

5.3 IMPACTS FOR THE PROPOSED ACTION

This section discusses the potential environmental consequences of the Proposed Action. The Proposed Action for this LLNL SW/SPEIS is the continued operation of LLNL, including near-term (5 to 10 years) proposed projects, as well as those projects, activities, and facilities described in the No Action Alternative. Chapter 3 and Appendix A of this document contain detailed descriptions of all projects included in the Proposed Action. The LLNL operations include the Livermore Site and Site 300.

5.3.1 Land Uses and Applicable Plans

This section describes the impacts to land uses and applicable plans under the Proposed Action. Impacts are analyzed for the Livermore Site and Site 300 based on the methodology presented in Section 5.1 of this chapter.

5.3.1.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Chapter 3, Section 3.3, for the Proposed Action and the land use impact analysis. The primary effect on land uses at the Livermore Site would be from the additional development associated with projects requiring new buildings under the Proposed Action. However, existing perimeter open space areas would be retained.

At Site 300, the Proposed Action includes construction of new facilities and upgrading of several existing facilities, roadways, and utilities. Due to proposed D&D, there would be a decrease of the current developed gross square footage. No land acquisitions would be included as part of the Proposed Action. The types of land uses at Site 300 would not change, and the open space character of the site would be retained.

5.3.1.2 *Impact Analysis*

Livermore Site

Under the Proposed Action, facilities would be constructed (Figure 5.3.1.2–1), others would be upgraded, and a number of trailers would be relocated, replaced, or removed as the permanent facilities are completed (see Chapter 3 and Appendix A). These projects are in addition to those planned under the No Action Alternative. While the types of land uses at the Livermore Site would not change under the Proposed Action, 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).

The land use effect would be extremely small because there would be only a small increase in the developed space at the site. 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, LLNL's R&D facility 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). The Proposed Action would result in additional development at the site to be used for the same types of uses as existing facilities. No changes in land ownership would occur and no new impacts to land use are expected.

New facilities at the site could have secondary effects due to increased personnel and activity at the site. These effects could include additional traffic, noise, vehicular exhaust emissions, demands for community services, increased consumption of natural resources, and increased waste generation. These potential effects are addressed in the applicable parts of Chapter 5 of this LLNL SW/SPEIS.

Site 300

The primary effect on land uses at Site 300 would be from the development of additional square footage associated with certain projects included under the Proposed Action. No major alteration in the types of land uses would result. The Proposed Action would result in additional development at the site for the same uses as existing facilities. No changes in land ownership would occur.

Site 300 is exempt from local plans, policies, and zoning regulations. However, it is NNSA and University of California policy to cooperate with local governmental planning agencies, in this case San Joaquin and Alameda counties and the city of Tracy, whenever possible. Land uses surrounding Site 300 include other explosives testing facilities, undeveloped open space, agricultural land, and an off-road vehicle recreation area (see Chapter 4, Section 4.2). The uses at Site 300 are compatible with the existing land uses and approved land use designations surrounding the site, and with open space policies regarding resources near the site. Because Proposed Action activities would represent a continuation of existing land uses, they would be compatible with existing and approved future land uses surrounding the site.

The Proposed Action would include upgrading several existing facilities, roadways, and utilities, and constructing the Energetic Material Processing Center (EMPC) and the High Explosives Development Center (HEDC). Chapter 3 and Appendix A provide more detailed descriptions of the Proposed Action. Because Site 300 is located on approximately 7,000 acres of largely undeveloped land and the proposed construction projects and upgrades would be dispersed throughout the site, they would not represent a substantial infill of land uses, and the existing character of the site would remain unaltered.

New structures would be for the same types of uses as existing 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. As discussed in Section 4.3, land uses would be compatible with the existing land uses and open space policies of San Joaquin and Alameda counties.

Growth at the site could have secondary effects due to increased personnel and activity at the site, including additional traffic, noise, vehicular exhaust emissions, demands for community services, increased consumption of natural resources, increased waste generation, etc. These potential effects are addressed in the applicable parts of Chapter 5 of this LLNL SW/SPEIS. Thus, minimal impacts to land use are anticipated.

5.3.1.3 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, which 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 Proposed Action 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 (6,175 acres) southwest of I-580, the area of Tracy that is now closest to Site 300. 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).

A residential community such as Tracy Hills 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.

5.3.2 Socioeconomic Characteristics and Environmental Justice

This section analyzes the socioeconomic impacts associated with implementation of the Proposed Action. This analysis is organized by employment, and housing and population, with effects delineated by geographic area (counties and cities within the ROI). Environmental justice issues are also discussed.

5.3.2.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.3 under the Proposed Action and the socioeconomic impact analysis. In general, the effect of projects under the Proposed Action on socioeconomics would be limited to the additional employment opportunities provided because of design, construction, and operation of these projects, as described below, and the effects of the additional secondary or indirect employment opportunities. Projected staffing changes are shown in Table 5.3.2.1–1.

TABLE 5.3.2.1–1.—Input Parameters for Socioeconomic Analysis Under the Proposed Action

Parameter	Units	Site	No Action Alternative	Proposed Action
Employment	Number of personnel	LLNL	10,650 (all site workers)	11,150 (all site workers)
		Livermore Site	8,900 (LLNL employees)	9,410 (LLNL employees)
			17,500 (LLNL employees and indirect)	18,500 (LLNL employees and indirect)
		Site 300	250 (LLNL employees) 490 (LLNL employees and indirect)	250 (LLNL employees) 490 (LLNL employees and indirect)
Expenditures	Dollars (2001)	LLNL	146 M (Bay Area)	153 M (Bay Area)
Payroll	Dollars (2002)	LLNL	690 M (LLNL employees) 1,130 M (direct and indirect)	729 M (LLNL employees) 1,200 M (direct and indirect)

LLNL = Lawrence Livermore National Laboratory; M = million.

5.3.2.2 *Impact Analysis*

LLNL jobs and expenditures generate indirect jobs in the region. The RIMS II economic model produces two multipliers that are useful for the evaluation of economic effects (BEA 2003). The first multiplier is used to calculate worker earnings, and the second calculates employment. These multipliers provide information needed to estimate LLNL's economic impact. Earnings and employment multipliers make possible the identification of not only the direct impacts of an activity on regional income and jobs, but also the indirect effects.

Under the Proposed Action, LLNL employment at the Livermore Site would increase by approximately 500 above the No Action Alternative to 9,410. This increase, multiplied by a factor of 1.97, would increase employment by approximately 1,000 within the four-county ROI. LLNL payroll would increase by \$39 million above the No Action Alternative. This increase multiplied by a factor of 1.64 would generate approximately \$64 million of overall economic effect within the ROI. Therefore, the Proposed Action would generate additional revenue from increased purchases of goods and services, and create additional increases in population and subsequent increases in housing demand. The employment projections are conservatively high for purposes of evaluating reasonably foreseeable socioeconomic impacts associated with employment growth.

Based on the FY2002 LLNL payroll of \$668 million, the regional earnings multiplier of 1.64 yields an overall economic effect of \$1.096 billion within the ROI. Based on the total LLNL

direct employment and the regional employment multiplier of 1.97, an estimated total of 17,400 jobs in the ROI are attributable to LLNL. In effect, one out of every 95 jobs (or 17,400 out of 1,644,500) in the ROI is directly or indirectly attributable to LLNL.

Under the Proposed Action, Site 300 total employment would remain at approximately 250 as projected for the No Action Alternative. There would be no additional socioeconomic impacts under the Proposed Action for Site 300 beyond those described for the No Action Alternative in Section 5.2.2. Therefore, socioeconomic impacts specific to Site 300 are not addressed in this section.

Employment and Expenditures

Region

The Proposed Action would provide additional employment opportunities in the region and would increase the payroll at LLNL. Assuming approximately a 500-employee increase in payroll and pay rates proportional with 2002 salaries, the additional annual payroll generated by the Proposed Action would be \$39 million higher than the No Action Alternative in 2002 dollars. A portion of this increased payroll would enter the local economy as the new workers purchase additional goods and services. The combined direct and indirect effects of increased employment would result in an employment increase of approximately 1,000 within the region. Likewise, the direct and indirect effect of payroll expenditures would result in a \$70 million increase to the regional economy.

In addition, the Proposed Action would result in an increase in expenditures by LLNL. Additional goods and services would be required to support the additional activities, facilities, and workers required by the Proposed Action.

Spending by both the additional LLNL personnel and the LLNL increased activity would generate additional revenue and employment opportunities within the ROI as monies filter throughout the economy. The additional income and employment opportunities generated by the Proposed Action would represent a beneficial economic impact to the region.

Alameda County

Total employment in Alameda County was estimated at 751,680 in 2000 (Association of Bay Area Governments 2001). The Proposed Action would generate approximately 500 more jobs at the Livermore Site than the No Action Alternative. Employment projections for the county estimate employment opportunities would increase 14.1 percent to 857,450 by the year 2010 (Association of Bay Area Governments 2001). The additional jobs created by the Proposed Action at LLNL would represent 0.5 percent of the projected increase in employment within the county. This increase in employment, less than a 0.1 percent increase over the 2000 county employment level, would have a minimal impact to the county.

Population and Housing

For this analysis, increases in population level and housing demand from the Proposed Action are projected to be conservatively high in order to determine the maximum expected impact. It

was assumed that someone outside of the project region would fill each new job, that all new LLNL workers (including LLNL employees, contractors, and Federal employees) would migrate to the region, and that each worker would represent a new household. In reality, a percentage of new workers would already reside in the project region, and some households would shelter more than one employee. While this method overestimates migration of new workers to the project region, it also allows for the backfilling of vacancies left as some workers leave their current jobs in the region to work at LLNL. The geographic distribution of future LLNL workers would be similar to the 2002 distribution of employee residences (Table 5.3.2.2–1).

TABLE 5.3.2.2–1.—Anticipated Geographic Distribution of Lawrence Livermore National Laboratory Worker Residences Under the Proposed Action

City	Percent of LLNL Workers ^{a,b}	Additional New Workers Projected to Reside in City under No Action Alternative ^c
Alameda County		
Livermore	37.0	185
Pleasanton	6.2	31
Castro Valley	4.0	20
Dublin	2.1	11
Oakland	2.1	11
Other Alameda County	4.1	21
Total	55.5	279
San Joaquin County		
Tracy	8.2	41
Manteca	4.8	24
Stockton	2.6	13
Other San Joaquin County	2.9	14
Total	18.5	92
Contra Costa County		
Brentwood	2.7	14
San Ramon	2.7	14
Other Contra Costa County	7.4	37
Total	12.8	65
Stanislaus County		
Modesto	3.2	16
Other Stanislaus County	2.9	14
Total	6.1	30
Counties Outside the ROI		
Total	7.2	36

Source: LLNL 2003ak.

^a Distribution as of September 30, 2002.

^b May not total 100 because figures are rounded off.

^c Calculated based on 500-employee increase. May not total 500 because of rounding.

ROI = region of influence.

Alameda County

Based on the anticipated geographic distribution of personnel residences (Table 5.3.2.2–1), the Proposed Action would result in an in-migration of 279 more workers to Alameda County over the next 10 years than under the No Action Alternative. This represents 56 percent of new LLNL personnel. Assuming 2.74 persons per household for the county (Census 2003), the population associated with the additional workforce migrating into the county would be 764 persons more than the No Action Alternative. This represents less than 0.1 percent of the 2001 population within the county. The county population is projected to increase 16.8 percent from 2001 to 2010 (Association of Bay Area Governments 2001, Census 2003). The incremental population increase associated with the Proposed Action would be within population growth projections for the county.

Assuming one worker per household, housing demand generated by the additional workforce would be 279 more dwelling units over 10 years than under the No Action Alternative, raising the total number of housing units occupied by LLNL workers to approximately 6,327 within Alameda County. In 2002, Alameda County had 546,735 housing units. The vacancy rate in the county was 3.0 percent, an estimated 16,620 available units (DOF 2002). Demand for housing associated with LLNL's additional personnel under the Proposed Action would be 1.7 percent of the unoccupied housing in 2001 within the county. Minimal impacts on housing in Alameda County is expected.

City of Livermore

As shown in Table 5.3.2.2–1, the majority of new LLNL workers (37 percent, or 185 more than the No Action Alternative) is projected to reside in Livermore, based on the 2002 pattern of employee residence location. Using the year 2000 person per household figure of 2.81 for the city of Livermore (Census 2002b), and assuming one worker per household, the population increase associated with the workforce migrating into the city would be 520 persons. This represents a 0.7 percent increase over the city of Livermore's 2000 population. The city's population is projected to increase by 23 percent from the year 2000 to 2010 (Association of Bay Area Governments 2001).

Assuming each new worker migrating into the city creates a demand for one additional housing unit, 185 units more than the No Action Alternative over 10 years would be required under the Proposed Action. In 2000, the city had a housing supply of 26,610 units, and a vacancy rate of 1.8 percent (Census 2002b). This represents 487 available housing units. The current city of Livermore Housing Implementation Program, covering the 3-year period 2002 through 2004, limits housing unit growth to a maximum of 1.5 percent per year (City of Livermore 2001). Assuming an annual growth rate of 1.5 percent, 5,363 new housing units would be available by the year 2014. The demand for housing associated with new employees needed under the Proposed Action would represent 3.4 percent of the projected number of new housing units, and 0.6 percent of the total projected housing stock. Population growth under the Proposed Action could be accommodated in the current housing market and housing growth is projected to continue; minimal impacts are anticipated.

