5.4 IMPACTS FOR THE REDUCED OPERATION ALTERNATIVE

This section discusses the potential environmental consequences of the Reduced Operation Alternative. Chapter 3 and Appendix A contain detailed descriptions of all projects included under the Reduced Operation Alternative. The LLNL operations include the Livermore Site and Site 300.

5.4.1 Land Uses and Applicable Plans

This section describes the impacts to land uses and applicable plans under the Reduced Operation Alternative. Impacts are analyzed for the Livermore Site and Site 300 based on the methodology presented in Section 5.1.

5.4.1.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.4 for the Reduced Operation Alternative and the land use impact analysis. In general, the effect of projects under the Reduced Operation Alternative on land use are related to the planned construction and D&D of facilities as part of projects that have been funded, but not yet executed. Changes to operations would not alter land use. No land acquisitions would be included under the Reduced Operation Alternative, so land use changes would be confined to onsite areas.

5.4.1.2 *Impact Analysis*

Livermore Site

Under the Reduced Operation Alternative, new facility construction, upgrades, and D&D activities would occur at the Livermore Site. Many of these projects are already underway. While the types of land uses would not change, some infill and modernization would occur. New facilities that would be located in the undeveloped portions of the Livermore Site are the same as those listed for the No Action Alternative (Table 5.2.1.2–1).

New structures would be for the same uses as existing facilities, R&D, which is the existing land use designation for all Livermore Site facilities. Therefore, they would not represent a change in land uses, nor lead to a conflict with existing and approved future land uses adjacent to the site. Although the Livermore Site is on Federal land and not subject to local zoning ordinances, the Livermore Site R&D activities would be compatible with the MP designation (industrial park) in Alameda County and the I-2/I-3 designations (professional and administrative offices/R&D facilities) in the city of Livermore (LLNL 2001r). No new types of land uses would be introduced in the buffer and perimeter areas. No change in the site's compatibility with existing and approved future land uses would result from the Reduced Operation Alternative. No new impacts are expected.

Secondary effects on land use could occur due to decreased personnel and activity at the site. These effects could include reduced traffic, noise, vehicular exhaust emissions, demands for community services, reduced consumption of natural resources, and reduced waste generation. These effects are addressed in the other parts of Chapter 5 in this LLNL SW/SPEIS.

Site 300

The Reduced Operation Alternative at Site 300 would include upgrades and a D&D project. No land acquisitions would be included. The types of land uses at Site 300 would not change, and the open space character of the site would be retained. No major alteration in the types of land uses would result.

Land uses at Site 300 are compatible with the existing land uses, approved land use designations surrounding the site, and with open space policies regarding open space resources near the site. Because activities under the Reduced Operation Alternative would be a continuation of existing land uses, they would be compatible with existing and approved future land uses surrounding the site. No new impacts are anticipated.

5.4.1.3 *Cumulative Impacts*

Livermore Site

The cumulative impact study area, with regard to land uses and planning programs for the Livermore Site, is defined as that area of Alameda County generally east of Tassajara Road in the city of Dublin and Santa Rita Road in the city of Pleasanton. This area encompasses the city of Livermore and eastern unincorporated Alameda County. Large undeveloped open space areas exist in the northern, eastern, and southern portions of Alameda County. The majority of the undeveloped areas are used for agricultural purposes, primarily for grazing and viticulture. Agricultural lands in the South Livermore Valley General Plan Amendment area support an active wine industry.

A continuing land use trend in Alameda County has been the encroachment of residential, commercial, and industrial uses upon agricultural and open space areas. Development of planned and proposed residential projects would contribute to the cumulative loss of agricultural land and open space. However, the Reduced Operation Alternative would not directly contribute to the cumulative effect on the loss of agricultural land and open space because the Livermore Site is already committed to R&D land uses and no acquisition of open space or agricultural land is proposed.

Site 300

The cumulative impact study area with regard to land uses and planning programs for Site 300 is defined as that portion of San Joaquin County generally south of I-205 that encompasses the city of Tracy and southwestern unincorporated San Joaquin County. Land uses in the area south of I-580 in unincorporated San Joaquin County include agricultural (primarily grazing), commercial recreation, and explosives testing facilities (including Site 300).

The city of Tracy, the border of which is located approximately 2 miles northeast of Site 300, has a developed core of residential and commercial uses, which becomes less dense along the outer boundaries of the city. Industrial and agricultural land uses surround the developed part of the city. In 1998, the city of Tracy annexed the Tracy Hills area southwest of I-580, the area of Tracy that is now closest to Site 300. The Tracy Hills planning area is 6,175 acres. In an effort to

preserve agricultural land on the valley floor, the city of Tracy Planning Department is encouraging new development in hillside areas, such as Tracy Hills (City of Tracy 1993).

Such residential communities could be compatible with Site 300, depending on the final design and siting of residences. The city of Tracy also has annexed an area of San Joaquin County that is approximately 2 miles from Site 300 and has planned for residential development in this area. The Tracy General Plan provides for a conservation, or open space, area to be established that would be a buffer zone between Site 300 and any potential new development.

5.4.2 Socioeconomic Characteristics and Environmental Justice

This section analyzes the socioeconomic impacts associated with implementation of the Reduced Operation Alternative. The section organizes the impact analysis by employment and housing and population, with effects delineated by geographic area (counties and cities). Environmental justice issues are also discussed.

5.4.2.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.4 under the Reduced Operation Alternative and the potential socioeconomic impacts. In general, the effect of projects under the Reduced Operation Alternative on socioeconomics would be limited to the reduction in employment opportunities and accompanying reduction in payroll dollars and the need for housing resulting from curtailed operation of these projects as described below. Projected staffing changes are shown in Table 5.4.2.1–1.

TABLE 5.4.2.1–1.—*Input Parameters for Socioeconomic Analysis Under the Reduced Operation Alternative*

Parameter	Units	Site	No Action Alternative	Reduced Operation Alternative
Employment	Number of personnel	LLNL	10,650 (all site workers)	9,770 (all site workers)
		Livermore Site	8,900 (LLNL employees) 17,500 (LLNL employees and indirect)	8,180 (LLNL employees) 16,100 (LLNL employees and indirect)
		Site 300	250 (LLNL employees) 490 (LLNL employees and indirect)	230 (LLNL employees) 450 (LLNL employees and indirect)
Expenditures	Dollars (2001)	LLNL	146 M (Bay Area)	134 M (Bay Area)
Payroll	Dollars (2002)	LLNL	690 M (LLNL employees) 1,130 M (direct and indirect)	635 M (LLNL employees) 1,040 M (direct and indirect)

LLNL = Lawrence Livermore National Laboratory; M = million.

5.4.2.2 *Impact Analysis*

To develop estimates of employment levels, employment projections for the Reduced Operation Alternative were based on staffing decreases associated with reduction of activities at existing facilities. Over the next 10 years, LLNL employment at the Livermore Site is projected to decrease by approximately 700 from the No Action Alternative level to 8,180 employees. Therefore, the Reduced Operation Alternative would eliminate 700 direct employment opportunities in Alameda County, and would reduce the growth rate of population and subsequent housing demand. Combined direct and indirect employment loss would be approximately 1,400 within the four-county ROI.

Over the next 10 years, Site 300 employment would decrease by 20 employees from the No Action Alternative level. Combined direct and indirect employment loss would be approximately 40 within the four-county ROI.

Employment and Expenditures

Region

Assuming a 740 combined employee decrease at Livermore Site and Site 300, the payroll under the Reduced Operation Alternative would be $55 million less than under the No Action Alternative in 2002 dollars. This would result in fewer dollars within the local economy for workers to purchase goods and services. The combined direct and indirect effects of decreased employment would result in an employment decrease of approximately 1,400 within the region. Likewise, the direct and indirect effect of payroll loss would result in a $90 million decrease from the No Action Alternative in the regional economy.

In addition, the Reduced Operation Alternative would result in reduced expenditures by LLNL. Fewer goods and services would be required to support the activities, facilities, and workers under the Reduced Operation Alternative.

The reduced payroll and other reductions in spending by LLNL would slow the rate of growth in personal income and employment opportunities within the ROI. However, the slower growth in expected personal income and employment under the Reduced Operation Alternative would have a very small economic impact on the region.

Alameda County

Total employment in Alameda County was estimated at 751,680 in the year 2000 (Association of Bay Area Governments 2001). The Reduced Operation Alternative would reduce employment at the Livermore Site by approximately 700 from the No Action Alternative employment level. Employment projections for the county estimate that opportunities would increase 14.1 percent to 857,450 by the year 2010 (Association of Bay Area Governments 2001). The reduction in jobs caused by the Reduced Operation Alternative at LLNL would represent 0.8 percent of the projected increase in employment within the county. This minimal decrease in LLNL employment, a 0.1 percent decrease from the year 2000 employment level, would have a minimal impact to the Alameda County economy.

San Joaquin County

Total nonfarm employment in San Joaquin County was estimated at 191,700 in the year 2001 (EDD 2003). The Reduced Operation Alternative would result in a 20 employee staff reduction at Site 300. Employment projections for the county estimate that employment opportunities will increase 22.3 percent to 234,430 by the year 2010 (SJCOG 2000). The jobs lost under the Reduced Operation Alternative at Site 300 would represent 0.05 percent of the projected increase in employment within the county. This minimal decrease in employment, a 0.01 percent decrease from the 2001 employment level, would have a negligible impact to the San Joaquin County economy.

Population and Housing

For this analysis, to determine the maximum potential impact, it was assumed that any positions eliminated under the Reduced Operation Alternative would result in a family leaving the project region, and that each LLNL worker (including LLNL employees, contractors, and Federal employees) would represent one household. In reality, a significant percentage of workers in positions eliminated would remain in the region, and some households have more than one LLNL worker. The geographic distribution of future LLNL workers would be similar to the current distribution (Table 5.4.2.2–1).

Alameda County

Based on the current geographic distribution of LLNL worker residences (Table 5.4.2.2–1), the Reduced Operation Alternative would result in a net migration of 500 more workers out of Alameda County over 10 years as compared with the No Action Alternative. Assuming 2.74 persons per household for the county (Census 2003), the population associated with the workforce migrating out of the county would be 1,370 persons. This would represent 0.1 percent of the 2000 population within the county. Population projections for the county estimate a 16.8 percent increase from 2001 to 2010 (Association of Bay Area Governments 2001, Census 2003).

Assuming one worker per household, the reduction in housing demand caused by the reduced workforce would be 500 dwelling units less than the No Action Alternative over 10 years, lowering the total number of housing units occupied by LLNL workers to approximately 5,550 within Alameda County. In 2002, the county had 546,735 housing units. The vacancy rate in the county was 3.0 percent, an estimated 16,620 available units (DOF 2002). Reduction in housing demand associated with project personnel leaving Alameda County would represent 3.0 percent of the 2001 housing supply within the county. The slower growth in population increase associated with the Reduced Operation Alternative would have minimal impact on population and housing demand within the county.

City of Livermore

The greatest percentage of LLNL workers leaving the region (333 more than the No Action Alternative or 37 percent of workers expected to leave the ROI) would move from the city of Livermore based on the current pattern of employee residence location. Using the year 2000 person –per household figure of 2.81 for the city (Census 2002b), and assuming one worker per household, the population associated with the workforce migrating out of the city would be 936 persons as compared with the No Action Alternative. This would represent 1.3 percent of the city's 2000 population. The projection of population growth for the city is 23 percent from the year 2000 to 2010 (Association of Bay Area Governments 2001). Given the demand for housing within the city of Livermore (development and additional demand for housing limited by the Housing Implementation Plan), the reduced pressure for available housing would have minimal impact to the community or housing market.

