are discussed in Section 5.14.3. The description of these measures in this chapter does not constitute a

commitment to undertake any of these measures. Any such commitments would be reflected in the ROD following this SWEIS, with a more detailed description and implementation plan provided in a Mitigation Action Plan following the ROD.

5.14.1 Existing Programs and Controls

The activities undertaken at LANL are performed within the constraints of applicable regulations, applicable DOE orders, contractual requirements, and approved policies and procedures. Laws and regulations applicable to Federal facilities are discussed in Chapter 6; many of these requirements are established to protect human health and the environment. It is assumed that these or similar regulatory controls will continue to be in place. When complied with, these regulations mitigate the potentially adverse impacts of operations to the public, the worker, and the environment. For example, the Clean Air Act (42 U.S.C. §7401) regulates air emissions and the Clean Water Act (33 U.S.C. §1251) regulates liquid effluent discharges in a manner designed to protect human health and reduce the adverse environmental effects of routine operations. In addition to the regulations applicable to LANL, Chapter 6 also discusses other requirements (including DOE Orders and external standards and regulations that would not otherwise apply to Federal facilities) that apply to operations at LANL through the contract between DOE and its management and operating contractor. As discussed in Chapter 6, these requirements are established and enforced through contractual mechanisms. As with the regulations that apply to LANL, it is assumed that these or similar controls will continue. These requirements also mitigate the potential for adverse impacts. For example, the application of DOE design standards results in facility designs for modern nuclear facilities that reduce the potential for catastrophic releases from these facilities in the event of earthquakes, high winds, or other natural phenomena. Similarly, the application of occupational safety and health regulations in 29 CFR Part 1900, et seq, and other standards promulgated by the American National Standards Institute, the U.S. Department of Defense, and DOE, as well as the use of other life safety and fire safety codes and manuals, limit worker exposures to workplace hazards, which reduces the potential for adverse worker health effects. DOE and LANL also have instituted policies and procedures applicable to work conducted at LANL to mitigate potentially adverse effects of operations. It is assumed that these or similar policies and procedures will continue. These policies and procedures are numerous and include, but are not limited to:

- Procedures that institute integrated safety management to control work conducted at LANL (to ensure that work conducted is planned and reviewed, funded, within the applicable regulations and requirements, within the range of risks accepted by DOE and its management and operating contractor, and is otherwise authorized);

- Policies regarding the knowledge, skills, and abilities of personnel assigned to perform hazardous work (including required training);

- Policies reflected in agreements with other entities (such as the Accords with the four Pueblos located nearest to LANL) that establish policies and protocols regarding consultations and other discussions regarding LANL activities;

- Policies and procedures regarding stoppage and restart of work where unexpected hazards or resources are identified (for example, policies regarding recovery of information from archaeological sites uncovered by excavation).

Work controls reduce potential impacts by ensuring that work conducted falls within the range of activities that have been studied for potential environmental and human health effects. Policies regarding the knowledge, skills, and abilities of personnel conducting work at LANL reduce potential impacts by ensuring that only personnel having an appropriate understanding of the work and its potential hazards may undertake that work (which minimizes the potential for adverse human health and environmental effects from inadvertent actions due to a lack of such understanding). Policies for consultations and discussions with other entities mitigate effects by providing an opportunity to avoid or change actions that could cause adverse impacts. For example, consultation with the Pueblos could identify a potential for impacts to traditional cultural properties prior to implementing a construction project or operations, as well as identify alternative siting or operational approaches that would avoid the impacts. Policies and procedures regarding the stoppage and restart of work are similar in effect to work controls; when unexpected situations occur that impose unexpected hazards or reveal unexpected resources (for example, cultural resources), work is stopped as soon as stoppage can be accomplished safely until work plans and authorizations can be modified in consideration of the new information. This reduces potential impacts in a manner similar to work controls, as discussed above.

DOE also has established programs and projects at LANL to increase the level of knowledge regarding the environment around LANL, the health of LANL workers, the health of the public around LANL, and the effects of LANL operations on these elements, as well as to avoid or reduce impacts and remediate contamination from previous LANL activities. These programs and projects reduce potentially adverse impacts by providing a heightened understanding of the resources that could be impacted; avoidance of some impacts (where mechanisms for impacts to specific resources are known and avoidable); early identification of impacts (which can enable stoppage or mitigation of the impacts); reduction of ongoing impacts; or beneficial management opportunities for natural, cultural, and sensitive resources, where appropriate. It is assumed that such activities will continue at LANL. Examples of these programs and projects include:

- The Environmental Surveillance and Compliance Program at LANL monitors LANL for permit and environmental management requirements. This program also includes evaluations of samples from various environmental media for radioactive materials and other hazardous materials locally and regionally (see Chapter 4, Section 4.6.1.2). The data generated under this program are collected routinely, publicly reported at least annually, and analyzed to determine regulatory compliance and environmental trends over long periods.