City of Pleasanton

Under the Proposed Action, 31 more new workers employed would reside in Pleasanton, based on the existing geographic distribution of personnel (Table 5.3.2.2–1). Using the year 2000 person per household figure of 2.73 (Census 2002b), the city of Pleasanton population increase associated with new personnel would be 85 persons more than the No Action Alternative. This represents a 0.1 percent increase over the 2000 population of 63,654. This population increase would be within the 22 percent population growth estimate by the year 2010 as projected by the local planning unit (Association of Bay Area Governments 2001).

Housing demand generated by new workers because of the Proposed Action would be 31 housing units more than the No Action Alternative over 10 years, assuming one household per new employee. The year 2000 housing supply within the city was 23,968 units, with a vacancy rate of 2.7 percent (Census 2002b). This represents an available supply of 657 units. The demand for housing units associated with new workers would represent 4.7 percent of the number of available units in the year 2000. In addition, local planning governments project an 18 percent increase in the supply of housing by 2010 (Association of Bay Area Governments 2001). Because population growth under the Proposed Action could be accommodated in the current housing market and housing growth is projected to continue, minimal impacts are anticipated.

San Joaquin County

Under the Proposed Action, based on the anticipated geographic distribution of personnel, 92 more of the new workers would reside within San Joaquin County than under the No Action Alternative (Table 5.3.2.2–1). Based on the person per household figure of 3.17 (Census 2003), the San Joaquin County population increase associated with the new employees would be 292 persons. This represents less than 0.1 percent of the total 2001 population within the county. San Joaquin County's population projection is 727,800 by the year 2010, a 26.2 percent increase (DOF 2001). The incremental population increase associated with the Proposed Action would be accommodated within county growth projections.

Housing demand generated by new workers, assuming one worker per household, in the county would be 92 units over 10 years, raising the total number of housing units occupied by LLNL workers to approximately 2,109 within San Joaquin County. Housing supply within the county for the year 2002 was 197,279 units, with a vacancy rate of 3.9 percent (DOF 2002). The total number of vacant units was 7,767. The county projects a 26 percent increase in the number of housing units by the year 2010 (SJCOG 2000). Because the demand generated by the project would be small relative to the number of available and planned units, minimal impacts are anticipated.

City of Tracy

Based on the anticipated geographic distribution of new personnel under the Proposed Action, 41 more new workers would choose to live in the city of Tracy over 10 years than under the No Action Alternative. Based on the person per household figure of 3.23 (Census 2002a), the city of Tracy population increase associated with the Proposed Action would be 132 persons. This represents 0.2 percent of the 2000 population.

Housing demand within the city of Tracy due to Proposed Action implementation would be an additional 41 dwelling units over the No Action Alternative. The housing supply within the city in 2000 was 18,087 units (Census 2002a). In 2000, the vacancy rate for the city was 2.7 percent, which represents 467 available units. The demand generated by the new workers would represent 8.8 percent of the year 2000 supply of available housing. In addition, the number of housing units in the city is projected to increase 38 percent by the year 2010 (SJCOG 2000). Thus, under the Proposed Action, the housing demand could be accommodated in the current and projected housing supply, and minimal impacts are anticipated.

Environmental Justice

In general, LLNL operations under the Proposed Action 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 Proposed Action:

- As indicated earlier in this section, 11,150 workers would be required at the Livermore Site, 500 more than under the No Action Alternative.
- As presented in Section 5.3.3, an estimated 4,900 metric tons per year of nonhazardous solid waste would be generated at the Livermore Site for disposal, 300 metric tons per year more than under the No Action Alternative.
- As presented in Section 5.3.8, the MEI dose from radiological air emissions at the Livermore Site would be 0.13 millirem per year, higher than the No Action Alternative estimate of 0.098 millirem per year.
- As discussed in Section 5.3.11, the collective radiation dose to the population along the transportation route is calculated at 5.9 person-rem per year with 0.004 LCFs per year, higher than the No Action Alternative estimates of 5.0 person-rem per year and 0.003 LCFs per year.
- As presented in Section 5.3.12, the projected peak electrical demand at LLNL would be 81 megawatts with an annual use of 442 million kilowatt-hours, compared with 82 megawatts and 446 million kilowatt-hours.
- As presented in Section 5.3.14, worker dose to ionizing radiation would be 125 person-rem per year, higher than the 90 person-rem per year 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 Proposed Action.

5.3.2.3 Cumulative Impacts

Approximately 380 more new LLNL workers would elect to live in the various communities listed in Table 5.3.2.2–1 under the Proposed Action than the No Action Alternative, in the same proportion that existing workers have selected communities for their residences. In addition,

approximately 120 workers and their families would be distributed throughout other communities in the Bay Area and central San Joaquin Valley. The Proposed Action would contribute to the cumulative demand for housing in the region associated with new employment opportunities. However, because vacancy rates are high enough to accommodate the demands of new employees for housing in the city of Livermore, the community with the highest current and anticipated concentration of LLNL employees, it is assumed that other parts of the region could also meet the housing demand created by the increase in local job opportunities.

5.3.3 Community Services

This section evaluates the effect of the Proposed Action on the provision of fire, police, school, and nonhazardous solid waste facilities and services to adjacent and nearby communities. Estimates of the increased levels of service needed as a result of the Proposed Action were made and evaluated.

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 growth at the Livermore Site and Site 300 as a single entity.

5.3.3.1 Relationship with Site Operations

This section summarizes the relationship between projects described in Section 3.3 for the Proposed Action and the community services impact analysis. In general, the effect of projects under the Proposed Action on community services is related to additional employment opportunities and changes in floorspace. Employment under the Proposed Action is detailed in Section 5.3.2. New construction projects, as listed in Section 3.3, would add to floorspace, but D&D projects, as part of an overall consolidation program, would decrease floorspace. Employment parameters are listed in Table 5.3.3.1–1.

**TABLE 5.3.3.1–1.—Input Parameters for Community Services Analysis
Under the Proposed Action**

Parameter	Units	Site	No Action Alternative	Proposed Action
Employment	Number of personnel	Livermore Site	10,650	11,150
		Site 300	250	250

5.3.3.2 Impact Analysis

Livermore Site

Fire Protection and Emergency Services

The Livermore Site has its own onsite fire protection services. Currently the Livermore Site Fire Department participates in an automatic aid agreement with the Livermore-Pleasanton Fire Department and a mutual aid agreement with the Alameda County Fire Patrol to serve the Livermore Site.

For purposes of evaluating impacts of the Proposed Action, square footage at the Livermore Site was assumed to decrease by 1 percent from the No Action Alternative. Under their automatic aid agreement, the Livermore-Pleasanton Fire Department responds to an average of three calls per year at the Livermore Site. No increase in the number of calls to the Livermore-Pleasanton Fire Department would be anticipated because of the Proposed Action. The average of three calls per year at the Livermore Site for the Livermore-Pleasanton Fire Department, would not impact that agency's ability to provide fire protection and mutual and automatic aid service under the No Action Alternative. Because the Proposed Action would not increase the number of calls, there would be no impacts on the Livermore-Pleasanton Fire Department.

The Alameda County Fire Patrol did not respond to any Livermore Site Fire Department calls from 1999 to 2001. Implementation of the Proposed Action would not increase the number of calls for assistance over the No Action Alternative. Therefore, the Proposed Action would not affect the Alameda County Fire Patrol's ability to provide fire protection within its service area or 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 5 percent increase in Livermore Site employees could raise the number of calls for assistance by one to two per year. This would be less than 0.01 percent of total calls to the Livermore Police and Alameda County Sheriff's departments, and would not impact the ability of the departments to provide service to the community.

School Services

A secondary effect of the Proposed Action would be an increase in student enrollment in those school districts where Livermore Site employees reside. Some of these school districts could accommodate the increase in student enrollment generated by the Proposed Action. However, other school districts in the region could have more limited enrollment capacity and would be subject to an enrollment demand that could be considered an adverse impact.

Due to the high proportion of new hires and their families projected to reside in the Livermore area, further evaluation of the demand for school services focuses on the Livermore Valley Joint Unified School District.

The Livermore Valley Joint Unified School District encompasses approximately 240 square miles of service area, including the city of Livermore, portions of unincorporated Alameda County, and a small portion of unincorporated Contra Costa County. Because the unincorporated areas served have a relatively low population density, the vast majority of the population served by the school district resides within the city of Livermore. This analysis makes the simplifying and conservative assumption that all district students are city of Livermore residents.

Approximately 37 percent of the new personnel under the Proposed Action would reside in Livermore. Based on the 2001 ratio in the Livermore Valley Joint Unified School District enrollment per Livermore resident (13,899 students for 73,345 residents, or 19 percent),

approximately 100 more new students would be enrolled under the Proposed Action than under the No Action Alternative (19 percent of the 520 new residents, as explained in Section 5.3.2.2).

Additional students generated from increased employment at the Livermore Site would be added to the school system incrementally from the year 2004 to 2014. Though several district schools are near capacity, there is currently adequate space district-wide (Miller 2003). The Livermore Draft General Plan (City of Livermore 2003) states “[f]uture growth shall not exceed the community’s capability to provide services” and notes school classroom facilities as one of the principal factors considered. The 100 student increase represents 0.7 percent of district enrollment. Based on an expected annual enrollment growth rate of 1.5 percent based on Livermore’s Housing Implementation Plan, the 100 student increase would be 3.7 percent of the total enrollment growth by 2014. Because the district’s facilities are adequate to meet current student demand, the addition of 100 students to the existing facilities would have minimal impact on the district’s ability to plan for and provide service within its jurisdiction.

Under the Proposed Action, the employment of 500 new workers at LLNL would lead to creation of an additional 500 indirect jobs within the ROI as discussed in Section 5.3.2. Because of the relatively high proportion of new LLNL workers that would reside in the city of Livermore, some of those additional jobs would likely be created within the community. If the distribution of indirect worker residences were the same as for LLNL workers, 100 students could be added to the Livermore Valley Joint Unified School District in addition to the 100 students projected for LLNL workers described above. However, the actual number of students added through indirect jobs would be much less than 100, as many of the additional jobs and worker residences to support LLNL workers residing in Livermore would be created in neighboring communities and other areas throughout the ROI.

Nonhazardous Solid Waste Disposal

Projections for nonhazardous solid waste generation were based on the estimated personnel increases associated with the Proposed Action. This method of analysis was used because existing data on the volume of nonhazardous solid waste generated by the Livermore Site are aggregate figures that do not distinguish waste generated by building type or by program. Thus, the most accurate measure of the increase in nonhazardous solid waste generation was assumed more closely associated with the increase in personnel generated by the Proposed Action.

Estimated increases in nonhazardous solid waste are related to the assumed increases in site employment. Based on an existing workforce level of approximately 10,350 persons and a generation rate of solid waste for disposal of approximately 4,700 metric tons per year, the Livermore Site generates 0.5 metric tons of solid waste per worker per year, which is disposed of at the Altamont Landfill. The estimated increase in the workforce of 500 personnel over the No Action Alternative would result in an increase of approximately 300 metric tons of solid waste per year taken to the landfill. This increase would occur gradually over the timeframe of 2004 to 2014; the projected increase accounts for current source reduction and recycling strategies, but not future strategies or technologies.

The projected lifespan of the Altamont Landfill under current conditions extends to the year 2038 (Hurst 2003). While the Livermore Site is a major generator of solid waste within the

county, the additional 300 metric tons of solid waste generated at the Livermore Site under the Proposed Action could be accommodated by the existing landfill. The increase in solid waste under the Proposed Action would represent only 0.01 percent of permitted landfill throughput. Therefore, due to the remaining lifespan and capacity of the Altamont Landfill, there would be minimal impacts to solid waste disposal within the county.

Site 300

Fire Protection and Emergency Services

Site 300 has its own onsite fire protection services. Currently, the Site 300 Fire Department participates in mutual aid agreements with the city of Tracy Fire Department, Tracy Rural Fire Protection District, and State of California Department of Forestry.

During the years 2000 through 2002, the Site 300 Fire Department and the city of Tracy Fire Department did not respond to any calls in each other's jurisdictions under their mutual aid agreement. The number of mutual aid responses would not increase for either agency under the Proposed Action, which would include no increase in building gross square footage at Site 300. Therefore, the Proposed Action would have no impact on the city of Tracy Fire Department's ability to provide fire protection services or mutual aid services.

Through mutual aid, the Tracy Rural County Fire Protection District currently responds to an average of one call per year at Site 300. The Site 300 Fire Department has never received a request for assistance from the Tracy Rural County Fire Protection District. The number of responses for each agency would not increase under the Proposed Action. Therefore, the Proposed Action would not impact 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 also participates in a mutual aid network with the California Department of Forestry. The Proposed Action would not impact the California Department of Forestry's ability to provide fire protection and mutual aid service.

The Proposed Action would not impact fire protection services onsite. There would be no need for increased interaction with offsite agencies.

Police Protection and Security Services

Site 300 provides onsite security services and participates in an emergency response agreement with the San Joaquin County Sheriff's Department for additional police protection services. Because the number of employees at Site 300 would be the same as projected under the No Action Alternative, the Proposed Action would not result in a need for increased security services onsite. No additional impacts are expected.

School Services

The existing setting and impact analysis for school services is combined for the Livermore Site and Site 300. Minimal impacts are expected. (See the discussion of school services under the Livermore Site heading above.)

Nonhazardous Solid Waste Disposal

The number of Site 300 employees under the Proposed Action is the same as under the No Action Alternative. No additional impacts to nonhazardous solid waste disposal would be anticipated.