TABLE 5.4.2.2–1.—*Anticipated Geographic Loss of Lawrence Livermore National Laboratory Worker Residences Under the Reduced Operation Alternative*

City	Percent of LLNL Workers [a,b]	Decrease in Number of Workers from No Action Alternative[c]
Alameda County		
Livermore	37.0	333
Pleasanton	6.2	56
Castro Valley	4.0	36
Dublin	2.1	19
Oakland	2.1	19
Other Alameda County	4.1	37
Total	**55.5**	**500**
San Joaquin County		
Tracy	8.2	74
Manteca	4.8	43
Stockton	2.6	24
Other San Joaquin County	2.9	26
Total	**18.5**	**167**
Contra Costa County		
Brentwood	2.7	24
San Ramon	2.7	24
Other Contra Costa County	7.4	66
Total	**12.8**	**114**
Stanislaus County		
Modesto	3.2	29
Other Stanislaus County	2.9	26
Total	**6.1**	**55**
Counties Outside the ROI		
Total	**7.2**	**65**

Source: LLNL 2003ak.
[a] Distribution as of September 30, 2002.
[b] May not total 100 because figures are rounded off.
[c] Calculated based on 900-employee decrease. May not total 900 because of rounding.
ROI = Region of Influence.

City of Pleasanton

Based on the anticipated geographic distribution of personnel leaving the region, it is estimated that 56 LLNL workers would leave the city of Pleasanton over 10 years as compared with the No Action Alternative. Based on the person per household figure of 2.73 in the city for the year 2000 (Census 2002b), the decrease in city population associated with the Reduced Operation Alternative would be 153 persons. This would represent 0.2 percent of the population for the year 2000. Given the high demand for housing within the city of Pleasanton, the out-migration of workers would have a very small impact on the expected demand for housing within the city.

San Joaquin County

Based on the current geographic distribution of personnel, 167 fewer LLNL workers would live in San Joaquin County than under the No Action Alternative (Table 5.4.2.2–1). Based on the person per household figure of 3.17 for the year 2001 in the county (Census 2003), the San Joaquin County decreased population associated with these employees would be 529 persons. This would represent a reduction of 0.1 percent of the total population within the county for the year 2000. The slightly slower growth in population associated with the Reduced Operation Alternative would have only a very small impact to population growth within the county.

Projected housing demand associated with the loss of workers (assuming one worker per household) in the county would total 167 units less than under the No Action Alternative over 10 years, lowering the total number of housing units occupied by LLNL workers to approximately 1,850 within San Joaquin County. The 2002 housing supply within the county was 197,279 units, with a vacancy rate of 3.9 percent (DOF 2002). The total number of vacant units was 7,767. County projections estimate a 26 percent increase in the number of housing units within the county by the year 2010 (SJCOG 2000). The Reduced Operation Alternative would be expected to have a very small impact on the demand for housing within the county.

City of Tracy

Based on the anticipated geographic distribution of personnel leaving the region, 74 fewer workers would be located in the city of Tracy over 10 years than under the No Action Alternative (Table 5.4.2.2–1). Based on the person per household figure of 3.23 for the city in the year 2000 (Census 2002a), the difference in city population associated with the Reduced Operation Alternative would be 239 fewer persons than under the No Action Alternative. This represents 0.4 percent of the population in the year 2000. The Reduced Operation Alternative would be expected to result in a very small impact on the demand for housing in the city of Tracy.

Environmental Justice

In general, LLNL operations under the Reduced Operation Alternative would have no anticipated disproportionately high and adverse health or environmental impacts on low-income or minority populations. Effects would be qualitatively equivalent to those described for the No Action Alternative in Section 5.2.3.2. A number of quantitative differences exist between the data presented in Section 5.2.3.2 and the Reduced Operation Alternative:

- As indicated earlier in this section, 9,770 workers would be required at the Livermore Site, 880 less than under the No Action Alternative. A total of 230 workers would be required at Site 300, 20 less than under the No Action Alternative.

- As presented in Section 5.4.3, an estimated 4,200 metric tons per year of nonhazardous solid waste would be generated at the Livermore Site for disposal, 400 metric tons per year less than under the No Action Alternative. Site 300 generation would decrease by 17 metric tons per year to 191 metric tons per year.

- As presented in Section 5.4.8, the MEI dose from radiological air emissions would be 0.087 millirem per year, lower than the No Action Alternative estimate of 0.098 millirem per year. At Site 300, the MEI dose would be 0.054 millirem per year, slightly lower than the No Action Alternative dose of 0.055 millirem per year.

- As discussed in Section 5.4.11, the collective radiation dose to the population along the transportation route is calculated at 1.1 person-rem per year with 0.0006 LCFs, lower than the No Action Alternative estimates of 5.0 person-rem per year and 0.003 LCFs.

- As presented in Section 5.4.12, the projected peak electrical demand at LLNL would be 81 megawatts, slightly lower than the 82 megawatts under the No Action Alternative.

None of these changes would result in disproportionately high and adverse impacts on low-income or minority populations under the Reduced Operation Alternative.

5.4.2.3 *Cumulative Impacts*

Approximately 680 fewer LLNL workers would live in the various communities listed in Table 5.4.2.2–1 under the Reduced Operation Alternative than under the No Action Alternative, in the same proportion that existing workers have selected communities for their residences. In addition, approximately 220 workers and their families would leave other communities in the Bay Area and central San Joaquin Valley. The Reduced Operation Alternative would slow the rate of increase in cumulative demand for housing in the region associated with new employment opportunities. However, because of high housing demands within the city of Livermore and the region, the increase in available housing would not impact the community or housing market.

5.4.3 Community Services

The following section evaluates the effects of the Reduced Operation Alternative on providing fire, police, school, and nonhazardous solid waste facilities and services to surrounding communities.

Personnel statistics for employees at the Livermore Site and Site 300 are combined; thus, some of the projections and analyses in this section discuss impacts of employee reductions at the Livermore Site and Site 300 as a single entity.

5.4.3.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.4 for the Reduced Operation Alternative and the community services impact analysis. In general, the effects of projects under the Reduced Operation Alternative on community services would be related to reduction in employment opportunities and changes in floorspace. Employment changes under the Reduced Operation Alternative are detailed in Section 5.4.2. Under the Reduced Operation Alternative, floorspace would increase slightly as construction would not be offset by equal amounts of D&D. Employment parameters are listed in Table 5.4.3.1–1.

TABLE 5.4.3.1–1.—*Input Parameters for Community Services Analysis Under the Reduced Operation Alternative*

Parameter	Units	Site	No Action Alternative	Reduced Operation Alternative
Employment	Number of personnel	Livermore Site Site 300	10,650 250	9,770 230

5.4.3.2 *Impact Analysis*

Livermore Site

Fire Protection and Emergency Services

Under their automatic aid agreement, the Livermore-Pleasanton Fire Department responds to an average of three calls per year at the Livermore Site. The incremental change in Livermore Site floorspace would result in no change in the number of calls to the Livermore-Pleasanton Fire Department and would be anticipated because of the Reduced Operation Alternative. The Livermore-Pleasanton Fire Department's current average of three calls per year at the Livermore Site does not affect that agency's ability to provide fire protection and mutual and automatic aid service to its constituency. Because the Reduced Operation Alternative would not change the number of calls, there would be minimal impacts on the Livermore-Pleasanton Fire Department.

The Alameda County Fire Patrol did not respond to any LLNL Fire Department calls during the 2000-2002 timeframe. Implementation of the Reduced Operation Alternative would not change the number of calls for assistance. Therefore, the Reduced Operation Alternative would not impact the Alameda County Fire Patrol's ability to provide fire protection within its service area or to carry out its mutual aid responsibilities with other agencies.

Police Protection and Security Services

The Livermore Site provides onsite security services and participates in emergency response agreements with the city of Livermore Police Department and Alameda County Sheriff's Department for additional police protection services at the Livermore Site. The decrease of 880 employees at the Livermore Site under the Reduced Operation Alternative would not affect the need for assistance, as the number of incidents where additional police protection is typically requested (for example, demonstrations near the facility) would not be expected to change.

School Services

It was assumed that personnel associated with workforce reduction under the Reduced Operation Alternative would leave the communities listed in Table 5.4.2.2–1 and other communities throughout the Bay Area and central San Joaquin Valley. Thus, a secondary or indirect effect of the Reduced Operation Alternative would be a decrease in student enrollment in those school districts where LLNL employees would otherwise reside. A small decrease in the projected enrollment (180 fewer students over 10 years in the Livermore Valley Joint Unified School District) would not be expected to affect school services.

Nonhazardous Solid Waste Disposal

The Livermore Site currently generates approximately 11,000 metric tons of nonhazardous solid waste per year, of which 4,700 metric tons are disposed of at the Altamont Landfill; the remainder is diverted for recycling or reuse. Assuming decreases in nonhazardous solid waste would be proportional to the anticipated decreases in site employment, the Reduced Operation Alternative would result in a decrease of approximately 400 metric tons of nonhazardous solid waste per year to be disposed of at the landfill.

The projected lifespan of the Altamont Landfill under current conditions extends to the year 2038 (Hurst 2003). The 400-metric-ton reduction in solid waste generated at LLNL for disposal under the Reduced Operation Alternative would not affect the Altamont Landfill lifespan. The decrease in solid waste under the Reduced Operation Alternative would represent only 0.01 percent of permitted landfill throughput; thus minimal impacts are expected.

Site 300

Fire Protection and Emergency Services

The Site 300 fire station and the city of Tracy Fire Department did not respond to any calls in each other's jurisdictions during the 2000-2002 timeframe under their mutual aid agreement. The number of mutual aid responses would not change for either agency under the Reduced Operation Alternative, which assumes no change in building gross square footage at Site 300. Therefore, no new impacts would be expected to the city of Tracy Fire Department's ability to provide fire protection services or mutual aid services.

Through a mutual aid agreement, the Tracy Rural County Fire Protection District currently responds to an average of one call per year at Site 300. The fire station at Site 300 has never received a request for assistance from the Tracy Rural County Fire Protection District. It is anticipated that the number of responses for each agency would not change under the Reduced Operation Alternative. Therefore, there would be no impact to the Tracy Rural County Fire Protection District's ability to provide fire protection within its service area or to fulfill its mutual aid responsibilities with other agencies.

Site 300 participates in a mutual aid network with the California Department of Forestry. No additional impact is projected on the California Department of Forestry's ability to provide fire protection and mutual aid service.

The Reduced Operation Alternative would not result in a change in the need for fire protection services onsite. There would be no impact to offsite agencies with whom LLNL has mutual aid and response agreements.

Police Protection and Security Services

Site 300 provides onsite security services and participates in an emergency response agreement for additional police and security services with the San Joaquin County Sheriff's Department. There would be no change in the demand for police protection and security services; therefore, there would be no additional impacts to onsite security services or on the San Joaquin County Sheriff's Department's ability to provide services to its constituency.

School Services

The impact analysis for school services is combined for the Livermore Site and Site 300 (see the discussion of school services under the Livermore Site heading above). Only a very small impact is expected.

Nonhazardous Solid Waste Disposal

The most accurate measure of the decrease in nonhazardous solid waste generation would be associated with the decrease in personnel generated by the Reduced Operation Alternative.

