EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) and the Regents of the University of California (UC) propose the continued operation, including near-term (within 5 to 10 years) proposed projects, of the Lawrence Livermore National Laboratory (LLNL). In addition, DOE proposes the continued operation, including near-term proposed projects, of Sandia National Laboratories, Livermore (SNL, Livermore). Continued operation plus proposed projects at the two Laboratories is needed so that the research and development missions established by Congress and the President can continue to be supported.

As provided and encouraged by the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), DOE and UC have prepared this document as a joint Environmental Impact Statement (EIS) and Environmental Impact Report (EIR) to analyze the impacts of the proposed action. In addition, this document discusses a no action alternative for continuing operations at FY 1992 funding levels without further growth, a modification of operations alternative focused on specific adverse environmental impacts of operations or facilities, and a shutdown and decommissioning alternative. To meet CEQA requirements, this document also examines the alternative of UC discontinuing its management of LLNL after the current contract expires on September 30, 1992.

In order to comply with both NEPA and CEQA, certain sections of this EIS/EIR contain more information than is required by NEPA while other sections contain more than is required by CEQA; however, nothing in this document is inconsistent with the requirements of either statute. The environmental documentation process provides information to the public, government agencies, and decision makers about the environmental impacts of implementing the proposed and alternative actions. In addition, this environmental documentation identifies alternatives and possible ways to reduce or prevent environmental impacts.

An integral part of this EIS/EIR is communication and cooperation with the public, government agencies, and environmental groups to improve the decision-making process. For example, the Draft EIS/EIR responded to public comments from a public scoping meeting held November 15, 1990, and during a public comment period between October 5 and December 15, 1990. During this scoping process, DOE and UC received a total of 282 comments from 61 members of the public; interest groups; and federal, state, and local officials. The scoping issues raised during the scoping meeting and public comment period were summarized in the Implementation Plan for this EIS/EIR, published separately in August 1991. A list of the issues raised through the EIS/EIR scoping process is presented in Table S-1.

There were 704 comments on the Draft EIS/EIR received from 200 individuals, groups, and agencies. The comments were received both from speakers at a public hearing on April 30, 1992, and as correspondence received during a 90-day comment period that lasted until June 11, 1992. A list of the issues raised through this Draft EIS/EIR public comment process is presented in Table S-2. These comments are reproduced in their entirety in Volume IV with additional supporting exhibits provided separately in Volume V. Responses to the commentors questions are provided in Volume IV with changes made to the body of the document as indicated in the responses. These changes, along with comments from internal reviews, have been incorporated into the Final EIS/EIR.

BACKGROUND

The LLNL Livermore site and SNL, Livermore, occupying a total of 1234 acres, are located about 40 miles east of San Francisco at the southeast end of Livermore Valley in southern Alameda County, California (see Figure S-1). Land use around the two sites was once primarily agricultural, but now includes residential areas to the west and industrial parks to the north of the sites. LLNL Site 300 is an area of approximately 7000 acres located mostly in San Joaquin County about 15 miles southeast of the LLNL Livermore site. LLNL also leases several small offsite properties in the Livermore Valley area.

LLNL (then known as the University of California Radiation Laboratory, Livermore site) was established in 1952 on the site of a previous naval air station. The facility was owned by the federal government and operated and managed by the University of California under a contract with the Atomic Energy Commission (a predecessor agency to DOE). DOE and UC established LLNL Site 300 in 1953 to perform non-nuclear high explosives testing in support of LLNL's mission. In 1956, Sandia National Laboratories (then known as Sandia Corporation) established facilities at Livermore (SNL, Livermore) to support LLNL in ordnance engineering.

MISSIONS

LLNL

The mission of LLNL, operated by the University of California, is to serve as a national resource of scientific, technical, and engineering capability with a special focus on national security. Over the years, this mission has been broadened to encompass such areas as strategic defense, energy, the environment, biomedicine, the economy, and education, including research, development, and test activities associated with all phases of the nuclear weapons life cycle and related tasks. LLNL supports science education through pre-college, university, and postgraduate programs, and also participates in the nationally directed initiative to understand the human genome at the molecular level, particularly gene ordering in the chromosomes, and molecular genetic toxicology and reproductive effects. In pursuing these programs, LLNL interacts closely with scientific and technical personnel throughout the federal government, at other national laboratories, and at universities and in industry throughout the world. This work is conducted with a commitment to preserving the environment, to ensuring the health of the employees and the community, and to complying with applicable environmental, safety, and health regulations.