5.3.3.3 Cumulative Impacts

Cumulative effects associated with planned and approved projects in the area would contribute to the cumulative demand for fire and police services in the jurisdictions for which LLNL has mutual aid agreements. However, because fire and security services at LLNL are independent departments at the Livermore Site and Site 300 and do not rely on offsite community agencies to provide primary responses to fire and police emergency calls, additional demand for these onsite services associated with the Proposed Action would not add to the cumulative demand for offsite fire and police services.

The Proposed Action would contribute to the cumulative demand for school services in the region. Existing school facilities cannot accommodate student generation from cumulative development within the district's jurisdiction. The Proposed Action would contribute approximately 100 students to the cumulative student population. As new school capacity will be required for the 2,700 additional students projected during the next 10 years, the portion of the student increase attributable to the Proposed Action (3.7 percent) would be within extra capacity design criteria.

The Proposed Action would contribute to the cumulative demand for solid waste disposal service associated with planned and approved projects in the area. The Livermore Site sends solid waste to the Altamont Landfill. The landfill operator has projected that the lifespan of this landfill will extend to the year 2038. With existing landfill capacity in Alameda County, the additional solid waste generated under the Proposed Action would not affect solid waste disposal services.

5.3.4 Prehistoric and Historic Cultural Resources

This section presents an evaluation of the impacts to cultural resources resulting from implementation of the Proposed Action. 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.

5.3.4.1 Relationship with Site Operations

This section summarizes the relationship between projects described in Chapter 3, Section 3.6, under the Proposed Action and the analysis of cultural resources. In general, those projects with

the potential to impact these resources include construction of new facilities and infrastructure; and D&D, rehabilitation, and renovation of existing facilities.

5.3.4.2 *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.

Implementation of the Proposed Action would have the potential to affect important historic buildings and structures on the Livermore Site through D&D, rehabilitation, and 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 Proposed Action. 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 would be expected, unrecorded subsurface prehistoric or historic resources still could be inadvertently discovered during construction or other ground-disturbing activities.

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 Proposed Action 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.

5.3.4.3 *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 attrition.

5.3.5 Aesthetics and Scenic Resources

This section analyzes the impact to aesthetics and scenic resources associated with implementation of the Proposed Action.

5.3.5.1 Relationship with Site Operations

This section summarizes the relationship between the projects described in Section 3.3 under the Proposed Action and the analysis of aesthetics and scenic resources. In general, effects to aesthetics and scenic resources would be limited to construction of buildings and infrastructure located in areas visible to public viewing.

5.3.5.2 Impact Analysis

Livermore Site

Activities under the Proposed Action 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. 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. Developments and modifications would be largely consistent with the existing character of the site. Therefore, no additional impacts to visual resources are expected.

Site 300

Activities under the Proposed Action that would change the built environment at Site 300 would include improvements to existing buildings and infrastructure, and construction of new facilities. 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 Proposed Action are not presently known, based on previous LLNL landscaping and development practices, development of these projects at Site 300 would be largely consistent with the existing character of the site.

Under the Proposed Action, the location, type, and extent of improvement activities at Site 300 would be similar to the No Action Alternative. The site would remain compatible with local and county scenic resource plans and policies. Two new buildings, the HEDC and the EMPC, would be constructed under the Proposed Action; however, both buildings would be located within areas that already contain buildings or structures. Consequently, the changes to the built environment because of the Proposed Action would still 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.

5.3.5.3 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 Proposed Action.

5.3.6 Geology and Soils

This section analyzes the impact to geology and soils associated with implementation of the projects described in Section 3.3 under the Proposed Action. The impact analysis is organized by geologic resources, topography and geomorphology, and geologic hazards. The Proposed Action includes those actions and facilities described under the No Action Alternative.

5.3.6.1 Relationship with Site Operations

Under the Proposed Action, future facilities would be located in the undeveloped areas at the Livermore Site in addition to those facilities described under the No Action Alternative (Figure 5.3.6.1–1). These facilities are listed in Table 5.2.1.2–1. Any future development in the developed areas would affect soils that have already been disturbed.

Under the Proposed Action, the EMPC would be built at Site 300 in addition to the Wetlands Enhancement Project and the connection to the Hetch Hetchy aqueduct (see Section 5.2.6). The EMPC would replace facilities that are more than 40 years old and allow for the continued support of the Stockpile Stewardship Program.

5.3.6.2 Impact Analysis

Geologic Resources

Livermore Site

No known aggregate, clay, coal, or mineral resources would be adversely affected by the Proposed Action. None of the activities under the Proposed Action would take place on or upon known or exploitable mineral resources, unique geologic outcrops, or other unique geologic features. No impacts from farming or grazing activities are expected.

No new facilities would be built in the undeveloped zone at the Livermore Site under the Proposed Action. A total of 462,000 square feet of land would be disturbed because of the construction that would proceed under the No Action Alternative, which would also proceed under the Proposed Action.

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

Site 300

No known aggregate, clay, coal, or mineral resources would be adversely affected by the Proposed Action. The impacts would be the same as described in the No Action Alternative, except the proposed construction of the EMPC. Under the Proposed Action, the EMPC, a 40,000-square-foot facility, would be constructed in the southeast quadrant of Site 300 to replace Buildings 805, 806, and 813. An additional building and three new magazines would also be built (see Appendix A). The total area to be disturbed would be approximately 100,000 square feet, only one third or about 33,000 square feet of which would occur in previously undisturbed soils. No projects would involve disturbing new areas. The EMPC would involve the disturbance of a larger area in a previously disturbed site. Therefore, there would be minimal impacts to soils at Site 300.

Several vertebrate fossil deposits have been found on Site 300 near Corral Hollow. The fossil finds are generally widely scattered, and no significant invertebrate or botanical fossil locales have been identified on Site 300 or in the surrounding area (Hansen 1991). Under the Proposed Action, there would be no impacts to any known fossil deposits. There would be no impacts to any known or exploitable mineral resources or unique geologic features.

Topography and Geomorphology

Livermore Site

The Proposed Action would not include project work that would impact the topography or geomorphology of the Livermore Site and no construction or excavation projects are planned that would alter the overall 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 Proposed Action would not include project work that would impact the topography or geomorphology of Site 300, and no construction or excavation projects 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. Chapter 4,

Section 4.8, and Appendix H, Seismicity, include information regarding potentially strong earthquake ground motion sources and the major regional fault zones and local faults. Potential impacts expected from an earthquake generating a horizontal peak acceleration of 0.73 g are discussed as part of the evaluation of accidents in Section 5.5 and Appendix D, Accident Analysis. The unit g is equal to the acceleration due to the gravity of the earth or 9.8 meters/second/second (32 feet/second/second).

Livermore Site

Adverse impacts to proposed structures, 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 built under the Proposed Action would take into account distance from active faults and the ground shaking to be expected within certain probabilities.

Site 300

There is potential for seismically induced landslides at Site 300 due to steep slopes and existing landslide deposits. 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 deposits. The potential for ground deformation at these buildings is considered to be moderate to high. The EMPC location is not underlain by landslide deposits and therefore, has low potential for ground deformation.

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.

5.3.6.3 Cumulative Impacts

SNL/CA projects approximately 100 acres of soil disturbance in connection with their activities and future facilities. A large portion of this disturbance would occur within areas that are already developed. The soils near 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 Proposed Action would not contribute to the overall loss of agricultural land since LLNL has been committed to R&D/industrial use instead of agriculture for decades.

5.3.7 Biological Resources

This section describes the impacts to biological resources under the Proposed Action. Chapter 4, Section 4.9, describes the existing biological conditions and current operations that impact or may impact biological resources. A more detailed discussion of the biological resources and the

impacts of current operations appears in Appendix E, Ecology and Biological Assessment, and Appendix F, Floodplain and Wetlands Assessment.

5.3.7.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Chapter 3, Section 3.3, for the Proposed Action and the ecological impact analysis. In general, the effect of Proposed Action 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.

5.3.7.2 *Impact Analysis*

Vegetation and Wildlife

Livermore Site

Under the Proposed Action, no additional facilities would be constructed in undeveloped areas in addition to those described in the No Action Alternative. The impacts of the Proposed Action on vegetation and wildlife would be minimal and similar to those for the No Action Alternative.

Site 300

Site 300 vegetation and wildlife consist of a wide range of plant and animal species. The impacts of the Proposed Action on vegetation and wildlife would occur primarily in previously disturbed areas representing less than 5 percent of the total site acreage. Under the Proposed Action, the EMPC would be constructed in the southeast quadrant of Site 300. This planned facility would result in the disturbance of approximately 40,000 square feet (approximately 0.9 acres) of soil and associated vegetation. The loss of less mobile animals such as small mammals and reptiles could occur. The facility would replace Buildings 805, 806, and 813. The operations of Building 807 would move to the EMPC, but Building 807 would be retained and waste packaging operations from Building 805 would be moved to Building 807. The EMPC would house modern explosives machining, pressing, assembly, inspection, and some radiography. An additional building would provide an inert machine, offices, and shower/change room facilities. Three magazines capable of storing 1,000 pounds of explosives each would also be built (LLNL 2002ap). A number of routine operations such as road grading and culvert maintenance would occur and include protective measures as detailed in Appendix E, Section E.2.2.

Tritium Levels in Vegetation and Commodities

The Proposed Action projects no releases of tritium above that in the No Action Alternative. A detailed discussion of tritium levels for the No Action Alternative is presented in Section 5.2.7.2.

Protected and Sensitive Species

Livermore Site

Under the Proposed Action, 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 2002e). For further details of the Arroyo Maintenance Project and ongoing consultation with the USFWS for this project, see Appendix E, Section E.2.1.

No California red-legged frogs have been identified in 1,800 feet of the 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 that species in the vicinity of the site. A separate Biological Assessment prepared to assess the impacts of the proposed Arroyo Seco Management Plan was submitted to the USFWS in August 2003.

Formerly designated critical habitat for the California red-legged frog at the Livermore Site is shown in Chapter 4, Figure 4.9.3–1. Construction of new structures under the Proposed Action would include No Action Alternative projects, such as BSL-3, the Edward Teller Education Center, an Emergency Operations Center, and a Community Gateway Science and Education Lecture Hall. The proposed projects at the Livermore Site would not be in or affect formerly designated critical habitat for the California red-legged frog, or areas where this species typically occurs.

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 Proposed Action, No Action Alternative projects described in Section 3.2 would be completed, as well as other projects described in Section 3.3 for the Proposed Action.

Affected Species and Habitat

The Proposed Action would affect three species: the California red-legged frog, the California tiger salamander, and the Alameda whipsnake, and would involve construction or maintenance activities in formerly designated critical habitat for two of these. The first affected species is the California red-legged frog, a federally listed threatened species. Formerly designated critical habitat for the California red-legged frog at Site 300 is shown in Chapter 4, Figure 4.9.3–3, together with its breeding and nonbreeding locations. 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, provides further details on potential impacts of this project and mitigation measures taken to minimize those impacts. Proposed termination of surface releases at Buildings 865, 851, and 827 was coordinated with the USFWS and received approval contingent upon implementation of mitigation measures in a recent Biological Assessment and related Biological Opinion (Jones and Stokes 2001, USFWS 2002b). This proposed termination may start as early as 2004 (LLNL 2003ab). Grading of fire trails disturbs sediment that could indirectly affect California red-legged frog habitat suitability. However, the use of best management practices could reduce adverse effects to this species by minimizing erosion of fire trails into drainages as discussed in Appendix E, Section E.2.2.6.1.

Under the Proposed Action, the EMPC would be constructed in the southeast quadrant of Site 300. A field reconnaissance of the proposed EMPC site was performed in March 2002 to detect the presence of special-status wildlife species and/or their habitats at Site 300. No California red-legged frogs or related breeding areas were detected in the proposed construction area (LLNL 2003cg). The proposed construction location would be within an area where designated critical habitat for the California red-legged frog has been rescinded by court order until further notice (USDCDC 2002). Depending on the outcome of ongoing critical habitat litigation, it is possible that the USFWS may reinstate this area as critical habitat for the California red-legged frog. The proposed EMPC site would impact low-quality California red-legged frog habitat. However, this location is within the dispersal capability of California red-legged frogs from known breeding and nonbreeding areas in the southeast quadrant of Site 300. Therefore, a pre-activity survey would be conducted prior to the groundbreaking for the EMPC to minimize the potential for injury or mortality to California red-legged frogs.

The second affected species is the California tiger salamander, a federally listed proposed threatened species. Figure 4.9.3–4 shows wetland locations where this species has been observed at Site 300. Although proposed grading of fire trails, and 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 minimize the potential for such adverse impacts (Jones and Stokes 2001, USFWS 2002b). The avoidance and mitigation measures discussed above for the California red-legged frog would also provide protection for the California tiger salamander and its habitat (Jones and Stokes 2001). The California tiger salamander was not observed during a field reconnaissance of the proposed EMPC site performed in March 2002 (LLNL 2003ag). Avoidance measures discussed above for the California red-legged frog would also minimize potential for damage or mortality to the California tiger salamander if the EMPC were constructed.

LLNL is proposing to mitigate the 0.62-acre artificial wetland removed by continued operations at Site 300 under the Proposed Action, 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 these two species. 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 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 and 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 Proposed Action on this species. Impacts are expected to be minimal.

Unaffected Species

Activities associated with the Proposed Action would not occur in areas that would affect the following federally listed endangered, threatened, or candidate species: 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 Proposed Action. Impacts are expected to be minimal, if any.