Under the No Action Alternative, Site 300 is projected to dispose of approximately 208 metric tons of solid waste per year at the Tracy Material Recovery and Solid Waste Transfer Station. A generation rate of 0.83 metric tons per employee per year can be assumed based on the current amount of solid waste generated and disposed of each year by the existing 240 persons at the site. Therefore, based on a projected decrease of 20 workers over the next 10 years, the Reduced Operation Alternative would result in a maximum decrease of approximately 16.6 metric tons per year of solid waste to be disposed of at the Tracy Material Recovery and Solid Waste Transfer Station, or another landfill if necessary. This would not be a substantial reduction and would have no impact on the Tracy Material Recovery and Solid Waste Transfer Station.

5.4.3.3 *Cumulative Impacts*

Changes in the number of employees associated with activities in the ROI would contribute to changes in the cumulative demand for fire and police services in the jurisdictions where these activities occur. However, fire and security services at LLNL are independent departments that do not rely on offsite community agencies to provide primary responses to fire and police emergency calls. No changes demanding these onsite services or is associated with the Reduced Operation Alternative are anticipated. There would be no new impacts to the cumulative demand for offsite fire and police services.

The Reduced Operation Alternative would not significantly alter the cumulative demand for school services in the region. Existing school facilities cannot accommodate student generation from non-LLNL-related development projected within the Livermore Valley Joint Unified School District's jurisdiction. The Reduced Operation Alternative would eliminate

approximately 180 students from the anticipated increase in student enrollment; however, this would not alter the district's ability to plan for and provide school services within its jurisdiction.

The Reduced Operation Alternative would lessen the cumulative demand for solid waste disposal services. The Livermore Site sends solid waste to the Altamont Landfill. The landfill operator projects the lifespan of this landfill will extend to the year 2038. This closure date would not be affected under the Reduced Operation Alternative.

5.4.4 Prehistoric and Historic Cultural Resources

This section presents an evaluation of impacts to cultural resources resulting from implementation of the Reduced Operation Alternative. The impact analysis is organized by location and type of resource. Steps taken to reduce impacts are also discussed, as are the measures to be implemented to ensure compliance with the NHPA.

5.4.4.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.4 for the Reduced Operation Alternative and the analysis of cultural resources. In general, those projects with the potential to impact these resources include construction of new facilities and infrastructure, in addition to D&D, rehabilitation, and renovation of existing facilities.

5.4.4.2 *Impact Analysis*

Livermore Site

The probability of impacting prehistoric resources at the Livermore Site would be very low because: (1) field and archival research have not identified any prehistoric resources; (2) the geomorphic setting of the site makes it unlikely that any such resources exist; and (3) extensive modern horizontal and vertical development has disturbed much of the site. Although no impacts to prehistoric resources would be expected, unrecorded subsurface prehistoric resources still could be inadvertently discovered during construction or other ground-disturbing activities.

To address the inadvertent discovery of cultural material, LLNL would require its employees and contractors to report any evidence of cultural resources unearthed during ground-disturbing activities at the Livermore Site. Work within the immediate vicinity of the discovery would cease until a qualified archaeologist had the opportunity to assess the discovery. If the discovery were deemed potentially significant, work would be stopped until an appropriate treatment plan was developed according to DOE guidelines. NNSA expects no impacts to these resources.

The Reduced Operation Alternative would have the potential to affect important historic buildings and structures on the Livermore Site through D&D, rehabilitation, or renovation of existing facilities. However, implementing the Programmatic Agreement (Appendix G) would avoid, reduce, or mitigate any impacts from these actions.

Site 300

Impacts to known prehistoric and historic resources at Site 300 would be unlikely to result from the Reduced Operation Alternative. NNSA recognizes the sensitivity of the resources and has established buffer zones to protect them. Implementation of the Programmatic Agreement (Appendix G) and continuation of current management practices would result in protection of these sensitive areas. Although no impacts to known resources are expected, there is still the possibility that unrecorded subsurface prehistoric or historic resources still could be inadvertently discovered during construction or other ground-disturbing activities.

To address the inadvertent discovery of cultural material at Site 300 would be addressed as described above for the Livermore Site. NNSA expects no additional impacts to these resources.

The Reduced Operation Alternative would have the potential to affect important historic buildings and structures on Site 300 through D&D, rehabilitation, and renovation of existing facilities. However, implementing the Programmatic Agreement (Appendix G) with responsible state and Federal agencies would avoid, reduce, or mitigate any impacts from these actions.

5.4.4.3 *Cumulative Impacts*

The Livermore Valley has undergone tremendous growth and development over the past decade. Because preservation measures such as Section 106 are only initiated when Federal agencies are involved, it is likely that the onset of development has caused the irretrievable loss of cultural resources in the region. Because cultural resources exist at both the Livermore Site and Site 300, future program activities could result in resource loss and add to regional attrition of these resources. Any potential impacts to cultural resources at LLNL would be mitigated through implementation of the Programmatic Agreement (Appendix G), thereby reducing LLNL's contribution to resource attritions.

5.4.5 Aesthetics and Scenic Resources

This section presents an evaluation of impacts to aesthetics and scenic resources resulting from implementation of the Reduced Operation Alternative.

5.4.5.1 *Relationship with Site Operations*

This section summarizes the relationship between the projects described in Section 3.4 for the Reduced Operation Alternative and the analysis of aesthetics and scenic resources. In general, effects to aesthetics and scenic resources would be limited to the construction of buildings, demolition of existing structures, and infrastructure located in areas visible to public viewing.

5.4.5.2 *Impact Analysis*

Livermore Site

Activities under the Reduced Operation Alternative that would change the built environment at the Livermore Site would include improvements to existing buildings and infrastructure, D&D of existing buildings, and construction of new facilities. As with the No Action Alternative,

developments and modifications would largely occur within the developed portion of the site, would be similar in character to surrounding uses, and would be largely screened from public view by the surrounding fences and trees. Like the No Action Alternative, developments and modifications would be largely consistent with the existing character of the site, and the site would remain compatible with local and county scenic resource plans and policies.

Construction of new facilities would be the same as for the No Acton Alternative. The changes to the built environment as a result of the Reduced Operation Alternative would have no impact on the visual character of the Livermore Site, views of the site from public viewing areas, or existing view sheds of the surrounding environment.

Site 300

Activities under the Reduced Operation Alternative that would change the built environment at Site 300 would include improvements to existing buildings and infrastructure. Development and modifications would largely occur within the developed portion of the site in the GSA and would be similar in character to surrounding uses. Although many specifics of these developments under the Reduced Operation Alternative are not currently known, based on previous LLNL landscaping and development practices, it is anticipated that development of these projects at Site 300 under this alternative would be largely consistent with the existing character of the site.

The locations, types, and extents of construction and improvement activities at Site 300 would be the same as under the No Action Alternative. The site would remain compatible with local and county scenic resource plans and policies. Consequently, the changes to the built environment because of the Reduced Operation Alternative would have no impacts on the visual character of Site 300, views of the site from public viewing areas, or existing view sheds of the surrounding environment.

5.4.5.3 *Cumulative Impacts*

There are no planned projects near the Livermore Site and Site 300 that, in combination with LLNL activities, would have an adverse effect on existing view sheds or the surrounding environment. There would be no cumulative impacts to aesthetics and scenic resources in the region under the Reduced Operation Alternative.

5.4.6 Geology and Soils

This section analyzes the impact to geology and soils associated with implementation of the project described in Section 3.4 under the Reduced Operation Alternative. The impact analysis is organized by geologic resources, topography and geomorphology, and geologic hazards.

5.4.6.1 *Relationship with Site Operations*

Under the Reduced Operation Alternative, the future facilities described under the No Action Alternative would be built. The difference between the alternatives lies exclusively in the level of operation only. The facilities for the Livermore Site are listed in Table 5.2.1.2–1.

Future development in the developed area at the Livermore Site would involve areas where soils have already been disturbed and therefore, would not involve any impacts to soils.

At Site 300, the Wetlands Enhancement Project artificial wetlands would be constructed as described under the No Action Alternative.

5.4.6.2 *Impact Analysis*

Geologic Resources

Livermore Site

No known aggregate, clay, coal, or mineral resources would be adversely affected by the Reduced Operation Alternative. None of the activities proceeding under the Reduced Operation Alternative would take place near or upon known or exploitable mineral resources, unique geologic outcrops, or other unique geologic features. None of the Reduced Operation Alternative activities would affect farming or grazing activities.

The Reduced Operation Alternative would include the same facilities to be built in the undeveloped zone at the Livermore Site as part of the No Action Alternative (Figure 5.2.6.1–1). Table 5.2.1.2–1 presents these facilities along with the estimated amount of land that would be disturbed by their construction. A total of 462,000 square feet would be disturbed because of the construction that would proceed under the Reduced Operation Alternative. No additional impacts are expected.

As discussed in Chapter 4, Section 4.8, of the LLNL SW/SPEIS fossils were discovered in the peripheral parts of the excavation for the NIF. The fossil localities were found 20 to 30 feet below the surface. Under the Reduced Operation Alternative, the potential would exist for the inadvertent excavation of fossils within this depth range during construction. Should any buried fossil materials be encountered, LLNL would evaluate the materials and proceed with recovery in accordance with the requirements of the *Antiquities Act*.

Site 300

No known aggregate, clay, coal, or mineral resources would be adversely affected by the Reduced Operation Alternative. Under the Reduced Operation Alternative, the Site 300 Wetlands Enhancement Project and the connection to the Hetch Hetchy aqueduct would be built at Site 300 as described under the No Action Alternative. There would be no impacts to any known or exploitable mineral resources, or unique geologic features.

Enhancement of the wetland habitat at Mid Elk Ravine and the area of the seep at the former SHARP Facility would involve disturbing 1.09 acres of soil. The connection to the Hetch Hetchy aqueduct would involve the disturbance of soils along the line of connection. The amount of disturbance would be dependent on the exact path and the engineering of the connection.

Several vertebrate fossil deposits have been found on Site 300 and near Corral Hollow. The fossil finds are generally widely scattered, and no significant invertebrate or botanical fossil localities have been identified on Site 300 or in the surrounding area (Hansen 1991). No projects

under the Reduced Operation Alternative would involve the disturbance of these areas. Therefore, there would be no impacts to any known fossil deposits.

Topography and Geomorphology

Livermore Site

The Reduced Operation Alternative would not include project work that would affect the topography or geomorphology of the Livermore Site. No construction or excavation projects would be planned that would alter the character of the landscape. Only the best management practices would be employed to minimize erosion resulting from ongoing operations; no additional impacts are expected.

Site 300

The Reduced Operation Alternative would not include project work that would affect the topography or geomorphology of Site 300. No construction or excavation projects would be planned that would alter the character of the landscape. Only the best management practices would be employed to minimize erosion resulting from ongoing operations; no additional impacts are expected.

Geologic Hazards

The geologic hazards associated with the Livermore region are part of the character of that region. The hazards exist regardless of the presence of human activities, buildings, or facilities. Therefore, there is no difference in the geologic hazards among the alternatives. Detailed discussion is presented in Section 4.8 and Appendix H of the LLNL SW/SPEIS and includes the major regional fault zones and local faults.

Potentially strong earthquake ground motion sources at the Livermore Site and Site 300 are discussed in Section 4.8 and Appendix H. Potential impacts expected from an earthquake generating horizontal peak acceleration of 0.73 g are discussed as part of the evaluation of accidents in Section 5.5 and Appendix D.