SNL, Livermore

SNL, Livermore, operated for DOE by Sandia Corporation(1), a wholly owned subsidiary of AT&T, applies its scientific, technical, and engineering capabilities to meet its primary mission of national security, with principal emphasis on engineering of non-nuclear systems and components associated with nuclear weapons development. As part of this responsibility SNL, Livermore generates new design concepts and develops new weapons systems. More specifically, in fulfilling its mission, SNL, Livermore performs research and development associated with weapons engineering for all levels and phases of the nuclear weapons life cycle. Other tasks related to national security, including nuclear materials safeguards and security, treaty verification and control, intelligence on foreign technologies and weapons systems, waste management, and programs, are conducted in support of the DOD. The Laboratory also performs basic and applied research and development in support of national energy programs, including fossil-fuel (coal, oil, and gas) engine and furnace combustion, conservation and renewable energy, magnetic-confinement fusion energy (mainly on plasma/material interactions); fundamental energy research related to combustion, geosciences, and materials sciences; and development and application of laser diagnostic techniques to study the fundamental physics and chemistry of combustion.

OTHER MISSION CONSIDERATIONS

DOE recognizes that in recent years there has been a significant change in the world's political environment. In scoping this EIS/EIR, DOE considered whether or not to include in the proposed action or the alternatives, a change to the basic mission of the Laboratories as currently established by Congress and the President. Indeed, in late 1991 the Secretary of Energy chartered an Advisory Board Task Force to begin to examine the future activities of the national

laboratories, including LLNL and SNL, Livermore. Comprised of non-DOE personnel with extensive knowledge of energy and defense issues, the Task Force recommended that in addition to the Laboratories' continued activities in energy and defense, capacities in science and technology also be brought to bear on the environmental cleanup of DOE facilities. While the Secretary can encourage the evolution of the agency toward a new set of missions—in part developed by independent task forces and other citizen recommendations—any change to DOE's missions must come from the President and Congress.

The goals of an agency, as defined by its enabling legislation, determine the universe of the proposed action and the reasonable alternatives. Although, as described below, DOE has initiated an effort to determine in the long term how the National Laboratories capabilities can best be employed to serve the Nation's research needs, that effort has not yet reached the point of formulating any specific proposals for consideration by Congress and the President. Furthermore, currently there are no specific proposals by Congress or the President for any changes in DOE's missions. Thus, at the present time, the alternative of excluding all nuclear weapons research and design activities and replacing them with other non-nuclear weapons activities, as suggested by many commentors, is too speculative to be meaningfully evaluated. The scope of this EIS/EIR, therefore, must necessarily be tied to the evaluations of alternative ways of achieving DOE's currently mandated missions including its nuclear weapons mission.

Nevertheless, DOE is considering what activities necessary to support DOE's nuclear weapons mission should be carried out at LLNL and SNL, Livermore. The Secretary of Energy has proposed to reconfigure the nuclear weapons complex to be smaller, less diverse, and more economical to operate. As part of this proposal DOE is examining whether certain weapons research, development, and testing activities now taking place at the national laboratories should be consolidated. DOE is preparing a programmatic EIS on its reconfiguration proposal. The Reconfiguration PEIS will address the long-term mission of LLNL and SNL, Livermore; in contrast, this EIS/EIR addresses the near-term continued operation of LLNL and SNL, Livermore. The focus of possible new long-term missions cannot be addressed until after completion of the Reconfiguration PEIS. Therefore, identification and description of new missions for LLNL and SNL, Livermore and analysis of associated environmental effects would be highly speculative and beyond the scope of this EIS/EIR. However, this document is expected to facilitate the environmental assessment of future changes in missions or activities. Such changes would be reviewed against this EIS/EIR and further NEPA and/or CEQA review efforts undertaken if appropriate. This could include the preparation of a supplemental EIS/EIR.

PROPOSED ACTION

The proposed action for the purposes of the EIS is the continued operation of LLNL and SNL, Livermore[(2)], including near-term (within 5 to 10 years) proposed projects. The proposed action, therefore, necessarily includes current operations plus programmatic enhancements and facility modifications pursuant to research and development missions established for the Laboratories by Congress and the President.

More specifically, the proposed action includes the construction of facilities at the LLNL Livermore site, at LLNL Site 300, and at SNL, Livermore. The list of facilities used for projecting the increased growth in square feet at the Laboratories is based on information available in January 1992. The facilities listed, regardless of funding status, constitute the total square footage of developments planned as part of this proposed action. The names and funding status of the facilities may vary year to year in response to changing funding levels and programmatic needs. The overall projection of a 9 percent increase in square footage for LLNL and a 6 percent increase for SNL, Livermore is expected to bound the actual increases.