Wetlands

Livermore Site

Under the Proposed Action, No Action Alternative projects and additional projects would be constructed. Construction of new buildings under the Proposed Action 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 under the Proposed Action during the time period covered by the LLNL SW/SPEIS (LLNL 1998a). Future actions involving these wetlands may require consultation with the USACE and the San Francisco Bay Regional Water Quality Control Board, 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 Proposed Action, construction of the EMPC would occur using best management practices to avoid runoff that could affect wetlands. Additionally, a No Action Alternative wetland enhancement project would be constructed to protect and enhance a minimum of 1.86 acres of wetland habitat in association with the termination of artificial wetlands, totaling approximately 0.62 acres, that have been created by cooling tower runoff near Buildings 801, 827, 851, and 865 (Jones and Stokes 2001, USFWS 2002b). This project is discussed in Section 5.2.7. Impacts are expected to be minimal.

5.3.7.3 Cumulative Impacts

Under the Proposed Action, approximately 732,000 square feet (approximately 16.8 acres) of terrestrial habitat at the Livermore Site would be disturbed due to proposed construction activities, a 34 percent increase over soil disturbance under the No Action Alternative (see Section 5.3.6.2). Approximately 40,000 square feet (approximately 0.9 acres) of soil disturbance would be required for construction of the EMPC in the more developed part of Site 300, and some additional soil disturbance would occur for continuing operations, such as road grading and culvert maintenance (see Appendix E). SNL/CA is managing its section of Arroyo Seco to protect California red-legged frog habitat and create a 30-acre wildlife reserve on the east side of that facility. The incremental effect of the Proposed Action on biological resources within the area would be positive, particularly in the long term.

5.3.8 Air Quality

5.3.8.1 Nonradiological Air Quality

Relationship with Site Operations

Similar to the discussion in Section 5.2.8.1, the Proposed Action is for the most part a continuation of current activities. In addition, there are a number of new projects such as facility upgrades, D&D activities, and new facility construction. The scope of these activities under the Proposed Action would be somewhat greater than under the No Action Alternative. Because these types of activities are normal during any 10-year period, potential air quality impacts of planned activities associated with the Proposed Action are considered in relation to current activity levels and are compared to those of the No Action Alternative. The general parameters that will be used in the analyses of potential air quality impacts are listed in Table 5.3.8.1–1.

Impact Analysis

Modifications to Facilities or Operations

Facility and infrastructure renovations (e.g., replacement of ductwork, roofs, installation of seismic and physical security upgrades, and repairs and modifications to roads) and new facility construction are normal during any 10-year period. Many such activities are planned under the No Action Alternative, but under the Proposed Action, the activity level and potential air quality emissions would be about three times that of the No Action Alternative. As discussed earlier, LLNL adheres to stringent requirements to ensure that air emissions are mitigated to the extent practicable, throughout the design, review, and implementation phases of modification activities. While the increased activity would result in a comparable increase in air emissions, primarily fugitive dust and combustion exhaust from increased vehicular activity and employment of construction equipment, with the use of stringent measures to control construction emissions as discussed in Section 5.1.8.1, the impact would not be significant.

New Facilities

The No Action Alternative includes some new facilities such as the NIF, Terascale Simulation Facility, and International Security Research Facility. The Proposed Action would additionally consolidate several programs within new structures. At the Livermore Site, these new facilities would increase utilized space by about 10 percent over that planned under the No Action Alternative. At Site 300, planned new space would be offset by the removal of a similar amount of obsolete space. At both sites, however, space utilization would not differ appreciably from current allocations. In fact, many of the activities to be housed within new structures are ongoing activities that would be relocated and/or consolidated. Activity relocations would be reviewed for compliance with air permit requirements in relation to their new settings. Where activities would require new air permits or modifications to existing air permits, these would be secured prior to construction or operation.

The increase in facility space at the Livermore Site would result in some additional fuel use. Natural gas is used in boilers, and diesel fuel is used in generators. Both are tested periodically. Several criteria and toxic air contaminants are emitted from fuel combustion. Oxides of nitrogen are a concern locally as a contributor to ozone formation. The increased fuel use anticipated under the Proposed Action would result in an increase in oxides of nitrogen emissions by 2.8 tons annually (over the No Action Alternative). Actual oxides of nitrogen emission levels may be limited by site-wide emission caps under the Synthetic Minor Operating Permit discussed in Chapter 4, Section 4.10.4.3. Impacts would be limited by air district offset requirements. Because fuel combustion sources are recognized as potentially significant sources of criteria pollutant emissions, LLNL has enacted standard measures, as described in Section 5.2.8.1, to mitigate emissions from this source category.

Decommissioning, Decontamination, and Demolition

As discussed in Section 5.2.8.1, LLNL has pursued removal of substandard space as part of a campaign to reduce the amount of active nonassignable space and optimize the use of existing space. The Proposed Action would include removal of an additional 456,456 gross square feet at the Livermore Site, and 109,333 additional gross square feet at Site 300. Although this rate would be higher than recent years, strict compliance with air district requirements to limit fugitive dust emissions, and continuing to employ standard measures to control pollution from D&D activities would limit the impact of these activities.

Support Personnel and Vehicular Activity

The Proposed Action requires a projected increase in workforce, adding 500 employees at the Livermore Site by the year 2014, and a corresponding increase in daily vehicular activities, primarily workers commuting to and from the site. Impacts of workforce commute on air quality would be lessened through transportation demand management. A large employment center holds more opportunities for alternatives to the single-employee commute. LLNL's transportation systems management program provides and promotes alternatives and environmentally responsible options for employee commuting. LLNL is committed to continuing this program.

The additional workforce would include some relocated employees new to the Bay Area air basin. Activities of the relocated population would contribute to air emissions associated with the commute to the workplace and secondarily from the additional energy consumption, other vehicular use, and goods and services that would be required to support the additional, relocated population. The jobs created under the Proposed Action at LLNL represent a small fraction (less than 1 percent) of the projected increase in employment within Alameda County over the 2000 to 2010 timeframe (Association of Bay Area Governments 2001). The air quality impact of this population growth would be on the same order as that of the growth rate, and this is well within the projections developed by the Association of Bay Area Governments, Metropolitan Transportation Commission and BAAQMD, and employed in the Clean Air Plan. Therefore, impacts are expected to be minimal.

Cumulative Impacts and Conformity

The parameters used to evaluate air quality impacts under the Proposed Action are listed in Table 5.3.8.1–1. Table 5.3.8.1–2 presents the calculated maximum carbon monoxide concentrations, which would remain within 20 to 30 percent of ambient standards. These levels do not differ appreciably from those under the No Action Alternative because the No Action Alternative and Proposed Action represent very minor contributors to the carbon monoxide concentration, which is dominated by current traffic levels and background sources.

Projected air pollutant emission rates associated with increased fuel combustion in boilers and engines, and increased vehicular activity associated with increased workforce under the Proposed Action are provided in Table 5.3.8.1–3. Total emissions are also provided in Table 5.3.8.1–3 for comparison with significance levels. As discussed in Section 5.1.8, annual and daily significant emission levels are established by local air districts in response to local air quality concerns. A project that generates criteria air pollutant emissions in excess of these levels would be considered to have a significant air quality impact and stringent mitigation would be required. By evaluating project emissions as a whole, including motor vehicle emissions, the air district has a greater level of control over a project, i.e., it is not limited to stationary source permitting.

Rules for conformity also consider total project emissions. These rules were established under the Federal *Clean Air Act* and pertain specifically to Federal actions. The underlying basis for the conformity demonstration is to preclude actions that would generate growth in air pollutants to a degree that is inconsistent with the local clean air plan, and thereby frustrate regional efforts to attain and maintain the ambient air quality standards. Within the Bay Area, conformity applies to projects that generate emissions of precursor organic compounds, oxides of nitrogen, or carbon monoxide in excess of 100 tons per year; such projects would be required to fully offset or mitigate the emissions caused by the action (BAAQMD 1999). A conformity review will be conducted and reported in the Final LLNL SW/SPEIS for projects at the central Livermore Site and Site 300 covered by the EIS.

Total emissions associated with the Proposed Action would be a small fraction of significance levels. Consequently, activities associated with the Proposed Action are not expected to result in an adverse impact to air resources.

The Proposed Action would also result in increased electrical use, which cumulatively contributes to greater demand and some additional air pollution. LLNL and DOE commitments to energy conservation, load management, and increased use of renewable energy sources (discussed in Appendix O, Section O.4.3) would help to offset this impact.

5.3.8.2 Radiological Air Quality

This section analyzes radiological air quality impacts under the Proposed Action due to normal releases from site operations such as R&D and waste management. Impacts in terms of dose related to the Livermore Site and Site 300 are discussed in this section.

Relationship with Site Operations

This section summarizes the relationship between projects described in Section 3.3 for the Proposed Action and radiological air quality. The dose resulting from exposure to routine air emissions from these projects is used to quantify the impacts. The incremental impact for the Proposed Action over the No Action Alternative would be due to additional tritium releases from Building 331 and additional fission products (most importantly, iodine-131) from the NIF. See Appendix M, Table M.5.3.8.4–1, for information on fission products.

Impact Analysis

Livermore Site

Building 331 annual tritium releases would remain 210 curies for the Proposed Action. The NIF releases of tritium, nitrogen-13, and argon-41, would remain the same as under the No Action Alternative, but additional fission products, including xenon, krypton and iodine isotopes, most importantly 0.93 curies per year of iodine-131, would also be released as a result of the NIF experiments.

The site-wide MEI location would be unchanged from the No Action Alternative, but the dose received from atmospheric emissions would be approximately 0.13 millirem per year, less than 1.5 percent of the NESHAP limit. Fifty-four percent of this dose would be from the NIF.

The population dose from the Proposed Action would be 1.8 person-rem per year, 84 percent of that from Building 331. The NIF would have relatively less affect on the population dose than on the site-wide MEI dose because many of the important nuclides released are short-lived and will decay prior to reaching the general population. The dose to the worker population would be 0.16 person-rem per year. No health impacts are expected to occur from exposure to normal radiological releases under this alternative (see Section 5.3.14.4).

Site 300

The releases from Site 300 would be the same for the Proposed Action as for the No Action Alternative. The site-wide MEI dose of 0.055 millirem per year, less than 0.6 percent of the NESHAP limit, and population dose of 9.8 person-rem per year and dose to worker population of 0.005 person-rem per year would therefore remain unchanged from the No Action Alternative.

No health impacts from radiological air releases are expected from the Proposed Action at Site 300 (see Section 5.3.14.4).

Cumulative Impacts

No adverse impacts on radiological air quality are expected under the Proposed Action. 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.

5.3.9 Water

5.3.9.1 Relationship with Site Operations

This section summarizes the relationship between projects described in Section 3.3 for the Proposed Action and the water impact analysis. The effect of projects for the Proposed Action on water resources is related to impervious surfaces and runoff from buildings, roads, and their associated site drainage measures, as well as increased use of potential contaminants resulting from construction and operation of projects under the Proposed Action.

5.3.9.2 Impact Analysis

Livermore Site

Surface Water

Surface water monitoring would continue under the Proposed Action in accordance with NNSA guidelines to ensure remediation of contamination already present and detection of hazardous materials in the future. Stormwater monitoring would continue in accordance with NPDES requirements.

Surface water resources could be degraded by contaminant releases during construction of some facilities under the Proposed Action. Contaminant sources could include construction materials; hydraulic fluid, oil, and diesel fuel; and releases from transportation or waste-handling accidents. LLNL stormwater pollution prevention plans have been devised to identify pollutant sources that could affect the quality of industrial stormwater discharges and to describe implementation practices to reduce pollutants in these discharges. In the event of a hazardous spill, necessary equipment to implement cleanup is available, and personnel are trained in proper response, containment, and cleanup of spills. Further guidance on response to hazardous material spills is provided in the ES&H Manual.

Compliance with an approved erosion and sedimentation control plan during construction would prevent impacts to surface water from construction-induced erosion.

The Livermore Site's primary water source is the San Francisco Hetch Hetchy Aqueduct system. The secondary or emergency water source is the Alameda County Flood and Water Conservation District, Zone 7. Approximately 1.37 million gallons per day would be used at the Livermore Site under the Proposed Action, the same as under the No Action Alternative. At the Livermore

Site, water would be used primarily for industrial cooling processes, sanitary systems, and irrigation. Minor amounts of water would be used for drinking, manufacturing, washing, system filters, boilers, and a swimming pool.

Under the Proposed Action, the square footage of impervious surfaces at the Livermore Site, primarily roads and buildings, would be approximately 370,000 square feet greater than under the No Action Alternative. Impervious surface area would be 29 percent, a 2 percent increase from the No Action Alternative. An increase in surface runoff would occur because of increased impervious surface areas. However, because Livermore Site soils are relatively permeable and abundant uncovered acreage remains for groundwater recharge, the impact of the reduction in recharge surface area under the Proposed Action would be minimal.

Because no activities under the Proposed Action would occur within the 100-year floodplain, other than the Arroyo Las Positas Maintenance Project, which is covered under an Environmental Assessment (DOE/EA-1272) (DOE 1998b), a separate NEPA document, no impacts to the floodplain would be expected. None of the Proposed Action projects would contribute significant amounts of surface water runoff to cause substantial flooding because the 100-year base flood event would be contained within all channels. Due to the high infiltration rates and lack of appreciable floodplains on the Livermore Site, hydrologic impacts from the Proposed Action would be minimal. No facilities would be located in either the 100-year or 500-year floodplain; therefore, no impact from flooding would be expected.