Livermore Site

Adverse impacts to proposed structures and related infrastructure and surrounding communities could occur from hazardous materials releases and/or structural failure of buildings and facilities following a major seismic event. Design and location requirements for new facilities, including waste management facilities, must take into account distance from active faults, and the ground shaking to be expected within certain probabilities.

Site 300

Buildings 899A and 899B at the pistol range could experience ground deformation during a major earthquake on the Carnegie Fault. However, these two structures contain no hazardous or radiological materials and have very low occupancies. A greater number of facilities are located near the Elk Ravine Fault; however, that fault has not been considered active.

There is potential for seismically induced landslides at Site 300 due to the presence of landslide deposits and steep slopes. The potential for slope instability is greater on northeast-facing slopes that are underlain by the Cierbo Formation. Buildings 825, M825, 826, M51, 847, 851A, 851B, 854, 855, and 856 are located on old landslides. The potential for ground deformation at these buildings located on landslide deposits is considered moderate to high.

A landslide could result in spills, fire, explosions, or burial of facilities within its path. The hazards and impacts of spills, fire, and explosions, regardless of cause are discussed in Section 5.5 and Appendices A and D. The impacts of burial of materials due to a landslide would be similar to spills and the firing of explosives at these facilities. These facilities have material limits under which they work on batches of materials. The working limits for explosives are close to the amounts detonated at the firing sites. The spread of materials into the environment when the explosives are detonated would be similar to the amount of materials that would be buried in a landslide.

5.4.6.3 *Cumulative Impacts*

SNL/CA projects approximately 100 acres of soil disturbance in connection with their activities and future facilities. A large fraction of this is within areas that are already developed. The soils in the vicinity of LLNL are capable of supporting agriculture. While there is a large amount of undeveloped land in Alameda County, continuing development in the immediate vicinity of LLNL is contributing to the cumulative loss of agricultural land. The projects associated with the Reduced Operation Alternative do not contribute to the overall loss of agricultural land since LLNL has been committed to R&D/industrial use instead of agriculture for decades.

5.4.7 Biological Resources

This section analyzes the potential impacts of the Reduced Operation Alternative on biological resources, including vegetation, wildlife, protective and sensitive species, and wetlands.

5.4.7.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.3 for the Reduced Operation Alternative and the ecological impact analysis. In general, the effect of the Reduced Operation Alternative projects on biological resources would occur primarily in areas that have been previously disturbed at the Livermore Site and Site 300 by construction, maintenance, wildfire prevention, and security activities.

5.4.7.2 *Impact Analysis*

Vegetation and Wildlife

Livermore Site

It is anticipated that approximately the same land disturbance activities described for the No Action Alternative would occur under the Reduced Operation Alternative. Up to 462,000 square feet (10.6 acres) of land disturbance may occur under this alternative with remaining vegetation consisting of landscaped areas, fields dominated by early successional plant communities

indicative of recent disturbance, annual grasslands in the security zone, and remnant wooded riparian vegetation along Arroyo Seco. The wildlife in the plant communities at the Livermore Site consists of species adapted to living in areas of high human activity or species adapted to living in grassland habitat. Therefore, the impacts of this alternative on vegetation and wildlife at the Livermore Site would be minimal.

Site 300

Site 300 vegetation and wildlife consist of a wide range of plant and animal species. The impacts of the Reduced Operation Alternative on vegetation and wildlife would occur primarily in previously disturbed areas representing less than 5 percent of the total site acreage. Under the Reduced Operation Alternative, no new facility construction would involve soil disturbance in new areas, although a number of routine operations such as road grading and culvert maintenance would occur and include protective measures as discussed in Appendix E, Section E.2.2.

Tritium Levels in Vegetation and Commodities

In 2001, as noted in Section 5.2.7, the No Action Alternative maximum potential dose from ingestion of vegetables, milk, and meat for the Livermore Valley was 0.0069 millirem (LLNL 2002cc). With the exception of vegetation from previously identified sites of contamination, the tritium levels at Site 300 were below the limits of detection and comparable to those exposed in previous years. Assuming a hypothetical average wine consumption and using the medium tritium values from the three sampling areas, the annual doses from Livermore, Europe, and California wines in 2001 would have been 0.13 microrem, 0.11 microrem, and 0.037 microrem, respectively (LLNL 2002cc).

No modeling was conducted to estimate tritium levels under the Reduced Operation Alternative in vegetation and other commodities. However, the tritium levels in vegetation and wine would be proportional to the annual release of tritium. These levels would be anticipated to be the same as those for the No Action Alternative, or lower depending on the level that operations at LLNL are reduced. A detailed discussion of tritium levels is presented for the discussion of the No Action Alternative in Section 5.2.7.3. No impacts are expected.

Protected and Sensitive Species

Livermore Site

Under the Reduced Operation Alternative, LLNL would continue to fulfill its obligation to maintain Arroyo Las Positas (previously modified to handle a 100-year flood event) and onsite tributaries for flood capacity. The objective of the Las Positas Maintenance Project is to allow the function and needs of onsite drainage capacity of the arroyo to be met in a timely and consistent manner without overlooking the preservation and habitat conservation requirements pertaining to the federally threatened California red-legged frog (LLNL 1998a, USFWS 1997, USFWS 2002c). For further details of the Arroyo Maintenance Project and ongoing consultation with the USFWS for this project, see Appendix E, Section E.2.1, of this LLNL SW/SPEIS.

No California red-legged frogs have been identified in the 1,800 feet of Arroyo Seco within the Livermore Site boundaries from the Vasco Road bridge to the East Avenue culvert (LLNL 2003ab). However, this segment of Arroyo Seco could be used by populations of this frog in the vicinity of the site. A separate Biological Assessment is being prepared to assess the impacts of the proposed Arroyo Seco Management Plan.

Formerly designated critical habitat for the California red-legged frog at the Livermore Site is shown in Figure 4.9.3–1. Construction of most, but not necessarily all, No Action Alternative structures would occur under the Reduced Operation Alternative. The Reduced Operation Alternative projects at the Livermore Site would not be designated critical habitat for the California red-legged frog or in areas where this species currently occurs.

In 1997, bullfrogs were noted in the southern sediment basin, a sediment trap south of the Drainage Retention Basin. A bullfrog management program, coordinated with the USFWS, was initiated to minimize the adverse impacts of this invasive species, which is a predator of the California red-legged frog (USFWS 2002e). See Appendix E for further discussion.

Measures to protect the California red-legged frog during Las Positas Maintenance Project activities would continue using the same USFWS-approved protection and conservation measures discussed in Section 5.2.7.3. Impacts are expected to be beneficial.

Site 300

Threatened, endangered, and other sensitive flora and fauna species of concern reside at Site 300. Under the Reduced Operation Alternative, most, but not necessarily all, No Action Alternative projects described in Section 3.2 would be completed.

Affected Species

The Reduced Operation Alternative would affect three species: California red-legged frog, California tiger salamander, and Alameda whipsnake, as well as rescinded critical habitat for the California red-legged frog and Alameda whipsnake. The California red-legged frog is a federally listed threatened species. Critical habitat for the California red-legged frog and its breeding and nonbreeding locations at Site 300 are shown in Figure 4.9.3–3. Proposed termination of surface water releases for an artificial wetland at Building 865 would impact this species since it has been a known breeding location for 6 years. Termination of water to a small, artificially maintained wetland at Building 801 would eliminate a potential breeding site for this frog species, although no California red-legged frogs occur at this site. Elimination of very small wetlands associated with the cooling towers at Buildings 851 and 827 would eliminate two low-quality habitat locations for the California red-legged frog where frogs have not been observed for the past 6 years. Appendix E, Section E.2.2.6.1, of this LLNL SW/SPEIS provides further details on potential impacts of this project and mitigation measures that would be taken to minimize those impacts. Proposed termination of surface releases at Buildings 865, 851, and 827 has been coordinated with the USFWS and has received approval contingent upon implementation of mitigations measures in a recent Biological Assessment and related Biological Opinion (Jones and Stokes 2001, USFWS 2002b). This proposed termination could start as early as 2004 (LLNL 2003ab). Grading of fire trails disturbs sediment that could directly affect

California red-legged frog habitat suitability. However, the use of best management practices could reduce negative effects to this species by minimizing erosion of fire trails into drainages as discussed in Appendix E, Section E.2.2.6.1.

LLNL is proposing to mitigate the 0.62-acre artificial wetland removed by continued operations at Site 300 under the Reduced Operation Alternative by enhancing selected areas and increasing breeding opportunities for the California red-legged frog. A minimum of 1.86 acres of wetland habitat would be enhanced and managed for this species. Two mitigation sites for potential enhancement include the wetlands at the seep at the SHARP Facility and Mid Elk Ravine. This mitigation measure has been previously addressed in a recent Biological Assessment and related Biological Opinion (Jones and Stokes 2001, USFWS 2002b). (See Appendix E, Section E.2.2.9, for more information on this mitigation measure).

The second affected species is the California tiger salamander, a federally listed proposed threatened species. See Chapter 4, Figure 4.9.3–4, for wetland locations where this species has been observed at Site 300. Although proposed storm drainage and culvert improvement activities could result in direct mortality of California tiger salamanders, proposed mitigations contained in a recent Biological Assessment and related Biological Opinion would greatly minimize the potential for such impacts (Jones and Stokes 2001, USFWS 2002b). Appendix E, Section E.2.2.6.3, provides further details on mitigation measures taken that would be to minimize potential impacts of the Reduced Operation Alternative on this species. Measures designed to mitigate impacts of the Reduced Operation Alternative on the California red-legged frog would also ameliorate impacts on the California tiger salamander. Minimal impacts are expected.

The third affected species is the Alameda whipsnake, a federally listed threatened species. Figure 4.9.3–5 shows critical habitat and potential habitat for the Alameda whipsnake at Site 300. Grading of fire trails as well as prescribed burns in grasslands adjacent to Alameda whipsnake habitat in sage scrub and rock outcrops have the potential to affect this species. However, a Biological Assessment and related Biological Opinion address mitigations that would minimize the adverse effects from these proposed activities (Jones and Stokes 2001, USFWS 2002b). Fire trail maintenance and prescribed burns are annual activities that would continue during the 10-year period covered by this LLNL SW/SPEIS. Appendix E, Section E.2.2.6.2, provides further details on measures taken to minimize impacts of the Reduced Operation Alternative on this species.

Unaffected Species

Approximately the same level of impacts from land disturbance and continued operations would occur under the Reduced Operations Alternative as under the No Action Alternative. Therefore, the Reduced Operation Alternative would not impact the following federally listed endangered, threatened, or candidate species (for the reasons discussed in Section 5.2.7.3): the large-flowered fiddleneck, the San Joaquin kit fox, the valley elderberry longhorn beetle and the willow flycatcher. Protection and conservation measures discussed in Section 5.2.7.3 would also be conducted under the Reduced Operation Alternative.