The proposed action includes upgrade, operational, or maintenance projects, and operation modifications, at the three sites. The proposed action at both LLNL and SNL, Livermore, in addition to the activities discussed above, includes such routine activities as infrastructure and building maintenance, minor modifications to buildings, general landscaping, road maintenance, and similar support activities.

The proposed action for the EIR is the renewal of the DOE and UC contract for UC's continued operation and management of LLNL from October 1, 1992, through September 30, 1997.

EIS/EIR ALTERNATIVES

Four alternatives to the proposed action are discussed in this EIS/EIR: no action, modification of operations, shutdown and decommissioning, and discontinuing UC's management of LLNL. The alternatives address separate NEPA and CEQA requirements; however, DOE and UC may consider and select any appropriate alternative within the scope of each of their activities.

No Action

This alternative is the continued operation of the two Laboratories, including those LLNL and SNL, Livermore projects already authorized and budgeted through FY 1992. Programs and projects would continue at their present FY 1992 levels. Employment and funding levels, adjusted for inflation, would also remain at FY 1992 levels. No new projects except those already funded, those required to maintain the existing infrastructure, and those required to comply with statutes and regulations (e.g., remediation of contaminated sites) would be implemented. The no action alternative could cause schedule modifications or delays, changes in funding priorities, less flexibility in responding to new program initiatives, and other potential program impacts. This could result in only partial fulfillment of the research and development missions established by Congress and the President.

Modification of Operations

This alternative is to modify LLNL and SNL, Livermore operations, including near-term (within 5 to 10 years) proposed projects, to reduce adverse environmental impacts. Modification of operations is broadly defined as the scaledown of operations and/or the application of alternative technologies and management strategies (formerly two alternatives as described in the Notice of Intent, 55 Fed. Reg. 41048) to reduce the probability of environmental impacts. Several operations, including an option for acquisition of land for additional buffer zones at both Laboratories, have been identified as potential candidates for this alternative. These modifications would be changes to the proposed action, but would not change LLNL's and SNL, Livermore's missions, although their implementation could result in extended schedules to accomplish mission activities. If this alternative were selected, more detailed engineering and environmental evaluations would be undertaken to identify specific facilities and operations for modification.

Shutdown and Decommissioning

This alternative is the phase out of all research and development operations at LLNL and SNL, Livermore with the eventual shut down and decommission of all facilities.

Shutdown means an orderly phaseout of programmatic research and development efforts; phased shutdown is estimated to take 5 years. This estimate includes time for planning, environmental documentation of the impact of closing facilities, and phaseouts of programs and shutdowns of facilities. The Laboratories would require a caretaker staff during and after shutdown to maintain the decommissioning, environmental restoration, and compliance infrastructure. The caretaker staff would continue operation and maintenance of LLNL and SNL, Livermore support functions, including security, utilities, shipping and receiving; environmental, safety, and health protection; and other services.

Decommissioning means the restoration or destruction and disposal of contaminated facilities. Decommissioning and

environmental compliance activities would start during shutdown and continue for an estimated 5 years beyond shutdown. Radioactive and other hazardous materials would be removed and transported to other DOE or commercial facilities as appropriate. During this time, individual facilities would be decontaminated as they are vacated. LLNL and SNL, Livermore would be restored so that facilities could be conveyed unrestricted to new owners or operators in a phased transfer, and in accordance with applicable regulatory limits. The subsequent fate of the various programs is not considered here because it is beyond the scope of this EIS/EIR and would be considered in subsequent NEPA documentation.

The projects to be eliminated and the facilities to be shut down are those in existence in FY 1992. Those projects and facilities required to comply with statutes and regulations (e.g., remediation of inactive sites) would continue.

This alternative would require a legislative redirection of DOE's mission, a new initiative to significantly restructure and consolidate the national laboratories, or both. It is therefore not likely to be implemented within the timeframe of this EIS. However, it has been included as an alternative to provide a basis for comparison with the impacts of the other alternatives. Although the analysis is less specific than that presented for the other alternatives, it provides an overview of the environmental and socioeconomic consequences of closing LLNL and SNL, Livermore.