Groundwater

Groundwater monitoring would continue under the Proposed Action to ensure that remediation of contamination already present continues to be effective and that contaminant fate and transport is fully understood. Groundwater quality should continue to improve because extracted groundwater would be collected and treated at the treatment facilities.

Groundwater resources could be degraded by contaminant releases during construction. Contaminant sources include construction materials, spills of oil and diesel fuel, and releases from transportation or waste-handling accidents. LLNL follows prevention and mitigation steps outlined in the spill response chapter of the ES&H Manual in the event of a hazardous material spill. Because the minimum depth to groundwater at the Livermore Site is approximately 50 feet and employees are trained in emergency spill response procedures, spills would likely be cleaned up before they reach the water table.

Impacts to groundwater from leaking underground storage tanks would not be expected since LLNL complies with all underground storage tank regulations.

Groundwater quality would continue to improve from ongoing remediation at treatment facilities. No negative impacts to groundwater are expected from operation because there would be no discharges to groundwater. Impacts to groundwater quality from surface water recharge would be minimal because LLNL would continue to comply with NPDES requirements.

Site 300

Surface Water

Stormwater monitoring would continue in accordance with NPDES requirements. Surface water resources could be degraded by contaminant releases during construction of new facilities. Contaminant sources could include construction materials, spills of oil and diesel fuel, and releases from transportation or waste-handling accidents. LLNL would follow mitigation steps outlined in the SPCC Plan in the event of a spill of petroleum products. Hazardous material spill response procedures are outlined in the ES&H Manual.

Compliance with an approved erosion and sedimentation control plan during construction would prevent impacts to surface water from construction-induced erosion.

Site 300's No Action Alternative water usage of 0.35 million gallons per day would continue under the Proposed Action.

Under the Proposed Action, developed space at Site 300 would be 80,000 square feet less than under the No Action Alternative, likely decreasing the amount of impervious surfaces. Less development would allow for increased surface area for groundwater recharge. Approximately 1 percent of Site 300 would be covered with impervious surfaces. Because Site 300 is largely undeveloped and contains permeable soils, there would be no noticeable impact to groundwater recharge.

Because no activities under the Proposed Action would occur within the 100-year floodplain, no impacts to the floodplain would be expected. None of the Proposed Action projects would contribute significant amounts of surface water runoff to cause substantial flooding because the 100-year base flood event would be contained within all channels. Due to the high infiltration rates and lack of appreciable floodplains at Site 300, hydrologic impacts from the Proposed Action would be minimal. However, due to the steep slopes, high runoff velocities within the channels could occur during a storm. No facilities would be located in these areas; therefore, no impact from flooding would be expected.

Groundwater

Although the eastern GSA offsite trichloroethylene plume has recently been restricted to Site 300, the plume had extended more than a mile down the Corral Hollow stream channel in the direction of the city of Tracy. Groundwater monitoring would continue under the Proposed Action to ensure that remediation of contamination already present continues to be effective and that contaminant fate and transport is fully understood. Groundwater quality should continue to improve because extracted groundwater would be collected and treated at the treatment facilities.

Groundwater resources could be degraded by contaminant releases during construction. Contaminant sources could include construction materials; spills of hydraulic fluid, oil, and diesel fuel; and releases from transportation or waste-handling accidents. LLNL follows prevention and mitigation steps outlined in the spill response chapter of the ES&H Manual in the event of a hazardous material spill. In all but one area where contamination activity could occur

under the Proposed Action, depth to groundwater ranges from approximately 50 feet to more than 180 feet below ground surface. Because the minimum depth to groundwater at Site 300 is approximately 50 feet in areas where activity is expected under the Proposed Action and employees are trained in emergency spill response procedures, spills would likely be cleaned up before they reach the water table.

Impacts to groundwater from leaking underground storage tanks would not be expected since LLNL complies with all underground storage tank regulations.

Groundwater quality should continue to improve from ongoing remediation at treatment facilities. No negative impacts to groundwater are expected from operation because there would be no discharges to groundwater.

Groundwater use would continue as under the No Action Alternative, and no impacts to groundwater availability would be expected under the Proposed Action. If Site 300 gets its water supply from the Hetch Hetchy system as planned, groundwater would no longer be used as the primary water source for Site 300. In this case, more groundwater would be available for other users in the area, thus no impacts would be expected.

5.3.9.3 Cumulative Impacts

Livermore Site

The San Francisco Public Utilities Commission provides water to 2.4 million people in San Francisco, San Mateo, Santa Clara, and Alameda counties, including the Silicon Valley business district. To maintain a reliable water system, the San Francisco Public Utilities Commission initiated regional and local water projects in 2003 to upgrade and repair Hetch Hetchy system facilities. These projects will ensure stability in the case of a seismic event, sufficient water supply for an increasing population, and high-quality drinking water that meets all regulatory requirements. The improvements are scheduled to be completed by the year 2016.

San Francisco Bay Area water use is expected to increase by 64 million gallons per day by the year 2030. This is approximately a 25 percent increase over current water usage. Livermore is projected to use 1.37 million gallons per day under the Proposed Action. This is 0.4 percent of the projected total Hetch Hetchy water supply. Livermore currently uses 0.5 percent of the Hetch Hetchy water supply. Livermore's future contribution to the cumulative Hetch Hetchy water use would remain proportional to current use.

Because much of the land surrounding the Livermore Site is zoned for low-density activities, such as grazing, vineyards, and rural residential, and the large residential parcel to the west of the Livermore Site is basically fully developed (see Chapter 4, Figure 4.2.1.1-1), it is expected that most of the surrounding undeveloped land would not be converted to impervious surfaces in the future. Therefore, cumulative impacts on surface water quality and groundwater recharge from increases in impervious surfaces would be minimal.

With the exception of Livermore Site VOC plumes, no other known contaminant plumes exist in the surrounding area that could cause a cumulative degradation of groundwater quality. Sources of groundwater contamination in Livermore are described in Section 5.2.15.3. Groundwater

quality at SNL/CA, located directly south of the Livermore Site, has improved through completion of remediation that began in 1984 on a 59,000-gallon diesel fuel spill. Similarly, groundwater quality should continue to improve in the Livermore Site vicinity with ongoing remediation at water treatment facilities.

Site 300

Site 300 currently receives water from onsite wells and should receive water from the Hetch Hetchy water supply system by early 2004. Water consumption rates have declined steadily since 1992, down to 25.3 million gallons per year in 2002. The new water system capacity is estimated to be 648,000 gallons per day, with the capacity expanding to 1.2 million gallons per day. Under the Proposed Action, Site 300 would use 0.1 percent of the Hetch Hetchy water supply. Given the low population and rural character of the area, an indiscernible increase in water use under the Proposed Action, and the eventual Hetch Hetchy supply, no cumulative impacts to water availability for Site 300 and the vicinity would be expected.

The land surrounding Site 300 is designated as general agricultural, recreational, conservational, and wind resource areas (see Figure 4.2.1.2–1). Most of this land is agricultural, however, property immediately east of the site is occupied by a company that packages and stores fireworks. The Carnegie State Vehicular Recreation Area, southwest of the site, is used for off-highway vehicles. Aside from the vehicular recreation area, which likely contributes to sediment runoff during rainstorms, the cumulative impact on surface water quality from activities in surrounding areas would be minimal. Because the area is largely undeveloped and expected to continue in that manner, no cumulative impacts to groundwater recharge would be expected.

Groundwater contamination at Site 300 has been restricted to within the site boundary and groundwater quality is improving through remediation activities. Because these plumes are the only known groundwater contamination in the Site 300 vicinity, no cumulative impacts to groundwater quality would be expected.

5.3.10 Noise

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

5.3.10.1 Relationship with Site Operations

Activities associated with the Proposed Action (Section 3.3) would contribute to noise generation, either directly or indirectly. The general parameters that were used to characterize community noise levels under the Proposed Action are listed in Table 5.3.10.1–1.

5.3.10.2 *Impact Analysis*

The Proposed Action would be a continuation of current activities. There would be a number of new projects including facility upgrades, D&D activities, and new facility construction. The scope of activities under the Proposed Action would include all planned No Action Alternative activities, as well as several additional projects at both the Livermore Site and Site 300 and increased staffing requirements.

Modifications to Facilities or Operations

Noise generated during construction activities supporting facility and infrastructure renovations at the Livermore Site and Site 300 would not generally be noticeable in nearby communities, owing to the relatively large spatial area, perimeter buffer zone, and intervening roadways. However, because the Proposed Action would include a higher level of activity, about two to three times that planned under the No Action Alternative, there would be higher likelihood of a discernible impact in offsite areas. At most, during peak activity levels, a person located 100 feet from a noisy construction site would not be exposed to more than 82 dB(A) and for only limited periods of maximum activity. These levels are similar to the No Action Alternative, and no additional noise impacts are expected for the Proposed Action.

New facilities associated with the Proposed Action would be primarily offices and laboratories and 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. No additional noise impacts are expected.

Livermore Site

At the Livermore Site, two near-fenceline construction projects, the Consolidated Security Facility and a Science and Education Lecture Hall near the West Gate, would have a higher likelihood of discernible impacts in areas offsite; however, even at their peak, these construction projects would not result in a community member being exposed to more than 82 dB(A) and that for only limited periods of maximum activity. These sources are not expected to be objectionable nor would they conflict with compatibility guidelines.

Site 300

Two construction projects would be included under the Proposed Action at Site 300. Construction activities would occur over a limited time and, other than construction-related vehicles accessing the site, would not result in a discernable impact to areas offsite.

Traffic Noise

The Proposed Action would result in a slight increase in heavy-duty vehicle activity at both the Livermore Site and Site 300, and a corresponding increase in the frequency of associated peak noise levels. Vehicles serving LLNL would be subject to requirements that they be properly muffled to reduce noise impacts, and activities would be limited to those times that would be less noticeable and less objectionable.

The Proposed Action would require a workforce increase, adding 500 employees at the Livermore Site by the year 2014, and a corresponding increase in vehicular activity. The additional traffic would add slightly to ambient noise levels, and would be a small increase from the No Action Alternative. To help alleviate this impact, LLNL would continue promoting and expanding its Transportation Systems Management Program to aid in providing viable alternatives to employee commuting, thereby reducing traffic congestion and noise (LLNL 2001s). Only incremental additions to the workforce, approximately 10 employees, would be required for Site 300; vehicular activity would be the same as under the No Action Alternative.

Impulse Noise

LLNL would continue explosives research testing under the Proposed Action at both the Livermore Site in the Building 191 High Explosive Application Facility, and at Site 300 within the Contained Firing Facility and on open firing tables. No additional noise impacts are expected. LLNL would continue to use blast forecasting as a tool to determine if explosive tests would adversely affect the surrounding community and to restrict operations when peak-impulse noise levels are predicted to exceed the 126-dB(A) level in populated areas. LLNL would also continue to perform meteorological monitoring to provide necessary input data for blast forecasting (LLNL 2001s). No additional noise impacts are expected.

Decommissioning, Decontamination, and Demolition

The Proposed Action would include the removal of 820,000 gross square feet of excess and legacy facilities. This is 456,456 square feet at the Livermore Site and 109,333 square feet at Site 300 greater than the No Action Alternative. Although this rate would be higher than that of recent years, with the relatively large spatial area and perimeter buffer zone, noise from demolition activities would not be discernible in offsite areas. No additional noise impacts are expected.

5.3.10.3 Cumulative Impacts

As stated, planned activities associated with the Proposed Action would include a projected increase in workforce, adding approximately 500 employees at the Livermore Site. Although the jobs that would be created under the Proposed Action represent a very small fraction (less than 1 percent) of the projected increase in employment within Alameda County and San Joaquin counties (described in Section 5.1.2), activities and services to support the relocated population would contribute to local noise levels, both short-term, in areas of increased construction activities, and long-term, associated with increased development, density of population and commercial activities, and vehicular traffic and congestion.

Local noise ordinances and restrictions on allowable noise levels, as stated in terms of land use compatibility guidelines for community noise environments (discussed in Section 4.12.1.2), would limit the impact of additional noise sources on the local community. The city of Livermore is currently working on several elements of its General Plan and may consider additional restrictions based on key findings related to noise (City of Livermore and LSA 2002). With Livermore's anticipated growth in the future, noise levels are expected to increase due to potential increases in Livermore's current key noise sources: construction activity, development,

vehicular activity, and rail and aviation operations. Noise levels from potential mixed use and infill development in Livermore, especially in the downtown, could exceed noise level guidelines as a result of land use incompatibilities.

5.3.11 Traffic and Transportation

Traffic congestion and the collective dose and LCFs to the general population from radiological shipments were analyzed. The estimate of traffic congestion is based on the change in employment under the Proposed Action compared to the No Action Alternative. Radiological consequences were calculated using DOE transportation models as described in Section 5.1.11. Appendix J presents more information on the methodology and important inputs for radiological transportation analysis.

5.3.11.1 Relationship with Site Operations

Section 3.3 describes the projects under the Proposed Action. These projects, when combined with the No Action Alternative, would result in increased radiological transportation. The major shipments in the Proposed Action would result in 290 shipments of special nuclear material, 82 shipments of LLW and MLLW, 5 shipments of tritium, and 9 TRU waste shipments in the maximum year (see Appendix J, Section J.5.3 for more details).