- The Threatened and Endangered Species Habitat Management Plan is intended to provide long-range planning information for future LANL projects and to protect the habitats of endangered species at LANL (see Chapter 4, Section 4.5.4).

- A recently completed *Cultural Heritage Management Plan* for LANL (see Chapter 4, Section 4.7) has undergone public review and is being implemented through a

programmatic agreement between DOE, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation.

- Flue gas recirculation equipment installed in 2002 on the boilers at the TA-3 power plant has reduced nitrogen oxides emissions by 64 percent. Such equipment and administrative controls are applied to the steam plant and other sources to comply with the emission source limitations and the facility-wide emission limitations specified in LANL's air permit (see Chapter 4, Section 4.4.2).

- Studies of public and worker health in and around LANL have been conducted (some by DOE and some by other agencies) to assess both human health in the region and the potential for adverse human health effects due to LANL operations (see Chapter 4, Section 4.6).

- The Health, Safety, and Radiation Protection Program is conducted by LANL to promote the health and safety of its workers. This program addresses the possible impacts that could result from working with ionizing and non-ionizing radiation, hazardous and chemical materials, and biohazard materials. Appropriate controls that protect the health and safety of workers are determined primarily by the type of hazard and the work environment. The level or amount of controls is commensurate with the risk associated with the hazards that would be encountered by the workers for each job activity.

- LANL's NPDES Industrial Stormwater Permit Program regulates stormwater runoff from industrial activities under a Multi-Sector General Permit. Stormwater monitoring and erosion controls are required at these sites. An integrated Stormwater Monitoring Program monitors stormwater runoff on a watershed basis and at individual solid waste management units. LANL recently began to implement these programs in response to the 2004 Federal Facility Compliance Agreement between the EPA and DOE. The NPDES Construction Stormwater Program regulates stormwater from construction activities disturbing 1 acre (0.4 hectares) or more (see Chapter 4, Section 4.3.1.3).

- LANL's Groundwater Protection Management Program assesses current groundwater conditions and monitors and protects groundwater. A Hydrogeologic Work Plan also supplements and verifies existing information on the environmental setting at LANL and collects analytical data on groundwater contamination (see Chapter 4, Section 4.3.2). An Interim Facility-wide Groundwater Monitoring Plan has been submitted to the New Mexico Environment Department as required by the 2005 Consent Order (LANL 2006g).

- The Safeguards and Security Program restricts unauthorized access to areas of LANL that have a high potential for impacts to human health and the environment. Such access restrictions limit the potential for intentional or inadvertent actions that could result in environmental or human health effects.

- LANL's Emergency Management and Response Program effectively combines Federal and local emergency response capabilities and provides planning, preparedness, and response capabilities that can aid in containing and remediating the effects of accidents or adverse operational impacts (see Chapter 4, Section 4.6.4).

- LANL's Fire Protection Program ensures that personnel and property are adequately protected against fire or related incidents, including fire protection and life safety (see Chapter 4, Section 4.6.4).

- An Interagency Wildfire Management Team has been established to coordinate activities related to reducing the fuel loading surrounding the site (see Chapter 4, Section 4.5.1). On the site, LANL is implementing actions around individual facilities that have moderate or higher vulnerability to burning as a result of wildfire.

- Waste minimization and pollution prevention efforts at LANL are coordinated by the Pollution Prevention Program, which works to reduce wastes generated and to some extent effluents and emissions from facilities (see Chapter 4, Section 4.9).

- Water and energy conservation programs at LANL are intended to reduce use of these resources, which should assist in mitigating the effects of water withdrawal and electrical consumption that occasionally exceed supply (see Chapter 4, Section 4.8.2).

- The LANL environmental restoration program (which includes DD&D) assesses and remediates contaminated sites that either were or still are under LANL control (see Chapter 4, Section 4.12). The LANL environmental restoration program serves an important role in reducing the potential for future impacts to human health and the environment due to legacy contaminants in the environment. This analysis assumes that current mitigation practices used in remediation actions will continue.

While this list is not all-inclusive, it reflects the importance of these programs in mitigating the potentially adverse impacts of operating LANL.

5.14.2 Mitigation Measures Incorporated in the SWEIS Alternatives

Several specific mitigation measures are included in the SWEIS alternatives. Unless otherwise noted below, the analyses in this chapter assume that the following measures would be implemented.