Discontinue University Management of LLNL

The alternative to UC's continuing management and operation of LLNL is the "no project" alternative, under which the UC Regents discontinue management and operation of LLNL. If this were to happen, it is assumed that DOE would select another contractor to manage and operate LLNL at the same operational level described in this EIS/EIR proposed action, or at the level of operations selected by DOE as an alternative through the EIS process.

ENVIRONMENTAL IMPACTS

The environmental impacts analyzed for the proposed action are based on assumptions that are designed to be a reasonable projection of the upper bound for consequences. These *assumptions* are not intended to be predictions of actual future consequences. For example, the number of personnel at the Laboratories is assumed to increase at the historical rate of 2 percent per year, while projections provided in the Laboratories' institutional 5-year plans show almost no growth in personnel. That is, the historical average is used as an upper bound for determining environmental impacts. Waste streams are similarly assumed to increase to provide an upper bound of the impacts.

A summary of the environmental impacts associated with the proposed action and the alternatives follows. Table S-3 (LLNL) and Table S-4 (SNL, Livermore), at the end of this Executive Summary, compare the environmental impacts of the proposed action with those of the alternatives. In accordance with CEQA and the UC CEQA Handbook, four descriptive categories are used in the EIS/EIR to discuss and analyze environmental impacts: less than significant, significant, significant and unavoidable, and beneficial. These categories have been created and assigned to individual impacts only for the purposes of compliance with CEQA requirements, and thus are used here only in a CEQA context. Under NEPA, the significance of environmental impacts determines the need for the NEPA document. Once that decision has been made, specific impacts are not categorized according to level of impact in an EIS.

For purposes of this Executive Summary, the impacts of the proposed action and alternatives at LLNL and at SNL, Livermore are discussed together. Because these facilities are managed for DOE by different contractors, however, and to conform to CEQA requirements, throughout the remainder of the EIS/EIR (unless otherwise noted) the current operations and environmental impacts of the proposed action and alternatives are discussed separately for each facility.

Land Uses and Applicable Plans

Onsite land uses at the LLNL Livermore site and SNL, Livermore include offices, laboratory buildings, support facilities, roadways, parking areas, and landscaping. Surrounding land uses include grazing land, vineyards, residences, and industrial parks. Onsite land uses at LLNL Site 300 include high explosive remote firing areas, a weapons test area, a general services area, and maintenance facilities. Surrounding land uses include grazing land, research and testing facilities, and an off-road vehicle recreation area.

The proposed action at the three sites would result in a relatively small increase in the amount of development at the sites. Because no new types of land uses would be introduced and the buffer and perimeter areas would not substantially change, the proposed action is considered compatible with surrounding land uses. Although LLNL and SNL, Livermore are federally owned facilities and outside the jurisdiction of local planning agencies, the proposed action at the three sites would be consistent with the existing land use plans and zoning policies of the various local jurisdictions.

The possible acquisition by DOE of a portion of East Avenue between Vasco and Greenville roads would alter the ownership status of this segment of the road from local government–owned to federal government–owned and could lead to restricted public access to this part of East Avenue to improve onsite security. In terms of cumulative impacts, development of approved and proposed projects in the vicinity of the Laboratories not related to LLNL or SNL, Livermore operations would result in a cumulative loss of agricultural and open space lands; however, because the Laboratories are already committed to the existing and proposed land uses and plan no land acquisitions other than the possible acquisition of the portion of East Avenue between the LLNL Livermore site and SNL, Livermore, the proposed action would not contribute to this cumulative effect.

Because no new land uses or land acquisitions would occur under the no action alternative, no land use impacts are identified. Although changes proposed under the modification of operations alternative would not result in an alteration of the types of land uses at the existing sites, this alternative considers the acquisition of an unspecified amount of additional land east of the current boundaries of the LLNL Livermore site and SNL, Livermore. Because the purpose of acquiring this land would be to provide a buffer zone, LLNL and SNL, Livermore would not construct facilities that would use hazardous or radioactive materials in this area. If this land acquisition were to occur, there could be potentially significant changes to the existing residential and agricultural uses, and a possible need for the local government to revise its land use plans. Implementation of the shutdown and decommissioning alternative would not result in land use changes other than the eventual shutdown of operations at the Laboratories. Determination of the potential land use impacts for the period following shutdown and decommissioning is beyond the scope of this EIS/EIR.

Socioeconomics

As of September 1991, approximately 11,400 people were employed at the LLNL Livermore site and Site 300 combined, and 1500 at SNL, Livermore. These figures include UC, DOE, and contractor personnel. A large proportion (approximately 40 percent) of these employees reside in the City of Livermore, and the remainder are distributed throughout the Livermore Valley, the Bay Area, and the central San Joaquin Valley.