Wetlands

Livermore Site

Under the Reduced Operation Alternative, it is anticipated that most, but not necessarily all, No Action Alternative projects would be completed. Construction of new buildings under the Reduced Operation Alternative would occur in upland areas, so that land clearing would not be anticipated to have direct or indirect impacts on natural wetlands. Wetlands along Arroyo Las Positas could be impacted if discharged treated water from the Environmental Restoration Program is terminated; although such termination is not being considered during the time period covered by the LLNL SW/SPEIS. Future actions involving these wetlands could require consultation with the USACE, such as ongoing efforts to develop a water management plan for an 1,800-foot segment of Arroyo Seco within Livermore Site boundaries from the Vasco Road bridge to the East Avenue culvert (LLNL 2001ap). Additionally, the State of California has a no net loss policy regarding wetlands, including artificial wetlands. No impacts are expected.

Site 300

Under the Reduced Operation Alternative, a No Action Alternative Wetlands Enhancement Project would also be constructed to protect and enhance a minimum of 1.86 acres of wetland habitat in conjunction with the termination of artificial wetlands (totaling 0.62 acres) that have been created by cooling tower runoff near Buildings 801, 827, 851, and 865. A Section 404 permit would be required from the USACE and a Section 401 certification of waiver would need to be obtained from the Regional Water Quality Control Board.

5.4.7.3 *Cumulative Impacts*

Under the Reduced Operation Alternative, cumulative impacts would be essentially the same as under the No Action Alternative, except that a smaller amount of land disturbance would likely occur at the Livermore Site and Site 300. SNL/CA is managing their section of Arroyo Seco to protect California red-legged frog habitat and create a 30-acre wildlife preserve of the east side of that facility.

5.4.8 Air Quality

5.4.8.1 *Nonradiological Air Quality*

Relationship with Site Operations

The Reduced Operation Alternative allows for continued operation of most LLNL functions, although some planned activities would go forward at a scaled-back rate (i.e., a reduction in operating levels). Scaling back activities would result in a reduction in workforce levels at both sites and therefore, some reduction in vehicular activity and fuel demand. The general parameters that will be used in the analyses of potential air quality impacts are listed in Table 5.4.8.1–1. Impacts are expected to be minimal.

Impact Analysis

Modifications to Facilities or Operations

The Reduced Operation Alternative is similar to the No Action Alternative in that facility and infrastructure renovation (e.g., replacement of ductwork, roofs, installation of seismic and physical security upgrades, and repairs and modifications to roads) activity levels would remain on par with current levels. LLNL would continue to include standard measures for controlling pollution as part of every design and construction project. With the mitigation measures in place as discussed in Sections 5.1.8 and 5.2.8.1, impacts would be similar to current levels.

This alternative would allow the construction and operation of planned and recently approved facilities as discussed under the No Action Alternative, resulting in a 1 percent increase in developed space. While the increase in facility space would result in some additional fuel use, this would be compensated by the scale back in some operating levels, providing a net reduction in demand. Several criteria and toxic air contaminants would be emitted from fuel combustion. Oxides of nitrogen are a concern locally as a contributor to ozone formation. The decreased fuel use anticipated under the Reduced Operation Alternative would result in a small reduction in oxides of nitrogen emissions, about 0.39 tons annually, which would be less than 2 percent of the oxides of nitrogen emissions from this source category under current operating conditions.

Decommissioning, Decontamination, and Demolition

The Reduced Operation Alternative would include the planned removal of excess and legacy facilities at the Livermore Site. The total space planned for removal and potential air quality impacts would equal that of the No Action Alternative. Mitigation measures that would be used to reduce air emissions associated with D&D actions are discussed in Section 5.2.8.1.

Support Personnel and Vehicular Activity

Scaling back activities would result in a reduction of approximately 900 workers at LLNL. The reduced workforce would result in a corresponding decrease in vehicular activity and therefore, slight reductions in vehicular emissions.

Cumulative Impacts

The Reduced Operation Alternative would result in a small reduction in air pollutant loading and a net positive impact on air quality. The parameters used to evaluate air quality impacts under the Reduced Operation Alternative are listed in Table 5.4.8.1–1. Table 5.4.8.1–2 presents the calculated maximum carbon monoxide concentrations, which would remain within 20 to 30 percent of ambient standards. These levels would not differ appreciably from those under the No Action Alternative because both the No Action and Reduced Operation Alternatives would represent minor contributors to the carbon monoxide concentration, which is dominated by current traffic levels and background sources. Projected air pollutant emission rate reductions associated with decreased fuel combustion in boilers and engines and the decreased vehicular activities associated with reduced workforce requirements under the Reduced Operation Alternative are provided in Table 5.4.8.1–3.

5.4.8.2 *Radiological Air Quality*

This section analyzes the Reduced Operation Alternative radiological air quality impacts due to normal releases from ongoing site operations (e.g., R&D, waste management). Impacts in terms of dose are related to either the Livermore Site or Site 300.

Relationship with Site Operations

This section summarizes the relationship between projects described in Section 3.4 for the Reduced Operation Alternative and radiological air quality. The dose resulting from exposure to routine air emissions from these projects is used to quantify the impacts. The important incremental impact to the No Action Alternative is due to reductions in NIF operations.

Impact Analysis

Livermore Site

The reduction in radiological air emissions and corresponding dose reductions from the No Action Alternative to the Reduced Operation Alternative would be a result of a one-third decrease in NIF releases other than tritium. Tritium emissions from the Tritium Facility would remain 210 curies per year. The resulting site-wide MEI dose from atmospheric emissions, at the same location as for the No Action Alternative, would be 0.1 millirem per year. This dose would be less than 0.9 percent of the NESHAP limit. Thirty-four percent of this dose would be from NIF emissions.

The corresponding population dose would be 1.8 person-rem per year, 86 percent would be a result of Tritium Facility operations. The NIF would have relatively less effect on the population dose than it would on the site-wide MEI dose because many of the important nuclides released are short-lived and would decay prior to reaching the general population. The dose to worker population would be 0.13 person-rem per year.

No adverse health impacts from normal radiological air emissions would be expected under the Reduced Operation Alternative at the Livermore Site (see Section 5.4.14.4).

Site 300

The reduction in impact from the No Action Alternative to the Reduced Operation Alternative would be a result of a decrease of tritium releases during explosives experiments to 15 milligrams (or 145 curies). The site-wide MEI dose, at the same location as under the No Action Alternative, would be 0.055 millirem per year, less than the 0.6 percent of NESHAP limit. The population dose would be 9.8 person-rem per year. The dose to the worker population would be 0.005 person-rem per year.

No adverse health impacts from normal radiological air releases would be expected under the Reduced Operation Alternative at Site 300.

Cumulative Impacts

No adverse impacts on radiological air quality would be expected under the Reduced Operation Alternative at either the Livermore Site or Site 300. Other than background radiation sources, there are no other known contributors to concentrations of radionuclides in air within 50 miles of the Livermore Site or Site 300. Therefore, there would be no cumulative radiological air quality impacts.

5.4.9 Water

5.4.9.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.4 under the Reduced Operation Alternative and the water impact analysis. The effect of projects under the Reduced Operation Alternative on water resources would be related to decreased water use, impervious surfaces and runoff, and decreased use of potential contaminants as a result of construction and operation of projects.

5.4.9.2 *Impact Analysis*

Livermore Site

Under the Reduced Operation Alternative, impacts to water resources would be expected to be similar to, but slightly less than, those described under the No Action Alternative. This is because similar, but fewer, activities would occur at the Livermore Site under the Reduced Operation Alternative. Due to reductions in activities at the NIF, the Terascale Simulation Facility, and other facilities, as described in Section 3.4, water consumption under the Reduced Operation Alternative would decrease by 16.8 percent from the level estimated under the No Action Alternative. Similarly, increases in impervious surfaces would be less than expected under the No Action Alternative. The surface water and stormwater monitoring program would not change and no impacts to surface water quality would be expected. Because no facilities would be located in either the 100-year or 500-year floodplain, no impact from flooding would be expected, nor would impacts to floodplains occur.

Impacts to groundwater would be similar to those described in the No Action Alternative. Groundwater remediation at the Livermore Site would continue and, therefore, groundwater quality would continue to improve. No discharges to groundwater would occur and potential impacts to groundwater quality from surface water recharge would be minimal because LLNL would continue to comply with NPDES requirements.

Site 300

Under the Reduced Operation Alternative, impacts to water resources would be expected to be similar to, but slightly less than, those described under the No Action Alternative. This is because similar, but fewer, activities would occur at Site 300 under the Reduced Operation Alternative. Water consumption for Site 300 would remain at 0.35 million gallons per day. Similarly, increases in impervious surfaces would be less than expected under the No Action Alternative. The surface water and stormwater monitoring program would not change and no

impacts to surface water quality would be expected. Because no facilities would be located in either the 100-year or 500-year floodplain, no impact from flooding would be expected, nor would impacts to floodplains occur.

Impacts to groundwater would be similar to those described in the No Action Alternative. Groundwater remediation at Site 300 would continue and, therefore, groundwater quality would continue to improve. No discharges to groundwater would occur and potential impacts to groundwater quality from surface water recharge would be minimal because LLNL would continue to comply with NPDES requirements.

5.4.9.3 *Cumulative Impacts*

Livermore Site

Under the Reduced Operation Alternative, cumulative impacts to water use, surface and groundwater contaminants, and impervious surfaces would be expected to be similar to, but slightly less than, those described under the No Action Alternative. A complete discussion of cumulative impacts can be found in Section 5.2.9.4.

Site 300

Under the Reduced Operation Alternative, cumulative impacts to water use, surface and groundwater contaminants, and impervious surfaces would be expected to be similar to, but slightly less than, those described under the No Action Alternative. A complete discussion of cumulative impacts can be found in Section 5.2.9.4.

5.4.10 Noise

This section presents noise impacts resulting from implementation of the Reduced Operation Alternative. The analysis is organized by noise-generating LLNL activities such as construction, modifications to and removal of facilities, traffic noise, and impulse noise.

5.4.10.1 *Relationship with Site Operations*

Activities associated with the Reduced Operation Alternative (Section 3.4) would contribute to noise generations, either directly or indirectly.

The general parameters that were used to characterize community noise levels are listed in Table 5.4.10.1–1.

5.4.10.2 *Impact Analysis*

The Reduced Operation Alternative would allow for continued operation of most LLNL functions, although some planned activities at both the Livermore Site and Site 300 would go forward at a scaled-back rate; i.e., a reduction in the planned number of demonstration projects or planned operating levels. Scaling back activities would also result in a reduction in workforce levels at both sites.

Modifications to Facilities or Operations

The Reduced Operation Alternative is similar to the No Action Alternative in that the projected level for construction activities related to facility and infrastructure renovations would remain on par with current levels, and the effect of these activities would not be noticeable beyond the site boundary, owing to the relatively large spatial area of LLNL sites and perimeter buffer zone common to both the Livermore Site and Site 300. Intervening roadways between the sites and community areas also would reduce the impact of onsite-generated noise. These improvements would not introduce any machinery or equipment that would differ from the current HVAC equipment, cooling towers, motors, pumps, fans, generators, air compressors, and loudspeakers. Noise from this equipment would not be noticeable beyond the site boundary. Impacts are expected to be similar to the No Action Alternative.

Traffic Noise

Scaling back activities would result in a reduction in workforce. Approximately 880 fewer workers would be required at the Livermore Site and 20 fewer at Site 300. The reduced workforce would translate into a corresponding decrease in vehicular activity and a slight, although probably not discernible, decrease in ambient noise.