5.3.11.2 Impact Analysis

Livermore Site

Under the Proposed Action, site employment would increase from the No Action Alternative of approximately 10,650 to 11,150 personnel. This increase would affect traffic near the Livermore Site. Although construction employment would rise and fall over the period of analysis for this LLNL SW/SPEIS, the average contractor employment level (including construction and operations contract employees) at the Livermore Site would not vary significantly from the current level. Any variations in construction employment for the Proposed Action would be small, compared to overall site employment, and temporary. Under the Proposed Action, offsite transportation of radioactive materials would increase from that under the No Action Alternative. The impacts of bounding radiological transportation accidents are described in Section 5.5.5. Chapter 4, Section 4.13, describes the existing traffic and transportation levels.

Operations traffic would be comprised of commuting workers and deliveries of materials needed for the operation of the facilities. The number of new Livermore Site workers under the Proposed Action would be approximately 500, representing a 5 percent increase in the Livermore Site workforce. This is a small fraction of the current traffic level near LLNL, as described in Section 4.13. Traffic in the Tri-Valley Area is heavily congested. Although LLNL traffic contributes to this congestion, its overall percent contribution is small, and the incremental contribution from the Proposed Action over the No Action Alternative would be negligible; very small impacts would be expected.

The increase in the site workforce could also affect the availability of parking spaces. Site planners working under the Parking Master Plan (LLNL 2002bv) would ensure that newly constructed facilities would have adequate parking for the facility's workforce.

Under the Proposed Action, shipments of radioactive materials would increase over the No Action Alternative because of the additional projects described in Section 3.2 that require radiological shipments. These would include nuclear material, tritium, LLW, MLLW, TRU waste (including Berkeley drums), and miscellaneous radioactive shipments (see Appendix J, Section J.5.3). Table 5.3.11.21 presents the collective dose under the Proposed Action. The number of LCFs for the Proposed Action would be much less than one (4×10^{-3}) per year.

TABLE 5.3.11.2–1.—Collective Dose to the General Public From Radioactive Shipments Under the Proposed Action

Shipment Type	Collective Dose (person-rem per year)			
	Along Route	Sharing Route	At Stops	Total
LLW	0.10	1.2	0.55	1.9
TRU waste	3.7×10^{-2}	0.45	.21	0.69
Materials ^a	0.20	2.3	1.1	3.7
Total	0.34	4.0	1.9	6.2
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.

All radioactive materials would be shipped in certified containers and in accordance with U.S. Department of Transportation and DOE regulations. These regulations specify package integrity during normal transport and accident conditions, limit dose rate from the packages and vehicles, and specify special precautions for the more radioactive shipments, including operational procedures such as reduced speed limits, limited routes, special vehicle maintenance, and escort during transport.

Site 300

The Proposed Action would result in very small changes to the workforce at Site 300. Construction of the EMPC and the HEDC would create small and temporary increases in construction-related traffic. Site 300 does not engage in any significant transport of radioactive materials; however, explosives are often transported. Under the Proposed Action, the number of explosives shipments would not significantly increase from those under the No Action Alternative and very small incremental impacts are expected.

Operations traffic would comprise of commuting workers and deliveries of materials needed for the operation of the facilities. The number of new Site 300 workers under the Proposed Action would not be expected to increase over the No Action Alternative. Traffic in the Site 300 area is generally not heavy due to its rural location. Any incremental increase in traffic could be readily accommodated by the local road system and no impacts are expected.

5.3.11.3 *Cumulative Impacts*

Livermore Site

Traffic congestion in the Tri-Valley Area is very heavy and would likely increase due to growth in the area. Any increases in LLNL employment under the Proposed Action would, however small, contribute to this congestion. Because the contribution of the Proposed Action plus current LLNL traffic to the overall congestion problem would be small, detailed analysis of the cumulative impacts is not warranted. However, LLNL's contribution to radiological impacts near LLNL would not be a small percentage of overall radiological impacts. Therefore, this cumulative impacts analysis focuses on collective dose from radiological transportation. The analysis considers LLNL's radiological transportation cumulative with SNL/CA's radiological transportation.

A RADTRAN 5 analysis for 3.5 miles of highway near the Livermore area where all radiological shipments would converge were performed. The shipments were comprised of those in the Proposed Action (6.1×10^{-2} person-rem per year) and those from SNL/CA (1.2×10^{-3} person-rem per year). The resulting collective dose would be 6.2×10^{-2} person-rem per year, corresponding to 4×10^{-5} LCFs per year. Impacts are expected to be minimal. More information on the calculation is presented in Appendix J, Section J.7.

Site 300

Traffic between Corral Hollow Road and I-580, and along Tesla Road between the Livermore Site and Site 300, is strongly affected by Site 300 traffic during shift changes. Nevertheless, the Site 300 contribution would be small compared to the capacity of the roads. Local traffic could increase slightly over the years as pressures for residential and commercial development increase for land near Site 300. Residential areas are few and sparsely populated, although, a Tracy Hills residential development near the site has been planned for many years. Currently, the Carnegie State Vehicular Recreation Area along the southwest side of the site, across Corral Hollow Road, and private ranching operations are the only commercial operations near Site 300. Commuters on I-580 occasionally use Corral Hollow Road as an alternative route when I-580 is heavily congested. Any small increases in employment at Site 300 under the Proposed Action would have minimal impact on this overall traffic condition.

5.3.12 *Utilities and Energy*

This section discusses the potential impacts of the Proposed Action on utilities and energy supplies. Utility and energy usage are 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.

5.3.12.1 *Relationship with Site Operations*

This section summarizes the relationship between projects described in Section 3.3 for the Proposed Action and the utilities and energy analysis. In general, the effects of projects for the

Proposed Action on utilities and energy analyses are related to water consumption, sewer discharges, electricity consumption, and fuel consumption resulting from design, construction, and operation of projects.

As discussed in Section 5.1.12, the utilities and energy analysis is based on projected square footage requirements and available system capacities. Under the Proposed Action, total facility space at the Livermore Site would decrease approximately 1.0 percent from the projections under the No Action Alternative, and total facility space at Site 300 would remain the same as that projected under the No Action Alternative. A number of facility and utility system upgrades are also planned under the Proposed Action. The impact categories for the utilities and energy analysis are discussed in depth in the following sections.

5.3.12.2 Impact Analysis

Water Consumption

Livermore Site

Under the Proposed Action, the Livermore Site would experience a 1.0 percent decrease in facility space and a corresponding decrease in water consumption from the No Action Alternative. Annual water consumption at the Livermore Site is estimated to be approximately 276 million gallons per year under the No Action Alternative (see Section 5.2.12.3). Annual water consumption under the Proposed Action is projected to decrease to approximately 273 million gallons per year. Peak water use at the Livermore Site would be the same as under the No Action Alternative, approximately 1.37 million gallons per day. The existing capacity of the Livermore Site domestic water system is approximately 2.88 million gallons per day. Because the Livermore Site domestic water system has adequate capacity to meet future water demand under this alternative, impacts would be minimal.

Site 300

Site 300 is supplied with water from a system of wells. The existing capacity of usable wells is approximately 930,000 gallons per day. A project to connect Site 300 with water pumped from the city of San Francisco's Hetch Hetchy water supply system is expected to be complete by early 2004. The capacity of this new water supply is estimated to be 648,000 gallons per day, with the capability of expanding to 1.2 million gallons per day (LLNL 2000a). Average water consumption at Site 300 is 67,900 million gallons per day (LLNL 2003aq). Under the Proposed Action, NNSA would demolish approximately 129,500 square feet of obsolete building space and replace it with an equal amount of modern building space. Therefore, the No Action Alternative water use at Site 300 is considered to be representative of future consumption rates for the Proposed Action. No new impacts are expected.

Sewer Discharges

Livermore Site

An increase in the volume of sewage discharges would result from implementation of the Proposed Action at the Livermore Site. The Livermore Site would discharge approximately 224,000 gallons of sewage per day under the No Action Alternative (See Section 5.1.12.3). Under the Proposed Action, sewage production would decrease by 1.0 percent to approximately 222,000 gallons per day. The LWRP currently receives a total of approximately 6.5 million gallons of effluent per day. The capacity of this facility is 8.5 million gallons of effluent per day, which is expected to be sufficient for inflow treatment for the next 10 years. Impacts from this increase in sewer discharges from the Livermore Site would be minimal.

Site 300

Site 300 sanitary sewage generated outside the GSA is disposed of through septic tanks and leachfields or cesspools at individual building locations. Sanitary sewage generated within the GSA is piped into an asphalt membrane-lined oxidation pond east of the GSA.

Under the No Action Alternative, Site 300 discharges approximately 2,100 gallons of sewage per day. Under the Proposed Action, NNSA would demolish approximately 129,500 square feet of obsolete building space and replace it with an equal amount of modern building space. Therefore, the No Action Alternative sewage discharge rates at Site 300 are considered to be representative of future consumption rates for the Proposed Action. No offsite sewage treatment is conducted for Site 300 wastes, therefore no impacts are expected.

Electricity Consumption

Livermore Site

The projected peak electrical demand under the Proposed Action would be 81 megawatts. The current system capacity is 125 megawatts. Growth at the Livermore Site would result in increased electricity consumption. This would have an impact on electrical power supply and distribution systems. The Livermore Site would consume approximately 446 million kilowatt-hours per year under the No Action Alternative. Under the Proposed Action, electric power consumption is expected to decrease by 1.0 percent to approximately 442 million kilowatt-hours per year. The LLNL distribution system and existing capacity for the utilities to supply energy on both a total and a peak load basis would adequately meet the projected increase in consumption, but may limit future development at the site.

Site 300

Electricity consumption at Site 300 decreased from an average of 21.75 million kilowatt-hours per year in 1992 to approximately 16.3 million kilowatt-hours per year (LLNL 2003aq). Electricity consumption at Site 300 has remained stable over the past 5 years.

Under the Proposed Action, NNSA would demolish approximately 129,500 square feet of obsolete building space and replace it with an equal amount of modern building space. Therefore, No Action Alternative electrical power consumption at Site 300 is considered to be representative of future consumption rates for the Proposed Action. 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. Based on the projected increase in gross square footage of developed space at the Livermore Site, fuel consumption under the Proposed Action would decrease by 1.0 percent to approximately 23,000 therms natural gas per day. This would result in minimal impact upon supply.

There is no planned change in diesel fuel or unleaded gasoline use for the Proposed Action. Consumption of approximately 72,200 gallons diesel fuel per year and 451,800 gallons unleaded gasoline per year is anticipated.

Site 300

Under the No Action Alternative, Site 300 fuel oil consumption is approximately 16,600 gallons per year (LLNL 2003aq). Under the Proposed Action, NNSA would demolish approximately 129,500 square feet of obsolete building space and replace it with an equal amount of modern building space. Therefore, fuel oil consumption under the No Action Alternative is considered to be representative of future consumption rates for the Proposed Action.

5.3.12.3 Cumulative Impacts

Water Consumption

Livermore Site

The Proposed Action 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 in the Hetch Hetchy service area in conjunction with water use at the Livermore Site would constitute a cumulative impact upon water resources and supply systems.

Site 300

Current water use at Site 300 is considered to be representative of future consumption rates for the Proposed Action. 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 water demands in San Joaquin County are expected to increase proportionally. This population growth would constitute an adverse cumulative impact on groundwater resources. Similarly, population growth within the Hetch Hetchy service area in conjunction with water use at Site 300 would constitute an impact upon water resources in the Hetch Hetchy service area.

Sewer Discharges

Livermore Site

The Proposed Action 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 discharges from the Livermore Site would constitute a cumulative impact on sewage systems in the area. The LWRP currently receives 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 Proposed Action.

Electricity Consumption

Livermore Site

The projected peak electrical demand under the Proposed Action would be 81 megawatts. The Proposed Action 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 cumulative impact on electric power resources in the area. Currently, electric utilities provide approximately 10,605 million kilowatt-hours per year of electricity to Alameda County (CEC 2001). However, more than 10,000 megawatts of new electric generation capacity is planned in the PG&E service area, which includes Alameda County. 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, any impact would be mitigated.

Site 300

Current electric power consumption at Site 300 is considered to be representative of future consumption rates for the Proposed Action. 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 could constitute a 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, which includes San Joaquin County. 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 San Joaquin County electrical energy needs for the next 10 years. Therefore, any impacts would be mitigated.

Fuel Consumption

Livermore Site

The Proposed Action 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 fuel 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. Diesel fuel and unleaded gasoline delivery systems in Alameda County are adequate and sufficient to meet fuel requirements for the next 10 years. Therefore, any impacts would be mitigated.

Site 300

Current fuel oil consumption at Site 300 is considered to be representative of future consumption rates for the Proposed Action. 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. 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 amounts of excess capacity sufficient to meet San Joaquin County requirements for the next 10 years. Therefore, any impacts would be mitigated.

5.3.13 Materials and Waste Management

5.3.13.1 *Materials Management*

This section provides an overview of management responsibilities regarding receipt, transfer, and shipment of radioactive, controlled, and hazardous materials at LLNL under the Proposed Action. 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 their planned and inadvertent releases to the environment.

The consequences of using radioactive, controlled, and hazardous materials are discussed in the sections associated with the affected media. For example, releases to the air associated with use of radioactive materials are discussed in Section 5.3.9, and releases affecting vegetation are discussed in Section 5.3.8. The workplace use of these materials and associated occupational exposures are discussed in Section 5.3.14.