For purposes of this EIS/EIR, it is assumed that implementation of the proposed action would result in an additional 2065 total personnel at the LLNL sites and SNL, Livermore. This increase would result in an increased demand for housing and an increase in the local population level. Assuming a worst case in which all new workers migrate from outside the area, and in which each employee represents a new household, it is estimated that a combined total of approximately 2065 housing units would be needed in the region, with the largest demand occurring in the City of Livermore. This demand could result in a potentially significant adverse impact on the housing supply in parts of the region due to the limited availability of housing in some areas. The proposed action would also result in an increase in LLNL and SNL, Livermore payroll, and in expenditures for goods and services. This increase would generate additional income and employment opportunities in the region, and therefore represents a beneficial economic impact. Planned and proposed projects in the area would contribute to a cumulative demand for housing that could not be

accommodated by the existing supply in some areas. This would constitute a potentially significant impact.

Selection of the no action alternative would maintain existing socioeconomic conditions for the area. It is assumed that implementation of the modification of operations alternative would result in population growth and demands on housing consistent with those described for the proposed action. Selecting the shutdown and decommissioning alternative would result in the eventual loss of approximately 12,900 jobs, a decrease in demand for local housing, and the eventual loss of income in the local and regional economy from the reductions in the Laboratories' purchases of goods and services.

Community Services

Fire protection services for LLNL and SNL, Livermore are provided by the LLNL Fire Department. Police and security services for LLNL and SNL, Livermore are provided by onsite security staff. In addition, both LLNL and SNL, Livermore have emergency response agreements with local fire and law enforcement agencies. The largest proportion of LLNL and SNL, Livermore employees' children are students within the Livermore Valley Joint Unified School District. Nonhazardous solid waste generated at the LLNL Livermore site and at SNL, Livermore is disposed of at the Vasco Road Sanitary Landfill. At LLNL Site 300, nonhazardous solid waste is disposed of at the Corral Hollow Sanitary Landfill.

Implementation of the proposed action is anticipated to slightly increase the need for onsite fire protection and security services at the LLNL and SNL, Livermore sites. This increase is not anticipated to be significant since onsite services will be upgraded as needed. The proposed action is also anticipated to result in an increase in the number of students enrolled within the region. This increase is potentially significant and unavoidable. In addition, the proposed action would result in a potentially significant increase in demand for nonhazardous solid waste disposal services at the Corral Hollow Sanitary Landfill in San Joaquin County. The landfill is slated to close in 1995, and the county has yet to identify an alternative disposal site. Planned and approved projects in the area would contribute to a cumulative demand for services that would represent a significant impact on the landfill, with current capacity unable to accommodate this increased demand.

Selection of the no action alternative would result in a continuation of existing community services conditions. Implementation of the modification of operations alternative would result in impacts similar to those described for the proposed action. Selection of the shutdown and decommissioning alternative would result in eventual elimination of the need for onsite fire protection and security services. The number of students from families of LLNL and SNL, Livermore employees would eventually decrease to zero. In the short term, nonhazardous solid waste disposal needs could increase under the shutdown alternative due to possible demolition and cleanup operations at the facilities. In the long term, however, nonhazardous solid waste generation would be eliminated from the sites until new uses, if any, were established.

Prehistoric and Historic Cultural Resources

No prehistoric cultural resources have been located at either the LLNL Livermore site or SNL, Livermore. Although four prehistoric resource sites were previously recorded at LLNL Site 300, none of these resources falls within the Area of Potential Effect defined for the proposed action.

The historic value of the LLNL Livermore site has yet to be formally determined. It appears that the site may contain historic resources that are eligible for inclusion in the National Register of Historic Places. The process for such a determination, which is being undertaken as part of DOE's responsibility to comply with Section 106 of the National Historic Preservation Act, includes an evaluation of whether portions of the Laboratory are eligible for the National Register. Ultimately, following consultation with the State Historic Preservation Office and the Advisory Council on Historic Preservation, and execution of an agreement document, such an agreement and its companion cultural

resources management plan will define steps providing for continued successful operation and utilization of the facility in concert with historic preservation needs.