Impulse Noise

LLNL would continue explosives research testing under the Reduced Operation Alternative at both the Livermore Site, within the HEAF Building, and at Site 300, within the Contained Firing Facility and on open firing tables. The shot frequency (blasts per year) would be scaled back to some extent, although the intensity would remain unchanged and impacts would be the same as under the No Action Alternative. LLNL would continue to use blast forecasting as a tool to determine if explosive tests would affect the surrounding community and to restrict operations when peak impulse noise levels are predicted to exceed 126 dB(A) in populated areas. LLNL would also continue to perform meteorological monitoring to provide necessary input data for blast forecasting (LLNL 2001s).

Decommissioning, Decontamination, and Demolition

The Reduced Operation Alternative would include the removal of excess and legacy facilities at the Livermore Site equal to that under the No Action Alternative. With the relatively large spatial area and perimeter buffer zone, noise from demolition activities would not be expected to be discernible in offsite areas.

5.4.10.3 *Cumulative Impacts*

The scale back of activities under the Reduced Operation Alternative would not be expected to contribute to cumulative impacts on community noise levels.

5.4.11 Traffic and Transportation

The estimate of traffic congestion is based on the change in employment under the Reduced Operation Alternative compared to the No Action Alternative. Radiological consequences were calculated using DOE transportation models as described in Section 5.1.11. Appendix J of this LLNL SW/SPEIS presents more detail on the methodology and important inputs for radiological transportation analysis.

5.4.11.1 *Relationship with Site Operations*

Section 3.4 describes the projects under the Reduced Operation Alternative. These projects, when combined with current operations, would result in decreased radiological transportation. The major shipments under the Reduced Operation Alternative would result in approximately 265 shipments of special nuclear material, 55 shipments of LLW and MLLW, 3 tritium shipments, and 7 TRU waste shipments (see Section J.5.4 for more details).

5.4.11.2 *Impact Analysis*

Livermore Site

Under the Reduced Operation Alternative, LLNL employment would decrease slightly from the No Action Alternative of 10,650 to approximately 9,770 workers. Radiological transportation under this alternative would slightly decrease from the No Action Alternative. This small percent decrease would result in a small benefit.

Radiological shipments would include reduced numbers of shipments of LLW (39), TRU (11), and special nuclear material (11). Potential impacts from these shipments are presented in Table 5.4.11.2–1. The number of LCFs under the Reduced Operation Alternative would be much less than one (1×10^{-3}) per year.

TABLE 5.4.11.2–1—*Collective Dose to the General Public From Radioactive Shipments Under the Reduced Operation Alternative*

	Collective Dose (person-rem per year)			
Shipment Type	**Along Route**	**Sharing Route**	**At Stops**	**Total**
LLW	6.5×10^{-2}	0.79	0.35	1.2
TRU waste	2.9×10^{-2}	0.35	0.16	0.54
Materials[a]	0.15	1.9	1.1	3.1
Total	**0.25**	**3.1**	**1.6**	**4.9**
No Action Alternative	0.33	3.8	1.8	5.9

[a] Nonwaste radioactive materials, including special nuclear materials, tritium, and other materials used for the LLNL mission.
LLW = low-level waste; TRU = transuranic.

Site 300

Under the Reduced Operation Alternative, a reduction in the number of hydroshots and a small potential decrease in the number of workers would result in a small decrease in traffic and parking requirements. This impact is expected to be negligible.

5.4.11.3 *Cumulative Impacts*

Cumulative transportation impacts under the Reduced Operation Alternative would be less than those from either the No Action Alternative or the Proposed Action for both the Livermore Site and Site 300.

5.4.12 Utilities and Energy

This section discusses the potential impacts of the Reduced Operation Alternative on utilities and energy supplies. Utility and energy usage is discussed separately for the Livermore Site and Site 300. LLNL-leased properties (i.e., Almond Avenue, Graham Court, Patterson Pass, and Arroyo Mocho Pump Station) are considered part of the Livermore Site in assessing utility and energy impacts.

5.4.12.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.4 for the Reduced Operation Alternative and the utilities and energy analysis. In general, the effect of projects for the Reduced Operation Alternative on utilities and energy analyses are related to water consumption, sewage discharges, electricity consumption, and fuel consumption resulting from reductions in the quantity of surveillance and test activity performed under the Reduced Operation Alternative.

5.4.12.2 *Impact Analysis*

Water Consumption

Livermore Site

The existing capacity of the Livermore Site domestic water system is approximately 2.88 million gallons per day. Under the No Action Alternative, water use at the Livermore Site would be approximately 276 million gallons per year (see Section 5.2.12.3).

Due to reductions in activities at the NIF, the Terascale Simulation Facility, and other facilities, as described in Section 3.4, water consumption under the Reduced Operation Alternative would decrease to approximately 230 million gallons per year, a 17 percent reduction from the level estimated under the No Action Alternative. Because the Livermore Site domestic water system has excess capacity and water use would decrease under the Reduced Operation Alternative, no new impacts are expected.

Site 300

Water consumption at Site 300 is expected to be 67,900 gallons per day under the No Action Alternative Consumption under the Reduced Operation Alternative would remain at this level. No new impacts are expected.

Sewer Discharges

Livermore Site

Under the No Action Alternative, the Livermore Site would discharge approximately 224,000 gallons per day to the sanitary sewer system (see Section 5.1.12.2). Under the Reduced Operation Alternative, LLNL would scale back operations at the NIF and the Terascale Simulation Facility by 33 percent and 40 percent, respectively. However, both facilities would maintain full operations and facility support staff. Therefore, sewer discharges under the Reduced Operation Alternative would remain at the level estimated under the No Action Alternative. No new impacts are expected.

Site 300

Site 300 will discharge approximately 2,100 gallons of sewage per day under the No Action Alternative. Discharges under the Reduced Operation Alternative would remain at these levels. No offsite sewage treatment is conducted for Site 300 wastes and no new impacts are expected.

Electricity Consumption

Livermore Site

The projected peak electrical demand under the Reduced Operation Alternative would be 81 megawatts. Under the No Action Alternative, electricity consumption at the Livermore Site would be approximately 446 million kilowatt-hours per year. Based on reduction activities at the NIF, the Terascale Simulation Facility, and other facilities, as described in Section 3.4, consumption under the Reduced Operation Alternative would decrease by 17 percent from the level estimated under the No Action Alternative to 371 million kilowatt-hours per year. No new impacts are expected.

Site 300

PG&E supplies electrical power to Site 300. Electricity consumption at Site 300 is approximately 16.3 million kilowatt-hours per year under the No Action Alternative. Consumption under the Reduced Operation Alternative would remain at these levels. No new impacts are expected.

Fuel Consumption

Livermore Site

PG&E supplies natural gas to the Livermore Site. Natural gas consumption for the Livermore Site would average 23,300 therms per day under the No Action Alternative. Consumption under

the Reduced Operation Alternative would decrease by 3 percent from the level estimated under the No Action Alternative, or approximately 22,600 therms per day. No new impacts are expected.

Diesel fuel and unleaded gasoline usage would remain constant even under the Reduced Operation Alternative. Consumption of approximately 72,200 gallons diesel fuel per year and 451,800 gallons per year unleaded gasoline is anticipated.

Site 300

Site 300 fuel oil consumption is approximately 16,600 gallons per year under the No Action Alternative. Consumption under the Reduced Operation Alternative would remain at these levels. No new impacts are expected.

5.4.12.3 *Cumulative Impacts*

Water Consumption

Livermore Site

The Reduced Operation Alternative, together with other developments in the Hetch Hetchy service area, would increase demand for and consumption of water. For example, the population in Alameda County is projected to increase by about 17 percent by the year 2015 (DOF 2001). Residential, commercial, industrial, and other uses in Alameda County are expected to increase proportionally. Other counties in the Hetch Hetchy service area would experience similar growth. This population growth would constitute cumulative impact upon water resources and supply systems in the Hetch Hetchy service area.

Site 300

Current water use at Site 300 is considered to be representative of future consumption rates for the Reduced Operation Alternative. However, development in the vicinity of Site 300 would increase demand for and consumption of water. Population in San Joaquin County is projected to increase by 30 percent by the year 2015 (DOF 2001). Residential, commercial, industrial, and other uses in San Joaquin County are expected to increase proportionally. This population growth would constitute a cumulative impact on groundwater resources and supply systems. Similarly, population growth in the Hetch Hetchy service area would constitute a cumulative impact on the Hetch Hetchy system.

Sewer Discharges

Livermore Site

The Reduced Operation Alternative, together with other developments in the area, would increase demand for sewage services. Population in Alameda County is projected to increase by about 17 percent by the year 2015 (DOF 2001). Residential, commercial, industrial, and other uses in Alameda County are expected to increase proportionally. This growth in conjunction with sewer discharge from the Livermore Site could constitute a substantial cumulative impact on

sewage systems in the area. The LWRP currently receives a total of approximately 6.5 million gallons of effluent per day. While existing LWRP capacity of 8.5 million gallons per day is expected to be sufficient for inflow treatment for the next 10 years, sewage treatment facility improvements are being planned in the region.

Site 300

Because Site 300 sewer discharge and treatment programs are mostly self-contained, no cumulative impact is expected as a result of the Reduced Operation Alternative.

Electricity Consumption

Livermore Site

The Reduced Operation Alternative, together with other developments in the area, would increase electric power demand. Population in Alameda County is projected to increase by about 17 percent by the year 2015 (DOF 2001). Residential, commercial, industrial, and other uses in Alameda County are expected to increase proportionally. This growth in conjunction with the demand for electrical power at the Livermore Site could constitute a substantial cumulative impact on electric power resources in the area. However, electric utilities provide approximately 10,605 million kilowatt-hours per year of electricity to Alameda County (CEC 2001). More than 10,000 megawatts of new electric generation capacity is planned in the PG&E service area, additional generating capacity is planned throughout California and surrounding states (CEC 2000). Expanded electric transmission capability is also planned in the region. If implemented as planned, these additions would provide sufficient capacity to meet Alameda County electrical energy needs for the next 10 years. Therefore, no new impacts are expected.

Site 300

Current electric power consumption at Site 300 is considered to be representative of future consumption rates for the Reduced Operation Alternative. However, the population in San Joaquin County is projected to increase by 30 percent by the year 2015 (DOF 2001). Residential, commercial, industrial, and other electric power uses in San Joaquin County are expected to increase proportionally. This growth in conjunction with Site 300 electricity use could constitute a substantial cumulative impact on electric power resources in the area. Currently, electric utilities provide approximately 5,106 million kilowatt-hours per year of electricity to San Joaquin County (CEC 2001). However, more than 10,000 megawatts of new electric generation capacity is planned in the PG&E service area, additional generating capacity is planned throughout California and surrounding states (CEC 2000). Expanded electric transmission capability is also planned in the region. These additions would provide sufficient capacity to meet San Joaquin County electrical energy needs for the next 10 years. Therefore, no new impacts are expected.

Fuel Consumption

Livermore Site

The Reduced Operation Alternative, together with other developments in the PG&E service area, would increase the demand for natural gas. Population in Alameda County is projected to increase by about 17 percent by the year 2015 (DOF 2001). Residential, commercial, industrial, and other uses in Alameda County are expected to increase proportionally. This growth could constitute a cumulative impact on natural gas supply systems. However, PG&E's transmission capacity is approximately 130 percent of the demand for natural gas in its service area (CPUC 2001). As required by the California Public Utilities Commission, PG&E uses a 15-year planning horizon for gas transmission and storage capacity and a 10-year planning horizon for local gas distribution systems. Accordingly, PG&E plans to provide sufficient capacity to meet Alameda County needs for the next 10 years. Therefore, no new impacts are expected.