- NNSA intends to implement actions necessary to comply with the Consent Order, regardless of decisions it makes on other actions analyzed in the SWEIS; however, specific remediation actions have not been selected. Removal of contamination from MDAs and other PRSs, if necessary, would be conducted in a manner that protects the environment and public and worker health and safety. Removal of waste from some large MDAs may require use of temporary enclosures to limit possible releases of contaminated material to the environment to levels within applicable standards and ALARA. The MDAs where use of enclosures or equivalent measures may be required for safe removal operations include MDAs A, B, T, AB, and G (Expanded Operations Alternative – MDA Removal Option).

- Under all alternatives, nonradioactive air emissions, such as from construction equipment, would be controlled by proper maintenance of equipment.

- Under the Expanded Operations Alternative, noise impacts on sensitive wildlife species during MDA remediation, DD&D, and construction activities would be mitigated by

planning activities outside of the breeding season for sensitive species, if any sensitive species' habitat is identified in the area and if the habitat is occupied or the status is uncertain. If appropriate, other protective measures could be employed, such as hand digging.

- Under the No Action and Expanded Operations Alternatives, radiological air emissions would be monitored and tracked to maintain the annual dose to the public from LANSCE emissions under the administrative limit.

- Under the Expanded Operations Alternative, the Science Complex would be constructed on a site in Northwest TA-62, located west of the Research Park area. This site is bounded to the north by an unpaved utility corridor access road with forested land beyond. The utility corridor access road may be paved in the future to provide all-weather access to areas of the Santa Fe National Forest and a local recreational ski facility.

- Under the Expanded Operations Alternative, traffic improvements would be implemented for operation of the new Science Complex on West Jemez Road in TA-62 and the consolidated Warehouse and Truck Inspection Station on East Jemez Road in TA-72 to mitigate the effect of these facilities on traffic flow.

- Under all alternatives, actions would be taken to mitigate the risks of a wildfire on waste storage domes in TA-54. In 2000, the Cerro Grande Fire burned a heavily forested canyon area to within about 0.75 miles (1.2 kilometers) of the waste storage domes in TA-54, but none were burned and there were no radiological releases from domes. Additional fuel reduction has been conducted since the Cerro Grande Fire, both to the vegetation surrounding the TA-54 area and within the domes themselves (for example, wooden pallets have been replaced with metal pallets), to further decrease the potential for a waste storage dome fire occurring as a result of a site wildfire. The LANL management and operating contractor would continue its wildfire management activities (for example, forest thinning) and further reduce risks by shipping legacy transuranic waste, currently stored in the domes, to WIPP.

5.14.3 Other Mitigation Measures Considered

In addition to those mitigation measures described above, other feasible mitigation measures considered in the preparation of this SWEIS are presented below.

- Expanded sealed source program procedures would be instituted under the Expanded Operations Alternative that would ensure adequate controls on the quantities and methods of storing sealed sources containing cobalt-60, iridium-192, or cesium-137 to mitigate the effects of potential accidents. This would reduce the potential direct gamma radiation-streaming dose from a postulated accident that could compromise the shielding around these gamma-emitting radioisotopes.

- Los Alamos County has recently completed a 40-year water plan (Stephens 2006) to address water service needs, balance the uses of water resources, and make recommendations for a water conservation program tailored to meet specific water supply customer needs in the

county, including LANL. Only the Expanded Operations Alternative is projected to have water demands that would approach the available water rights from the regional aquifer. Los Alamos County's plans to use up to 391 million gallons (1,500 million liters) of water per year from the San Juan-Chama Transmountain Diversion Project as early as 2010 would alleviate any potential shortfall between future demand and current groundwater rights. LANL's water use would be mitigated somewhat by the use of recycled water from the Sanitary Effluent Recycle Facility for cooling water.

- Ongoing upgrades are being made to the electrical power transmission and distribution system, including construction of a third transmission line to allow import of additional power into the Los Alamos Power Pool and to support a higher electric peak load beyond 2006. In addition, an EA (DOE/EA 1430) was prepared and a FONSI was issued in December 2002 for a project to install two new (20 megawatt) gas-fired combustion turbine generators and to upgrade the existing steam turbines at the TA-3 Co-Generation Complex (DOE 2000f). As discussed in Chapter 4, Section 4.8.2, upgrades and installation of one new combustion turbine generator were completed in September 2007. Although DOE currently has no timeframe for installing a second combustion turbine generator, its installation in the future would add 20 megawatts (equivalent to 175,200 megawatt-hours) of electrical power generating capacity at LANL.

- Under all of the alternatives, particulate matter (fugitive dust) emissions from exposed soil and roadways during construction activities would be controlled using routine watering as appropriate. As necessary, air pollutant emissions from construction activities and MDA remediation activities would be controlled using standard construction emissions controls. Application of chemical stabilizers to exposed areas and administrative controls such as planning, scheduling, and use of special equipment could further reduce emissions under all of the alternatives.

- Use of containment vessels for high explosives testing under all of the alternatives could further reduce air pollutant emissions, such as beryllium and depleted uranium, from this activity. The use of vessels for certain tests could reduce emissions from these tests by close to 100 percent.