The LLNL Site 300 area includes portions of the historic townsite of Carnegie. The historic importance of this former townsite stems from the mineral exploration, ranching, mining, and manufacturing activities that once occurred in the area. Additional research and site evaluation has recently been conducted for the portion of the site that exists within the LLNL Site 300 boundary (William Self Associates, 1992). Information on the Carnegie site, as well as appropriate documentation of the history and prehistory of LLNL Site 300, will be provided to the State Historic Preservation Office with a request for concurrence as to National Register recommendations contained in those documents. Should the State Historic Preservation Office concur that a site(s) meets the National Register eligibility criteria, a Determination of Effect process then ensues, with the State Historic Preservation Office and DOE applying for Criteria of Effect as contained in 36 C.F.R. 800.4. Documentation of a finding of No Adverse Effect would terminate DOE's Section 106 compliance responsibilities regarding the properties. If adverse effects on an eligible property are identified, then an agreement document will be developed in coordination with the Advisory Council on Historic Preservation and the State Historic Preservation Office, outlining DOE responsibilities in the process and measures to mitigate effects to the resource.

Based on the comprehensive evaluation of SNL, Livermore conducted in 1990 (Busby and Garaventa, 1990; Busby, Garaventa, and Harmon, 1990), it was not anticipated that any prehistoric or historic resources at this facility would qualify for the National Register. The State Historic Preservation Office concurred with this recommendation (State Historic Preservation Office, 1990). Consequently, no impacts to historic resources are anticipated inside the borders of the facility, and no further Section 106 review is necessary.

In summary, the Section 106 (of the National Historic Preservation Act) process will be completed prior to approval of funding for any construction project under the proposed action. It will not be known whether there are historic resources of significance at the LLNL Livermore site or LLNL Site 300 that might be affected by the proposed action until the process is complete. Completion of the Section 106 review process at these sites will reduce potential impacts to historic resources to a less than significant level.

Cumulative impact study areas for prehistoric and historic resources include the Laboratory sites and areas surrounding the sites where similar resources are expected to occur. The full extent of impacts to prehistoric and historic resources within the identified cumulative impact study areas cannot be delineated as part of this EIS/EIR. The Laboratories would contribute to this potential impact to both prehistoric and historic resources, although at this time it is too speculative to determine whether or not potential cumulative impacts would be significant.

Potential impacts to prehistoric and historic resources under the no action alternative would be consistent with those described for the proposed action. Compliance with Section 106 of the National Historic Preservation Act would still be required. If any additional lands are acquired under the modification of operations alternative, these lands would require an evaluation for the presence of cultural resources before impacts to prehistoric and historic resources could be determined. Otherwise, impacts to cultural resources under the modification of operations alternative would be consistent with those described for the proposed action. The shutdown and decommissioning alternative could result in increased impacts to prehistoric and historic resources at the LLNL Livermore site and LLNL Site 300 due to increased activity across the sites during the shutdown and decommissioning process and increased potential for impacts to buildings and equipment. The exact nature of such impacts would be unknown until a determination was made of which structures or facilities were considered potentially eligible for inclusion on the National Register of Historic Places, and until DOE determined which structures, if any, would be dismantled under the shutdown and decommissioning program.

Aesthetics and Scenic Resources

The area surrounding the LLNL Livermore site and SNL, Livermore is a mixture of rural, residential, and business/industrial land uses. The area surrounding LLNL Site 300 is mostly undeveloped and rural in character.

Implementation of the proposed action would result in less than significant impacts to the visual quality of the LLNL Livermore site or SNL, Livermore because any new facilities constructed would be similar in size and appearance to existing structures. In addition, the proposed action would be compatible with the scenic resources plans and policies of the County of Alameda and the City of Livermore. At LLNL Site 300, new construction would have less than significant visual impacts because the majority of the facility upgrades would occur within the interior of LLNL Site 300 and would not be visible from Corral Hollow Road, Tesla Road, or I-580. The construction projects that may be visible from Corral Hollow Road include the new fire station and infrastructure improvements in the General Services Area. These could result in view impacts but would disrupt a limited area of landscape and would be short-term in nature. Project construction would be compatible with scenic resources plans and policies of the County of San Joaquin and the County of Alameda.

Because selection of the no action alternative would result in less construction than the proposed action, no adverse impacts would occur under this alternative. Under the modification of operations alternative, visual impacts would be consistent with those identified under the proposed action except for potential visual impacts associated with possible buffer zone land acquisition east of the LLNL Livermore site and SNL, Livermore. The effects of changes to the visual quality of the affected area would depend on the disposition of Greenville Road, and any land use changes that might occur within the new buffer zone. For the shutdown and decommissioning alternative, short-term visual impacts could occur during possible demolition activities, but these impacts would be temporary and are considered less than significant. A determination of long-term visual impacts cannot be made until such time as the shutdown and decommissioning process is better defined. Evaluation of visual impacts associated with future land uses at the sites is beyond the scope of this EIS/EIR.