Relationship with Site Operations

Several new operations are currently in the planning stages at LLNL. However, they were considered outside of the scope of the existing conditions for this LLNL SW/SPEIS because they had not yet reached operational status. New operations are defined as programmatically planned projects with implementation schedules that will take place in the future (e.g., the NIF). In general, material usage at LLNL would increase, consistent with a 7 percent increase in LLNL operations above the No Action Alternative.

Under all conditions, existing waste minimization and pollution prevention techniques would be expected to offset a portion of the projected increase. Average maximum quantities would likely remain constant as material storage space remains constant; however, average quantities would be expected to increase to meet demand. Under the Proposed Action, material projections used for analysis would not exceed existing material management capacities.

Impact Analysis

The Proposed Action would not cause any major changes in the types of materials used onsite. Material usage at LLNL would increase, consistent with a 7 percent increase in laboratory operations above the No Action Alternative. However, existing waste minimization and pollution prevention techniques would offset a portion of the projected increase. Average maximum quantities would likely remain constant as material storage space remains constant; however, average quantities would be expected to increase to meet demand. Under the Proposed Action, material projections used for analysis would not exceed existing material management capacities.

Existing Operations

The Proposed Action total hazardous material usage would increase for existing facilities. Under the Proposed Action, average quantities would increase by an estimated 7 percent (Table 5.3.13.1–1) above the No Action Alternative. Annually, approximately 183,000 to 204,000 chemical containers, ranging from 210-liter (55-gallon) drums to gram-quantity vials, would be used or stored at LLNL.

Annually, for the Livermore Site, approximately 75,000 gallons of liquids would be managed under the Proposed Action with an estimated storage capacity of 227,000 gallons. Approximately 1.5 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) would be less likely to be consumed and more likely to be reused and reclaimed. Regardless, there would be sufficient capacity to accommodate anticipated operations. Approximately 1.2 million cubic feet of mostly industrial gases (argon, helium, hydrogen, oxygen, nitrogen) would be used annually with a storage capacity 71.6 million cubic feet.

Technology Program operations (Table 5.3.13.1–3). New LLNL operations would account for approximately 70,000 gallons of liquids and solids and approximately 20,000 standard cubic feet of industrial gases). Materials that would be expected to support other projects, including the new Office of Science Laboratories and typical D&D projects, are described in Tables 5.3.13.1–3 and 5.3.13.1–4. For new facilities, no impacts would be expected because each of the new facilities would be designed to handle expected quantities.

TABLE 5.3.13.1–3.—Types of Hazardous Materials in Use with New Operations Under the Proposed Action

Project Title	Hazardous Materials Expected
Increased Admin limits for plutonium in Superblock	Plutonium limits increased.
Integrated Technology Program	See Appendix N
Energetic Materials Processing Center	Explosives, other explosive materials, solvents, acids, bases, other chemicals. Project replaces existing operations at Site 300 (see general information in Table 5.3.13.1.2–2)
Increase in Tritium Facility material limits	Tritium increases
Materials Science modernization project	Materials would be similar to those at existing Materials Science facilities
High Explosives Development Center	Explosives, other explosive materials, solvents, acids, bases, other chemicals. Project replaces some existing operations at Site 300 (see general information in Table 5.3.13.1.2–2)
Berkeley waste drums	No materials associated with this project
Increased worker population	Included in Table 5.3.13.1.2–1
Use of court-ordered materials at NIF	Plutonium targets and other materials (See Appendix M)
Petawatt laser prototype	No new materials
Building 696 Mixed Waste Permit	Limited materials, primary function would be waste management
Deactivation and D&D projects	Limited materials, primary function would be D&D
Increase MAR for Superblock	No new materials; only MAR increase
NIF Neutron Spectrometer	No new materials
CBNP expansion	Small samples of RG-1 and RG-2 nonselect biological agents
Consolidated Security Facility	No new materials
Waste management	Waste management activities only
Building 625 waste storage	Waste management activities only
Direct shipment of TRU from plutonium facility	Waste management activities only
Building utilities upgrade	No new materials
Building seismic upgrades	No new materials

Source: TtNUS 2003.

CBNP = Chemical and Biological National Security; D&D = decontamination and decommissioning; MAR = material-at-risk; NIF = National Ignition Facility; TRU = transuranic.

TABLE 5.3.13.1–4.—Listing of Materials for Use with Decontamination and Decommissioning, Construction, Upgrades, and Other Improvements Under the Proposed Action^{a, b, c}

Material Usage Description
Acoustical ceiling, acoustical insulation, acrylic, additives, adhesives, asphalt, bonding agent, carpet and padding, caulking, ceramic, cleaners, concrete, coolants, fillers, glazing, glues, gypsum wallboard, insulating paints, insulation, joint compounds, latex, metal ceiling, oils, paints, pipes, primer, putties, quarry and conductive tile, reducers, roofing materials, sealants, sealer, soil, solder, solvents, spackling, sprayed fireproofing, structural metals, tile grout, tubes, wallpaper supplies, waterproofing, wiring, and wood finishing.

Source: TtNUS 2003.

^a Examples of D&D projects include Buildings 808, 412, 175N, 212, 251, 419, 171.

^b Examples of construction projects include Office of Science Lab, EMPC, and other new buildings listed in Table 5.3.13.1–3.

^c Examples of Upgrades include building utilities, seismic, site utilities upgrades.

D&D = decontamination and decommissioning; EMPC = Energetic Material Processing Center.

Along with the projects identified under the No Action Alternative (see Section 5.2.13.1), the Proposed Action would include four construction projects, nine D&D projects, five miscellaneous projects, six renovation/modernization/consolidation projects, and six new operations (see Appendices A and B for additional details). Site material usage would increase because of the new operations. Overall radioactive materials and explosive materials, based on current administrative limits, would increase. Under the Proposed Action, radioactive material and explosive material requirements used for analysis would not exceed material management capacities.

Cumulative Impacts

The ROI for materials 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, NNSA, local projects and activities, and the State of California. Where appropriate, qualitative information has been provided in tabular form.

Livermore Site

Under the Proposed Action, approximately 183,000 to 204,000 chemical containers, ranging from 210-liter (55-gallon) drums to gram-quantity vials, would be used or stored at LLNL annually. For the Livermore Site, approximately 75,000 gallons of liquids would be managed with an estimated storage capacity of 227,000 gallons (remaining capacity of 67 percent) annually. Approximately 1.5 million pounds of solids would be handled with a storage capacity of 2.4 million pounds (remaining capacity of 38 percent). Solid material storage would not be expected to fluctuate because metals (e.g., lead used for shielding) would less likely be consumed and more likely be reused and reclaimed. Regardless, there would be sufficient capacity to accommodate anticipated operations. Approximately 1.2 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. Table 5.3.13.1–5 lists some commonly used chemicals at LLNL.

TABLE 5.3.13.1–5.—Commonly Used Chemicals at Lawrence Livermore National Laboratory^a

Hazardous material	Quantity in Pounds
Paints (varies assumed 1-2% glycol ethers)	8,000
Sulfuric acid	5,016
Hydrochloric acid	3,500
Toluene	3,500
Methanol	700

Source: TtNUS 2003.

^a The commonly used chemicals listed above were derived during comparisons of chemicals reported in LLNL, EPA, and DOE databases.

LLNL uses explosives in various R&D and test applications. Explosive quantities used per activity range from milligrams to several kilograms. Overall, the quantities of explosive material maintained onsite are restricted by the approved explosive capacity of various storage areas. No increases in storage capacity were projected.

Sandia National Laboratories/California

SNL/CA maintains a small inventory of radioactive materials used in laboratory and radiation monitoring activities. All radioactive material used by SNL/CA is obtained from offsite sources. Individual sources at SNL/CA generally have small quantities of radioactive material and most are sealed. Radioactive material inventories are maintained at mission-essential levels, and all attempts are made to reduce inventories of surplus legacy material. No increases in radioactive material would be expected since most radioactive sources are sealed and not consumed (NNSA 2003a).

Like LLNL, SNL/CA uses a wide variety of chemicals in small-scale laboratory operations. Using the Maximum Operations Alternative from the January 2003 *Final Site-Wide Environmental Assessment of SNL/CA Environmental Information Document* and projecting a 53 percent increase in operations, more than 12,000 different chemicals would be in use or stored at SNL/CA at any given time in more than 52,000 different containers.

SNL/CA uses explosives in various R&D and test applications. Explosive quantities used per activity range from milligrams to several kilograms. Overall, the quantities of explosive material maintained onsite are restricted by the approved explosive capacity of various storage areas. No increases in storage capacity were projected.

California (including Alameda and San Joaquin Counties)

Annually, over 340 million tons of hazardous materials are used in California. The U.S. EPA online Toxics Release Inventory (TRI) database was queried for specific materials (indirectly related to release) in California. The data extracted are presented in Table 5.3.13.1–6. In 2000, over 178 hazardous materials totaling 77.5 million pounds were managed.

TABLE 5.3.13.1–6.—Toxics Release Inventory Database

Hazardous Material	Quantity in Pounds
Top Five	
Asbestos (friable)	8,312,561
Aluminum oxide (fibrous forms)	4,257,079
Lead compounds	4,479,859
Zinc compounds	4,042,183
Methanol	3,905,599
Other Chemicals	
Glycol ethers	3,184,791
Hydrochloric acid	1,085,636
Sulfuric acid	853,968
Xylenes	616,644
Total of over 178 materials	77.5 million pounds

Source: TiNUS 2003.

Note: In Alameda County, 59 materials totaling 3.76 million pounds were released. In San Joaquin County, 46 chemicals totaled 1.5 million pounds.

National Nuclear Security Administration

NNSA maintains large inventories of radioactive materials in a variety of forms such as used fuels, source material, components, and laboratory and radiation monitoring equipment. Surplus weapons-grade plutonium inventories were estimated at 40 metric tons; surplus highly enriched uranium totaled approximately 180 metric tons. Accident analysis associated with NNSA tritium supply considered approximately 40 million curies source term. NNSA maintains large inventories of other radioactive materials including depleted uranium, natural uranium, and thorium. Radioactive material inventories are maintained at mission-essential levels and all attempts are made to reduce inventories of surplus legacy material.

Over 6 million tons of hazardous materials are managed by DOE. To estimate the amount of use (indirectly related to released) by DOE (NNSA was not an agency during the most recently available report), the U.S. EPA online TRI database was queried. The data extracted are presented in Table 5.3.13.1–7. DOE released 750,000 pounds of hazardous materials in 2000.

TABLE 5.3.13.1–7.—Top Five Hazardous Materials and Other Chemicals of Interest Releases by DOE Based on the Environmental Protection Agency's Toxics Release Inventory Database

Hazardous Material	Quantity in Pounds
Top Five Chemicals	
Hydrochloric acid	170,000
Zinc compounds	170,000
Nitrate compounds	92,000
Sulfuric acid	72,000
Methanol	59,000
Other Chemicals of Interest	
Xylenes	17,000
Toluene	13,000

Source: TiNUS 2003.

All States

In the U.S., over 3 billion tons of hazardous materials are used annually. In 2001, U.S. explosives production was 2.38 million metric tons, 7 percent less than that in 2000; sales of explosives were reported in all states. Coal mining, with 69 percent of total consumption, continued to be the dominant use for explosives in the U.S. Kentucky, West Virginia, Indiana, Wyoming, and Virginia, in descending order, were the largest consuming states, with a combined total of 46 percent of U.S. sales.

Cumulative Impacts

In general, LLNL manages less than 1 percent of hazardous material used in California. For example, LLNL uses 0.35 percent of the hydrochloric acid used in California. Similarly, LLNL uses 0.59 percent of sulfuric acid. Overall, LLNL hazardous material use would not result in critical shortages or other cumulative impacts.

5.3.13.2 Waste Management

This section provides an overview of management responsibilities for generation, storage, treatment, and disposal of radioactive, hazardous, mixed, and other wastes, including biohazardous and D&D wastes at LLNL under the Proposed Action. Appendices B, M, and N include a description of wastes and facilities associated with the use, generation, and analyses of these wastes.

Relationship with Site Operations

In general, waste generation increases proportionately from the No Action Alternative to the Proposed Action.

Waste minimization and pollution prevention techniques would offset a portion of the projected increases. Under the Proposed Action, waste generation projections used for analysis would not exceed existing waste management capacities.

Impact Analysis

Implementation of the Proposed Action 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. Although increasing over current conditions, waste generation levels over the next 10 years at LLNL would remain essentially consistent with recent generation quantities experienced during 1993 to 2002. 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 increases. Between 1993 and 2002, 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 the 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 presented below, including other wastes.

The Proposed Action would include all new operations, D&D projects, and other activities, including permit modifications and RCRA closures, identified in the No Action Alternative. See Section 5.2.13.2 for a list of activities under the No Action Alternative. The Proposed Action differs from the No Action Alternative in:

- Generation of routine waste quantities presented in Table 5.3.13.2–1
- Generation of nonroutine waste quantities presented in Table 5.3.13.2–1
- Generation of wastes associated with new operations presented in Table 5.3.13.2–2
- Additional permit modifications as discussed below

Existing Operations

For projection purposes, the CY1993 to CY2002 routine waste generation data were considered a reasonable range for existing facilities (existing operations); an average of these years was used. The amount of waste generated from existing operations would reflect proportional increases in LLNL activity levels. A margin (standard deviation) was added to differentiate the Proposed Action, account for normal fluctuations experienced since 1992, and bound any operational increases. The waste quantities projected represent a site-wide (Livermore Site and Site 300) aggregate of quantities for each type of waste category. Table 5.3.13.2–1 presents existing operations that are included in the estimated annual (routine) waste generation quantities by waste category. Current waste management infrastructure is adequate to manage this waste.