Site 300

Current fuel oil consumption at Site 300 is considered to be representative of future consumption rates for the Reduced Operation Alternative. However, the population in San Joaquin County is projected to increase by 30 percent by the year 2015 (DOF 2001). Fuel oil use in San Joaquin County is expected to increase as the population increases, but at a lower rate. This growth could constitute a cumulative impact on fuel oil supplies in the county. However, overall fuel oil use in California has declined substantially as air quality regulations concerning greenhouse gas emissions become more stringent. Consequently, fuel oil delivery systems within San Joaquin County have large amount of excess capacity. This excess capacity is sufficient to meet San Joaquin County requirements for the next 10 years. Therefore, no new impacts are expected.

5.4.13 Materials and Waste Management

5.4.13.1 *Materials Management*

This section provides an overview of management responsibilities regarding receipt, transfer, and shipment of radioactive, controlled, and hazardous materials under the Reduced Operation Alternative. Appendices A, B, D, M, and N of this LLNL SW/SPEIS include descriptions of programs and buildings associated with use of these materials. The use of these materials historically has resulted in both their planned and inadvertent releases to the environment.

Relationship with Site Operations

New operations are defined as programmatically planned projects with defined implementation schedules that would take place in the future (e.g., the NIF). The Reduced Operation Alternative could include all new operations, D&D projects, and other activities identified in Section 3.4. In general, material usage at LLNL would decrease, consistent with an 8 percent decrease in LLNL operations from the No Action Alternative.

Waste minimization and pollution prevention techniques would further reduce material usage. Average maximum quantities would likely remain constant as material storage space remains constant; however, average quantities would increase to meet demand. Under the Reduced

Operation Alternative, material projections used for analysis would not exceed existing material management capacities.

Impact Analysis

The Reduced Operation Alternative would not cause any major changes in the types of materials used onsite. Material usage at LLNL would decrease, consistent with an 8 percent decrease in laboratory operations from the No Action Alternative. Waste minimization and pollution prevention techniques would be expected to increase reductions in material usage. Average maximum quantities would likely remain constant as material storage space remains constant; however, average quantities would be expected to decrease as demand decreases. Under the Reduced Operation Alternative, material projections used for analysis would not exceed existing material management capacities.

Existing Operations

The Reduced Operation Alternative total hazardous material usage would decrease for existing facilities. Under the Reduced Operation Alternative, average quantities would decrease by an estimated 8 percent (Table 5.4.13.1–1) below the No Action Alternative. Annually, approximately 158,000 to 177,000 chemical containers, ranging from 210-liter (55-gallon) drums to gram-quantity vials would be used or stored at LLNL.

For the Livermore Site, approximately 64,000 gallons of liquids would be managed annually with an estimated storage capacity of 227,000 gallons under the Reduced Operation Alternative. Approximately 1.3 million pounds of solids would be handled with a storage capacity of 2.4 million pounds. Solid material storage would not be expected to fluctuate because metals (e.g., lead used for shielding) are less likely to be consumed and more likely to be reused and reclaimed. Regardless, there would be sufficient capacity to accommodate anticipated operations. Approximately 1.1 million cubic feet of mostly industrial gases (argon, helium, hydrogen, oxygen, nitrogen) would be used annually with a storage capacity of 71.6 million cubic feet. Projections for specific hazardous chemicals for existing Livermore Site operations and Site 300 operations are presented in Table 5.4.13.1–1 and Table 5.4.13.1–2, respectively. Additional detail is provided in Appendix B.

New Operations

The Reduced Operation Alternative would include new operations under the No Action Alternative that would offset decreases in annual hazardous material usage rates over the next 10 years. The majority of the offset would be due to the full implementation of NIF and BSL-3 operations. New operations would account for approximately 70,000 gallons of liquids and solids and approximately 20,000 standard cubic feet of industrial gases. Materials expected to support other projects, including the new projects, are described in Tables 5.2.13.1–3 and 5.3.13.1–3. For new facilities, no impacts would be expected because each of the new facilities would be designed to handle expected quantities.

Under the Reduced Operation Alternative, seven facility initiatives would be undertaken, all of which would reduce operations. Site material usage would be expected to decrease slightly because of these facility initiatives. See Appendix B for more information.

5.4.13.2 *Waste Management*

This section provides an overview of generation, storage, treatment, and disposal of radioactive, hazardous, mixed, and other wastes, including biohazardous and D&D wastes at LLNL under the Reduced Operation Alternative. Appendices B, M, and N include descriptions of wastes and facilities associated with their use, generation, and management.

Relationship with Site Operations

New operations are defined as programmatically planned projects with defined implementation schedules that will take place in the future, such as the NIF. The Reduced Operation Alternative would include all new operations, D&D projects, and other activities, including permit modifications, identified under the No Action Alternative. In general, waste generation at LLNL would decrease, consistent with an 8 percent decrease in LLNL operations from the No Action Alternative.

Under the Reduced Operation Alternative, waste generation projections used for analysis would not exceed existing waste management capacities.

Impact Analysis

Implementation of the Reduced Operation Alternative would not cause any major changes in the types of waste streams generated onsite. No additional waste storage, treatment, handling capacity, regulatory requirements, or security requirements would be needed. Overall waste generation levels at LLNL would remain essentially consistent with recent generation quantities experienced since 1992. Annually, any increase would be consistent with increases from new operations and normal fluctuations as previously noted. Waste minimization and pollution prevention techniques would be expected to offset a portion of the projected wastes. Between 1993 and 2001, overall (routine and nonroutine) TRU waste, LLW, MLLW, and hazardous waste generation, as reported by DOE, were reduced by 91, 57, 89, and 57 percent, respectively (DOE 2002s). Onsite waste handling capacities are four to five times expected waste volumes. Waste projections used for analysis would not exceed existing offsite waste management disposal capacities. Wastes associated with existing operations, new operations, and special operations are discussed later in this section, including other wastes.

The Reduced Operation Alternative would not eliminate assigned missions or capabilities, but could entail not consolidating, enhancing, or upgrading operations. However, RHWM operations would not be reduced beyond those required to maintain safety, permit requirements, or other agreements, such as the Site Treatment Plan. Several project initiatives would be implemented under the Reduced Operation Alternative, as shown in Table 5.4.13.2–1. The associated waste generation would not change overall generation rates. The Reduced Operation Alternative would allow only partial fulfillment of the RHWM mission by limiting future permit modifications and delaying RCRA closures and would not fully satisfy the purpose and need for agency action.

TABLE 5.4.13.2–1.—*Planned Projects Under the Reduced Operation Alternative and Associated Waste Projections*

Project Title	Project Description	Expected Waste Streams
Terascale Operations Reduction Simulation Facility	Scale back of operations to reduce use of electricity and cooling load.	Minimal changes to routine waste generation.
Integrated Technology Program	Reduce from No Action by canceling system demonstration.	Minimal changes to routine waste generation.
Reduce Number of Hydro Shots at S300	Scale back from the No Action planned number of hydroshots at Site 300 with corresponding decrease in CMS activity.	Minimal changes to routine waste generation.
Reduce Number of EDUs	Reduction in planned number of engineering demonstration.	Minimal changes to routine waste generation.
Reduce Number of Subcritical Assemblies	Reduce number of assemblies for subcritical experiments.	Minimal changes to routine waste generation.
Reduce Pit Surveillance	Reduction in planned number of surveyed pits.	Minimal changes to routine waste generation.
NIF Operations Reduction	Reduce ignition yield from 1,200 MJ/y to 800 MJ/yr.	Minimal changes to routine waste generation.

Sources: LLNL 2002y, TtNUS 2003.
CMS = chemicals and materials science, EDU = Engineering Demonstration Units; MJ/yr = megajoules per year; NIF = National Ignition Facility.

The Reduced Operation Alternative would include all new operations, D&D projects, and other activities, including permit modifications and RCRA closures, identified under the No Action Alternative, as discussed in Section 5.2.13.2. This alternative would differ from the No Action Alternative in generation of routine waste quantities (Table 5.4.13.2–2) and nonroutine waste quantities (Table 5.4.13.2–2).

Existing Operations

For projection purposes, CY1993-CY2002 routine waste generation data were considered a reasonable range for existing facilities; an average of these years was used. The amount of waste generated from existing operations would reflect proportional decreases in LLNL activity levels. The waste quantities would represent a site-wide aggregate of quantities for each type of waste category. Table 5.4.13.2–2 includes existing operations contributions to the estimated annual (routine) waste generation quantities by waste category. No new impacts are expected.

New Operations

New operations (including project-specific information) wastes are considered to be derived from mission-related work and additive. The waste quantities would represent a site-wide aggregate of quantities for each type of waste category. Table 5.4.13.2–2 includes new operations contributions to the estimated annual (routine) waste generation quantities by waste category. Table 5.4.13.2–2 includes new operations under the Reduced Operation Alternative. Table 5.4.13.2–1 presents qualitative waste information by project. No impacts are expected.

TABLE 5.4.13.2–2.—*Routine and Nonroutine Operations Waste Generation Quantities Under the Reduced Operation Alternative and No Action Alternative*

	Annual Quantities			
	No Action Alternative[a]		Reduced Operation Alternative	
Waste Type	Routine	Nonroutine	Routine[b]	Nonroutine
LLW	200 m^3/yr	630 m^3/yr	180 m^3/yr	550 m^3/yr
MLLW	61 m^3/yr	72 m^3/yr	42 m^3/yr	63 m^3/yr
Total Hazardous[c]	390 metric tons	1,500 metric tons	300 metric tons	1,300 metric tons
TRU	50 m^3/yr	55 m^3/yr	45 m^3/yr	5 m^3/yr
Mixed TRU	1.7 m^3/yr	0 m^3/yr	0.7 m^3/yr	0 m^3/yr
Sanitary solid	4,800 metric tons	Included in Routine	4,400 metric tons	Included in Routine
Wastewater	310,000 gal/day	Included in Routine	290,000 gal/day	Included in Routine

Sources: TtNUS 2003.
[a] For routine wastes based on average quantities since 1992 and one standard deviation, expected increase in activity levels, and new operations contributions. No margin was added for nonroutine.
[b] Based on average quantities since 1992, expected decrease in activity levels (approximately 8 percent), and new operations (No Action only) contributions.
[c] Total Hazardous includes RCRA hazardous, State-Regulated, and TSCA.
gal/day = gallons per day; LLW = low=level waste; MLLW = mixed low-level waste; m^3/yr = cubic meters per year; TRU = transuranic.

Special (Nonroutine) Operations

Waste generation levels for special (nonroutine) program waste, such as for unused chemicals or laboratory closeout, are derived separately from 1993 to 2002 nonroutine waste generation. The amount of waste generated would reflect proportional decreases in LLNL activity levels. The waste quantities would represent a site-wide aggregate of quantities for each type of waste category. Table 5.4.13.2–2 presents estimated annual (nonroutine) waste generation quantities by waste category. No impacts are expected.

All Other Wastes

LLNL operations would also involve the five additional waste management activity areas discussed below.

Biohazardous (includes Medical Waste Management Act*) Waste*

In 2002, several hundred pounds of biohazardous waste were disposed of at an approved offsite facility. Under the Reduced Operation Alternative, biohazardous waste generation would decrease by 8 percent. The existing waste handling capabilities would be adequate to accommodate this waste. No impacts would occur because offsite disposal capacity would continue to be sufficient.