Geologic Resources and Hazards

No known geologic resources will be adversely impacted by the proposed action at either LLNL or SNL, Livermore. This would also be the case for the no action, the modification of operations, and the shutdown and decommissioning alternatives.

For both LLNL and SNL, Livermore, significant impacts to proposed structures, related infrastructure, and surrounding communities could occur from hazardous material releases following a major earthquake. The potential effects of these impacts are analyzed in the EIS/EIR accident analysis and are summarized in the Bounding Case Accidents section. To reduce these impacts, new structures for human occupancy (i.e., occupied more than 2000 person-hrs/year) would be located more than 50 ft from an active fault trace (a fault that has had surface displacement during the last 11,000 years). All such new structures and upgrades would also be designed according to existing seismic safety standards stated in DOE Order 5481.1B. A major seismic event would likely expose entire communities in the region of LLNL and SNL, Livermore to risks from ground shaking. The cumulative impacts from seismically induced structural failure in surrounding communities, however, are beyond the scope of this EIS/EIR.

LLNL and SNL, Livermore revitalization activities that would occur under the no action alternative could be adversely impacted by geologic hazards. Impacts associated with the modification of operations alternative would be consistent with the impacts anticipated under the proposed action. Subject to appropriate safety procedures, shutdown and decommissioning activities would not be impacted by geologic hazards.

Ecology

Vegetation

The plant communities at the LLNL Livermore site and SNL, Livermore are highly altered as a result of human activity. The pristine nature of the original grasslands and riparian areas was affected by grazing and farming long

before the Laboratories were constructed. Buildup began on the sites in the early 1940s and has continued to the present. No further significant impact on plant communities is expected from planned construction activities at these two sites under the proposed action.

By contrast, LLNL Site 300 is relatively unaffected by human disturbance. An estimated 5 percent of this 7000-acre area has been altered by LLNL Site 300 operations and maintenance activities; much of the remainder of the site is essentially unaltered by human activities. LLNL Site 300 practices of excluding grazing and conducting annual controlled burns have created a mosaic of diverse plant community types including a large stand of native perennial grasslands, now rare in California. The proposed action would result in clearing an estimated 2.4 acres of disturbed ground and introduced grassland. This impact would be less than significant.

Because little or no land would be disturbed, the no action and modification of operations alternatives would also have a less than significant impact on vegetation at the three sites. The shutdown and decommissioning alternative may eventually have a less than significant impact at the LLNL Livermore site and SNL, Livermore. This alternative could result in significant degradation of vegetation at LLNL Site 300 if grazing were allowed onsite, if public access to the site were allowed, or if the annual controlled burns ceased. Determination of potential land use impacts for the period following shutdown and decommissioning, however, is beyond the scope of this EIS/EIR.

Wildlife

The wildlife species that occur at the LLNL Livermore site and SNL, Livermore are largely those adapted to living in areas highly altered by human activity. There are also relatively small stands of grassland habitat and remnant areas of wooded riparian habitat at both sites that support an assemblage of wildlife species somewhat different from those in the built-up areas. The proposed action would take place largely in built-up areas and thus would have a less than significant impact to wildlife.

LLNL Site 300 has a high level of wildlife species diversity due to the unaltered nature and interspersion of plant communities onsite. Species adapted to grassland, shrub, and oak woodlands all flourish, in large part because of the exclusion of grazing and the limited amount of human activity in much of the area. The proposed action would result in the clearing of a small amount (2.4 acres) of marginal wildlife habitat and would therefore result in a less than significant impact to wildlife.

The no action and modification of operations alternatives would have a less than significant impact on wildlife at the three study sites. The shutdown and decommissioning alternative could result in a degradation of wildlife habitat and a reduction of species diversity, especially if grazing were allowed to occur onsite.

Threatened and Endangered Species and Sensitive Species

Detailed surveys for threatened and endangered species and other sensitive species (referred to collectively as sensitive species in this section) were conducted in 1991 at all three sites. No sensitive species were recorded at the LLNL Livermore site or SNL, Livermore. Therefore, the proposed action at these sites would not impact sensitive species.