- The possibility exists that traffic into and out of LANL could increase over the next several years. Additional traffic studies should be undertaken to determine if activities under consideration in the SWEIS would increase traffic to unacceptable levels and to identify possible solutions in the event such problems are identified.

- Traffic and noise impacts on residents of the Royal Crest Mobile Home Park and Los Alamos Town Center due to increased truck traffic under the Expanded Operations Alternative could be mitigated by scheduling activity for off-peak hours, rerouting truck traffic, using multiple shifts, using alternative entries and exits, and, in the case of TA-21 remediation and DD&D, possible construction of a bridge or another road off of DP Mesa to allow alternate routing of traffic. Stockpiling fill and cover materials on the sites during off-peak hours also could be considered to avoid frequent trips during peak hours.

- To alleviate concerns associated with additional employees commuting to LANL from areas such as Rio Arriba and Santa Fe Counties, it may be necessary to expand the park-and-ride bus services that are currently offered from Española and Santa Fe.

5.15 Resource Commitments

This section describes the unavoidable adverse environmental impacts that could result from changes in ongoing activities at LANL; the relationship between short-term uses of the environment and 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 maintaining and enhancing 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.

5.15.1 Unavoidable Adverse Environmental Impacts

Ongoing activities at LANL under any of the three alternatives analyzed in this SWEIS could result in unavoidable adverse impacts on the human environment. In general, these impacts would be minimal and would come from incremental impacts attributed to ongoing LANL operations.

Ongoing activities at LANL will continue to result in unavoidable radiation and chemical exposure to workers and the public. Generation of radioactive isotopes under any of the three alternatives is unavoidable. Radioactive waste generated during operations would be collected, treated, stored, and eventually removed for suitable recycling or disposal in accordance with applicable DOE and EPA regulations.

Operations at LANL under any of the three alternatives would have minimal unavoidable adverse impacts from air emissions. Air emissions include various chemical or radiological constituents in the routine emissions typical of nuclear facility operations. Decontamination and decommissioning of buildings could result in the one-time generation of radioactive and nonradioactive waste material that could affect storage requirements. This could produce unavoidable impacts on the amount of available and anticipated storage space and the requirements of disposal facilities at LANL.

Temporary construction impacts associated with the construction of new facilities at LANL also would be unavoidable. These impacts would include generation of fugitive dust, and noise, as well as increased construction vehicle traffic.

5.15.2 Relationship Between Local Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Ongoing operations at LANL under any of the three alternatives would require short-term commitments of resources and permanent commitments of certain resources (such as energy). Environmental resources have already been committed to continuing operations at LANL.

Additional commitments would serve to maintain existing environmental conditions with little or no impact on the long-term productivity of the environment.

Short-term commitments of resources would include space and materials required to construct new buildings; new operations support facilities; transportation; and disposal resources and materials for continued LANL operations. Workers, the public, and the environment could be exposed to increased amounts of hazardous and radioactive materials over the period of this SWEIS analysis due to relocation of materials, including process emissions, and handling of radioactive waste.

Regardless of changes in the location and levels of activities at LANL Key Facilities, additional air emissions could introduce small amounts of radiological and nonradiological constituents to the air in the region around LANL. These emissions would result in additional loading and exposure, but would not be expected to impact compliance with air quality or radiation exposure standards at LANL. There would be no significant residual environmental effects on long-term environmental viability.

Management and disposal of additional sanitary solid waste and nonrecyclable radiological waste would require the use of energy and space at LANL treatment, storage, or disposal facilities or at replacement offsite disposal facilities. Regardless of location, the land required to meet solid waste needs at LANL would require a long-term commitment of terrestrial resources. Activities being considered at LANL, such as consolidation of new facilities, could result in further disturbance, use, and commitment of previously undisturbed land. Ultimately, after closure of facilities at LANL, NNSA plans to decontaminate and decommission the buildings and equipment and restore them to brownfield sites that could be made available for future reuse.

5.15.3 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources unanticipated in the *1999 SWEIS* would include mineral resources consumed during the life of certain projects and energy and water used to operate buildings and facilities at LANL. Commitments of capital, energy, labor, and materials are generally irreversible.

Energy expended would be in the form of fuel for equipment and vehicles, electricity for facility operations, and human labor. Changes in LANL operations could generate nonrecyclable waste streams such as radiological and nonradiological solid waste and some wastewater. Certain materials and equipment used during operations, however, could be recycled when buildings are decontaminated and decommissioned.

Operations at LANL require water, electricity, and diesel fuel. These resources are discussed in Section 5.8.2.

Disposal of hazardous and radioactive wastes also would cause irreversible and irretrievable commitments of land, mineral, and energy resources.