Construction and D&D Waste

No new construction would occur under the Reduced Operation Alternative.

With approximately 700,000 square feet of excess facilities, to bound impacts, this analysis assumed the removal of all excess facilities. This would generate approximately 4,200 metric tons of debris (600 metric tons per 100,000 square feet). It is estimated that only 350 metric tons would be of the LLW, MLLW, and hazardous variety (Bisanni 2003). Approximately two-thirds of the debris total would be diverted, recycled, or reclaimed (LLNL 2002cc). The existing waste treatment facilities would occur because existing waste handling capabilities are already in handling capabilities would be adequate to accommodate this waste. No impacts would occur because offsite disposal capacity would continue to be sufficient.

Environmental Restoration Waste

Site-wide environmental restoration waste generation trends at LLNL would generally remain a function of treatment units, the number of wells, and the number of hours of operation. No impacts to treatment facilities would occur because existing waste handling capabilities are already in place.

Explosive Waste

The Explosives Waste Treatment Facility would handle 2,400 to 2,800 pounds per year. The Explosive Waste Storage Facility would store (gross) 5,200 to 6,200 pounds per year. This would represent an 8 percent decrease from the No Action Alternative. No additional capacity would be required. No impacts are expected.

Wastewater

Wastewater would decrease to approximately 290,000 gallons per day. The current capacity of 1.69 million gallons per day would be adequate to accommodate this waste. No impacts would occur because offsite disposal capacity would continue to be sufficient.

Permit Modifications, RCRA Closures, Permit Renewal, and Other Planned Activities

The Reduced Operation Alternative would include all permit modifications and a permit renewal identified in the No Action Alternative, as discussed in Section 5.2.13.2. This alternative would differ from the No Action Alternative as follows:

- Submit 50 Class 1 permit modification request (may include more than one item per submittal) over the next 10 years (see Appendix B for details).
- Submit no Class 2 or Class 3 permit modifications over the next 10 years.

These Class 1 permit modifications would enhance existing operations and would likely result in beneficial environmental impacts through improved efficiency. The Reduced Operation Alternative would allow only partial fulfillment of the RHWM mission by limiting future permit modifications and would not fully satisfy the purpose and need for agency action.

Cumulative Impacts

The ROI for waste management involves LLNL and its facilities as presented in Chapter 4 of this LLNL SW/SPEIS. The ROI for cumulative impacts is larger than that presented in Chapter 4 and considers the contributions of LLNL (Livermore Site and Site 300), SNL/CA, other NNSA activities, local projects and activities, and the State of California. NNSA assessed cumulative impacts by combining the potential effects of the Proposed Action with the effects of other past, present, and reasonably foreseeable activities in the ROI. The Proposed Action was chosen to assess and present a bounding scenario of potential cumulative effects. This approach allowed a conservative analysis or a maximum estimation of cumulative impacts, as discussed in Section 5.3.13.2.

5.4.14 Human Health and Safety

5.4.14.1 *Nonradiological Health Impacts*

Operations at LLNL would involve a wide range of activities with the potential for exposures of involved and noninvolved workers and the public hazardous materials or conditions. These hazards would include radioactive material, ionizing and non-ionizing radiation, chemicals, biological agents, and industrial hazards. Hazardous chemicals to which involvewd and noninvolved workers could potentially be exposed, under the Reduced Operation Alternative at the Livermore Site and Site 300, are listed in Table 5.4.13.1–1 and Table 5.4.13.1–2.

Relationship with Site Operations

Section 3.4 describes projects under the Reduced Operation Alternative. These projects, when combined with current operations, would result in a decrease in chemical inventories. Construction or demolition activities associated with this alternative would reduce overall site hazards by removing chemical and physical hazards from the workplace. These activities would represent a decrease in potential injuries associated with industrial safety hazards.

Impact Analysis

Under the Reduced Operation Alternative, six facility initiatives would be undertaken, all of which would reduce operations. Site material usage would decrease slightly because of these initiatives. Under the Reduced Operation Alternative, some construction, renovation, or modification of facilities would occur. Although no specific D&D projects were identified under the Reduced Operation Alternative, the potential for completing a D&D project would exist. Under the Reduced Operation Alternative, decreases in average chemical inventories would be expected. The level of exposure to occupational, toxic, or physical hazards encountered by site personnel would be expected to decrease slightly. Impacts are expected to be decreased under the Reduced Operation Alternative.

During the course of routine operations, the potential would exist for some personnel to be exposed to radiological, chemical, biological, and physical hazards. Implementation of the LLNL ISMS would minimize the risk of personnel exposures through characterization and control measures during the planning stages of work activities.

Overall, site usage of toxic substances and physical hazards would decrease under the Reduced Operation Alternative. The reduced use of chemicals is also projected under the Reduced Operation Alternative. This should result in a reduction in the potential for worker exposures. Continued application of site ES&H and ISMS principles would result in minimal impacts to workers and the public. Thus, the impacts of this alternative would not be considered adverse.

Employees at Site 300 perform work in accordance with established site-wide programs as well as Site 300-specific programs. Site-specific integration work sheets, facility safety plans, and standard operating procedures are prepared to supplement activities not covered by site safety plans or the LLNL ES&H Manual (LLNL 2000i). The projects under the Reduced Operation Alternative would result in a decrease in usage of hazardous chemicals.

The proposed decrease in construction, demolition, and renovation activities should represent a moderate impact on the reduction of site injury and illness rates. Additionally, scaling back operations at seven facilities would result in reducing site staff. Injury and illness case rates applied to a reduced staff should lead to an overall reduction in site recordable incidents making these impacts beneficial. Using the 2002 injury and illness data from the year 2002 as bounding, due to the downward trend, the following results would be expected for the lowest site population year under the Reduced Operation Alternative:

- 219 recordable cases
- 66 last or restricted workday cases
- No fatalities would be expected

Facility upgrades and continued implementation of the site ES&H program components would significantly reduce the risk of personnel exposures. Workplace and personnel monitoring data indicate the effectiveness of the current program (LLNL 2002bk).

The proposed decrease in construction, demolition, and renovation activities should lead to a moderate reduction in site injury and illness rates and would have a beneficial impact.

Cumulative Impacts

The occupational health and safety of workers at LLNL is site-specific and would not be affected by other activities occurring within the area. Cumulative effects for workers would be the same as those presented in the Reduced Operation Alternative impact analysis above.

5.4.14.2 *Radiological Health Impacts*

This section analyzes the radiological health impacts from the Reduced Operation Alternative. Impacts to workers are given in terms of number of cancer fatalities resulting from employment activities in the worker population. Impacts to the public from normal releases are given in terms of the probability of the site-wide MEI contracting a fatal cancer from these operations. The number of fatal cancers expected in the general population because of LLNL operations is also described.

Relationship with Site Operations

This section summarizes the relationship between projects described in Section 3.4 for the Reduced Operation Alternative and radiological health impacts from normal site operations. The number of cancer fatalities to the workers and general public from exposure to these operations is used to quantify the impacts.

Impact Analysis

Worker

The dose to involved workers, those directly exposed to radiation in the performance of their jobs, would be 38 person-rem per year versus 90 person-rem per year in the No Action Alternative. This dose includes 10 person-rem per year from the NIF. Most of the remainder of this dose would be from operations in Building 332. Workers would be exposed to an increased risk of cancer as a result of occupational exposure to radiation over an extended period (calculated value of 0.023 fatalities per year of operation). Note that radiation exposure in all radiologically controlled areas would be kept ALARA through facility and equipment design and administrative controls.

The dose to noninvolved workers, those exposed to normal site radiological emissions not directly related to performance of their jobs, would be approximately 0.14 person-rem per year, as discussed in Section 5.4.8.2. Over 95 percent of this dose is from Livermore Site operations. No cancers (calculated value of 8.2×10^{-5} fatalities per year of operation) are expected to noninvolved workers.

General Public

The Reduced Operation Alternative impacts to the public would be a result of the radiation dose from atmospheric emissions described in Section 5.4.8.2. The dose to the Livermore Site site-wide MEI would be 0.22 millirem per year (0.09 from airborne effluents and 0.13 from skyshine). This dose is 0.2 percent of the DOE standard at 100 millirem per year (DOE O 5400.5). The probability of a fatal cancer to this site-wide MEI would be 1.3×10^{-7} per year of exposure versus 1.8×10^{-7} for the No Action Alternative.

The Reduced Operation Alternative site-wide MEI dose from Site 300 operations would 0.054 millirem per year, less than 0.6 percent of the NESHAP standard. This dose is essentially the same as for the No Action Alternative. The probability of a cancer fatality to this hypothetical individual would be 3.3×10^{-8} per year of exposure.

The population dose from all LLNL operations would be 12 person-rem per year. Skyshine effects are limited to locations in close proximity to the Livermore Site boundary next to the NIF and are not included in the population dose. No cancer fatalities (calculated value of 0.007 fatalities per year of operation) to the public would result from exposure to LLNL operations.

Cumulative Impacts

There is a possibility that an involved worker would contract a fatal cancer at some point during his or her lifetime as a result of extended occupational exposure under the Reduced Operation Alternative per year of operation (calculated value of 0.023 fatalities per year of operation versus 0.054 fatalities).

No adverse impacts to site workers or the general population would occur under the Reduced Operation Alternative. Other than background radiation sources, there would be no other known contributors to concentrations of radionuclides near the Livermore Site or Site 300. Therefore, there would be no new cumulative radiological impacts.

5.4.15 Site Contamination

The following section analyzes impacts of contaminated soils and sediments, surface water, and groundwater under the Reduced Operation Alternative.

5.4.15.1 *Relationship with Site Operations*

The Reduced Operation Alternative would include continued operations of investigation, cleanup, long-term stewardship, other activities including treatment system modifications and reporting and new actions identified under the No Action Alternative, as discussed in Section 5.2.13.2.

A general decrease in activity levels across the site is projected. Accordingly, a decrease in hazardous material and waste management and the potential for associated spill or release could occur. LLNL would conduct immediate cleanup actions and periodic site surveys to ensure environmental impacts would be minimized.

5.4.15.2 *Impact Analysis*

The Reduced Operation Alternative would result in minimal deposition of contaminants from continued operations to soil and continued removal of known contaminants under the cleanup effort would occur. No adverse impacts to future designated land use would be expected. No adverse effect on groundwater would be expected. Continued improvement of water quality and source reduction would occur.

5.4.15.3 *Cumulative Impacts*

The ROI for site contamination involves LLNL and its remedial sites as presented in Chapter 4 of this LLNL SW/SPEIS. The ROI for cumulative impacts is larger than that presented in Chapter 4 and considers the contributions of LLNL (Livermore Site and Site 300) and local projects.

Since the Reduced Operation Alternative and No Action Alternative begin with the same level of existing contamination, opportunities for future contamination and remediation activities would be the same. Cumulative impacts would be the same as those described in Section 5.2.15.4,

combining the potential effects of the No Action Alternative with the effects of other past, present, and reasonably foreseeable activities in the ROI.

Within the ROI, soil contamination and groundwater contamination have occurred from various operations. However, past, present, and planned activities are designed to minimize contamination at LLNL, SNL/CA, and other sites. The cleanup of these sites has been and will be performed to a level that meets State of California approved health risk-based standards (which vary depending on the contaminants of concern) corresponding to the intended future uses of the sites. As existing contamination at LLNL is being cleaned up under the Environmental Restoration Program, no cumulative impacts would be expected.