TABLE 5.3.13.2–1.—Routine and Nonroutine Operations Waste Generation Quantities Under the Proposed Action and No Action Alternative

Waste Type	Annual Quantities			
	No Action ^a		Proposed Action ^b	
	Routine	Nonroutine	Routine	Nonroutine
LLW	200 m ³ /yr	630 m ³ /yr	340 m ³ /yr	710 m ³ /yr
MLLW	61 m ³ /yr	72 m ³ /yr	88 m ³ /yr	81 m ³ /yr
Total Hazardous ^c	390 metric tons	1,500 metric tons	510 metric tons	1,700 metric tons
TRU	50 m ³ /yr	55 m ³ /yr	60 m ³ /yr	10 m ³ /yr
Mixed TRU	1.7 m ³ /yr	0	2.8 m ³ /yr	0
Sanitary solid	4,800 metric tons	Included in Routine	5,100 metric tons	Included in Routine
Wastewater	310,000 gal/day	Included in Routine	330,000 gal/day	Included in Routine

Source: TtNUS 2003.

^a For nonroutine 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 and one standard deviation, expected increase in activity levels (approximately 5 percent), and new operations contributions.

^c Total Hazardous includes RCRA hazardous, State-Regulated, and TSCA.

gal/day = gallons per day; m³/yr = cubic meters per year; LLW = low-level waste; MLLW = mixed low-level waste; RCRA = *Resource Conservation and Recovery Act*; TRU = transuranic; TSCA = *Toxic Substance Control Act*.

New Operations

New operations (including project-specific information) wastes would be derived from mission-related work. The waste quantities projected represent a site-wide aggregate of quantities for each type of waste category and are included in routine projections included in Table 5.3.13.2–1. Table 5.3.13.2–2 presents qualitative and quantitative waste information for each new operation. Existing waste management infrastructure can accommodate the predicted waste quantities.

Special (Nonroutine) Operations

Special (nonroutine) operations wastes are a result of special, limited duration projects such as construction that are considered separate from facility operations. Special, limited duration wastes include those generated from construction, demolition, D&D activities, and environmental restoration. The amount of waste generated would reflect proportional increases in LLNL activity levels for the foreseeable future. The waste quantities projected represent a site-wide aggregate of quantities for each type of waste category and are included in Table 5.3.13.2–1. Table 5.3.13.2–2 presents additional qualitative and quantitative waste information for each D&D and construction project.

All Other Wastes

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

Biohazardous (includes Medical Waste Management Act) Waste

In 2002, several hundred pounds of medical wastes were disposed of at an approved offsite facility. Under the Proposed Action, biohazardous waste generation would increase by 7 percent. The existing waste handling capabilities would be adequate to accommodate this waste. No offsite impacts would occur because offsite disposal capacity would continue to be sufficient.

Construction and Decontamination and Decommissioning Waste

To bound impacts, this analysis assumed the construction of 100,000 to 200,000 square feet of new facilities, including specific projects listed in Table 5.3.13.2–2. This would generate 200 to 400 metric tons of construction debris. Approximately two-thirds of wood, concrete, asphalt, soil, metal, and cardboard would be diverted for recycling or reuse (LLNL 2002cc). The existing waste handling capabilities would be adequate to accommodate this waste. No additional offsite impacts would occur because offsite disposal capacity would continue to be sufficient.

With approximately 820,000 square feet of excess facilities to bound impacts, this analysis assumed the removal of all excess facilities. This would generate approximately 4,920 metric tons of debris (600 metric tons per 100,000 square feet). Only 350 metric tons would be of the LLW, MLLW, and hazardous waste variety (Bisanni 2003). Approximately two-thirds of the debris total would be diverted, recycled, or reclaimed (LLNL 2002cc). The existing waste handling capabilities would be adequate to accommodate the remaining waste. No new offsite 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. Existing waste handling capabilities are already in place.

Explosive Wastes

The Explosives Waste Treatment Facility would handle 2,800 to 3,000 pounds per year of explosive wastes. Explosives Waste Storage Facility would store (gross) 6,000 to 7,200 pounds per year. This represents a 7 percent increase over No Action. No additional capacity would be required.

Wastewater

Wastewater would increase to approximately 330,000 gallons per day. The current capacity of 1.69 million gallons per day (or 80 percent remaining capacity) would be adequate to accommodate this waste. Offsite disposal capacity would continue to be sufficient.

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

The Proposed Action includes all permit modifications, RCRA Closures, and a permit renewal identified in the No Action Alternative (see Section 5.2.13.2 for a list of activities under the No Action Alternative). The Proposed Action differs from the No Action Alternative in that it includes:

- Submit 100 Class 1 permit modification requests (may include more than one item per submittal) over the next 10 years (see Appendix B for details).
- Submit approximately 10 to 20 Class 2 permit modification requests (may include more than one item per submittal) over the next 10 years (see Appendix B for details).
- Submit approximately 1 to 2 Class 3 permit modifications over the next 10 years (see Appendix B for details).
- Obtain RCRA Part B permit for Building 696 operations.
- Relocate a 3,000-cubic-foot-liquid storage capacity at Building 696.
- Begin storage of hazardous and mixed wastes in Building 696.

These changes would enhance existing operations and would likely result in beneficial environmental impacts through improved technology and efficiency.

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, NNSA, local projects and activities, and the State of California.

The waste generation impact of the Proposed Action would be larger than impacts of FY2002 operations, but still generally small, as compared to DOE/NNSA operations nationally or total wastes in California annually. For radioactive waste, LLNL would generate 99 percent of NNSA operations locally (or 1,700 cubic meters) and approximately 4 percent of DOE/NNSA operations nationally (or 40,000 cubic meters per year). SNL/CA would generate 10 cubic meters of LLW per year and 118 tons of hazardous waste per year. For hazardous waste, LLNL generation (1,365 metric tons) would only be 0.31 percent of total generation within California (427,302 tons hazardous waste). For municipal solid waste, the U.S. EPA determined that California has more than 10 years of remaining landfill capacity. NNSA recognizes landfill space can have a cumulative impact; however, land disposal would not result in critical shortages.

5.3.14 Human Health and Safety

5.3.14.1 Nonradiological Health Impacts

Operations at LLNL involve a wide range of activities with the potential for exposures of involved and noninvolved workers and the public to hazardous materials or conditions. These hazards include non-ionizing radiation, chemicals, biological agents, and industrial hazards. Evaluation of occupational protection issues considered existing ES&H programs that specifically address worker and general population protection measures implemented to control, reduce, or eliminate operational hazards. Hazardous chemicals to which involved and noninvolved workers could potentially be exposed, under the Proposed Action at the Livermore Site and Site 300, are listed in Table 5.3.13.1–1 and Table 5.3.13.1–2, respectively.

Relationship with Site Operations

Section 3.3 describes projects under the Proposed Action, that when combined with the No Action Alternative and current operations would result in a moderate increase in chemical inventories. There would also be an increase in construction and demolition activities associated with site facility expansion and renovation due to new missions and facility demolition and removal activities. These activities represent an increase in potential injuries associated with construction safety hazards.

Impact Analysis

The Proposed Action would not cause any major changes in the types of occupational, toxic, or physical hazards encountered by site personnel. Material usage at LLNL would increase. For purposes of this LLNL SW/SPEIS, it was assumed that the net percentage increase in laboratory operations would be accompanied by an increase in the amounts of hazardous substances used and stored onsite. However, as the mix of site missions shifts from chemical to mechanical and technological processes (i.e., computer modeling, computational research, etc.), the proportional increase in chemical inventories associated with new operations would be lessened.

Overall site usage of toxic substances and physical hazards would increase under the Proposed Action as activity levels increase at existing facilities and as new facilities are constructed and

begin operation. However, this would not represent an adverse impact. Under the Proposed Action, the use of additional quantities of chemicals would result in a slight increase in worker exposures. Facility improvements and additions would result in improved control measures for handling hazardous chemicals and controlling physical hazards. Worker exposure to hazardous chemicals would be minimized by the use of improved facilities for handling toxic chemicals and controlling physical hazards, such as the EMPC. Continued application of site ES&H and ISMS principles would result in minimal impacts to workers and the public.

LLNL has strict safety guidance and procedures in place. The site injury and illness rates have been declining as a result. Therefore, an increase in construction, demolition, and renovation activities that would occur under the Proposed Action would not significantly increase site injury and illness rates.

Based on the assumption that the increase in facility operations associated with the Proposed Action would represent an increase in chemical inventory, worker exposures would slightly increase. Facility upgrades and continued implementation of the site ES&H Program components would significantly reduce the risk of personnel exposures. Several proposed projects would result in increased levels of protection for both workers and the public. These would include:

- Building 151 upgrade
- Building 331 renovation and modification
- Building 332 ductwork replacement
- EMPC operations consolidation
- Building utilities upgrade
- Site utilities upgrade

Ongoing and proposed D&D activities would reduce overall site hazards by removing chemical and physical hazards from the workplace. These facilities would include:

- U235 cooling tower
- Building 514
- Building 419
- Building 412
- Building 171
- Building 175 north section
- Building 194 line-of-flight tube
- Building 212 ITC Accelerator Building

- Building 251

The proposed infrastructure improvements, such as roof replacements, facility renovations and facility and system upgrades, improve the overall safety envelope for the site. The proposed structural and seismic upgrades would result in improved facilities and work areas. Facility roof replacement would provide protective measures for sensitive facility components and increase the protection of potentially hazardous areas from exposure to the environment. Electrical and ventilation upgrades would increase facility control features and reduce the risk of hazardous energy events. Therefore, the reduction of impacts from these proposed activities would be beneficial.

Relocation of some existing explosives operations to the EMPC would consolidate higher hazard activities in a compliant facility. Likewise, the consolidation of operations currently conducted in Buildings 825, 826, and the Building 827 Complex into the planned HEDC would provide a similar increase in process and worker safety. Improvements could reduce worker exposure to chemicals and physical hazards relative to the facilities that are currently being used. This would represent a reduction in impacts and could be beneficial.

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 Proposed Action impact analysis above.

5.3.14.2 Radiological Health Impacts

This section analyzes the radiological health impacts from Proposed Action operations such as ongoing and proposed R&D and waste management. Impacts to workers are given in terms of the 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 3.3 for the Proposed Action and radiological health impacts from normal site operations. The Proposed Action dose would increase as new and increased operations come online. The maximum doses and health effects over this timeframe are presented here. The number of cancer fatalities to the workers and the public from exposure to these operations is used to quantify the impacts.

Impact Analysis

Workers

The dose to involved workers, such as those directly exposed to radiation in the performance of their jobs, would be 125 person-rem per year. This dose includes 32 person-rem per year from the ITP and 19 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 0.075 fatalities per year of operation). Note that radiation exposure in all radiologically controlled areas are 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 0.16 person-rem per year (see Section 5.3.8.2). Ninety-seven percent of this dose is from Livermore Site operations. No cancers (calculated value of 9.6×10^{-5} LCFs per year of operation) are expected among noninvolved workers.

General Public

The Proposed Action health impacts to the general public result from the radiation dose from atmospheric emissions, described in Section 5.3.8.2, and skyshine from neutrons produced during the NIF yield operations and scattering off of the atmosphere (skyshine). The latter would be unchanged from the No Action Alternative. The Proposed Action dose to the Livermore Site site-wide MEI would be 0.33 millirem per year (0.13 from air emissions and 0.2 from skyshine). This dose is less than 0.4 percent of the DOE standard of 100 millirems per year (DOE O 5400.5). The probability of a fatal cancer to this site-wide MEI would be 2.0×10^{-7} per year of exposure.

The Proposed Action site-wide MEI dose from Site 300 operations would be 0.055 millirem per year, less than 0.6 percent of the NESHAP standard. This dose is unchanged from the No Action Alternative. The probability of a cancer fatality to this hypothetical individual would be 3.3×10^{-8} per year of operation.

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 sometime during that worker's lifetime as a result of extended occupational exposure under the Proposed Action (calculated value of 0.075 fatalities per year of operation).

No adverse impacts to the general population would occur under the Proposed Action. Other than background radiation sources, there are no other known contributors to concentrations of

radionuclides near the Livermore Site or Site 300. Therefore, there are no additional cumulative radiological impacts.

5.3.15 Site Contamination

This section analyzes impacts of contaminated soils and sediments, surface water, and groundwater under the Proposed Action. For the purpose of this LLNL SW/SPEIS, soils and sediments discussed below include surficial soils, both unconsolidated and consolidated sediments, and unsaturated bedrock. Hydrologic impacts not related to surface or groundwater quality are presented in Section 5.3.9.

5.3.15.1 Relationship with Site Operations

The Proposed Action, as described in Section 3.3, includes continued operations of investigation, cleanup, long-term stewardship, other activities (including treatment system modifications and reporting), plus actions identified for the No Action Alternative. A general increase in activity levels across LLNL is projected; accordingly, an increase in hazardous material management and waste management and an associated spill or release could occur. LLNL would conduct immediate cleanup actions and periodic site surveys to ensure environmental impacts would be minimized.

5.3.15.2 Impact Analysis

The Proposed Action would result in minimal deposition of contaminants to soil from continued operations 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.

5.3.15.3 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 Proposed Action and No Action Alternative begin with the same level of existing contamination, present substantially the same opportunities for future contamination, and remediation activities would be the same under each, 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.