Surveys at LLNL Site 300 resulted in the observation of eight sensitive species and potential habitat for an additional four species. The large-flowered fiddleneck, tiger salamander, red-legged frog, California horned lizard, golden eagle, burrowing owl, San Joaquin pocket mouse, and American badger were the observed species. The large-flowered fiddleneck is a federal and state endangered species; the remaining seven species are either federal candidate species or state species of special concern or both. Potential habitat of the valley elderberry longhorn beetle (federal threatened, no state status), Alameda whipsnake (federal candidate, state threatened), tricolored blackbird (federal candidate, no state status), and San Joaquin kit fox (federal endangered, state threatened) occurs at LLNL Site 300. The proposed action would have the potential to impact sensitive species at LLNL Site 300. The implementation of the proposed mitigation measures would reduce this to a less than significant impact.

Because the mitigation measures for the proposed action would be implemented for the no action and modification of operations alternatives, these alternatives would have less than significant impacts to sensitive species at the three sites. Shutdown and decommissioning would not impact sensitive species at the LLNL Livermore site or SNL, Livermore.

However, this alternative might eventually have a significant impact on sensitive species at LLNL Site 300 because of possible habitat degradation if grazing or other agricultural practices were to replace existing onsite uses, if public access to the site were to occur, or if the annual controlled burns were ended.

Wetlands

An estimated 0.36 acre of wetlands occurs along Arroyo Las Positas at the LLNL Livermore site and 1.44 acres of wetlands occur at SNL, Livermore along Arroyo Seco. Activities associated with the proposed action would not impact these wetlands because these activities would not occur at or near the wetlands.

There are an estimated 6.76 acres of wetlands at LLNL Site 300; 4.88 acres are natural and 1.88 acres are artificial wetlands. The natural wetlands consist of a number of small, widely dispersed wetlands that occur, principally, at springs in the bottoms of some of the steep canyons onsite. One vernal pool (0.32 acre) occurs in the northwestern part of the site. The artificial wetlands are created by surface water runoff from four buildings and typically grow in drainage ditches along roads or on banks near the buildings. The proposed action would result in the loss of 0.5 acre of artificial wetlands at two buildings. Although these wetlands are not regulated by the U.S. Army Corps of Engineers, they do fall under the state "no net loss of wetlands" policy. Mitigation for the loss of these wetlands would be coordinated with the California Department of Fish and Game.

The no action and modification of operations alternatives would not impact any wetlands at the three sites. The shutdown and decommissioning alternative would likely not impact wetlands at the LLNL Livermore site or SNL, Livermore. However, this alternative may eventually result in the loss of all artificial wetlands at LLNL Site 300 through cessation of operations. In addition, the natural wetlands would be eliminated and/or degraded if grazing were allowed onsite.

Air Quality

Air emissions from LLNL and SNL, Livermore come from permitted stationary sources as well as mobile sources. These sources emit air pollutants that are classified as criteria pollutants, toxic air contaminants, or radionuclides. Potential stationary sources of these air pollutants at the two Laboratories are stacks and vents from boilers, spray booths, and research facilities, as well as open burning activities at LLNL Site 300. Mobile sources consist of vehicular traffic in the Livermore area that is associated with these DOE facilities.

Criteria Pollutants

The present rate of emissions of criteria pollutants from the LLNL Livermore site is 0.2 ton per day, which comprises about 0.03 percent of the Bay Area Air Quality Management District (BAAQMD) area emissions. The LLNL Livermore site's contribution to criteria pollutant emissions can be further divided, showing that 2 percent is particulate, 17 percent is volatile organic compounds, 46 percent is nitrogen oxides, 1 percent is sulfur dioxide, 9 percent is carbon monoxide, and 25 percent is chlorofluorocarbons.

The current rate of criteria pollutant emissions from SNL, Livermore is 0.02 ton per day, which is 0.003 percent of the area BAAQMD emissions; these emissions can be further broken down to 1 percent particulate, 40 percent volatile organic compounds, 52 percent nitrogen oxides, 0.03 percent sulfur oxides, and 7 percent carbon monoxide.

These criteria pollutant emissions contribute to the existing air quality levels in the Livermore area. The air quality in the LLNL Livermore site and SNL, Livermore area is currently classified as meeting the Ambient Air Quality Standard of all criteria pollutants except particulates under 10 mm in diameter (PM10) and ozone. The area is considered a "moderate" nonattainment area for ozone, which requires an implementation plan by the state to bring the area into compliance with the ozone standard by 1997. Since the regional air basin is nonattainment for ozone and PM10, any emission, no matter how small, that contributes to a nonattainment condition must be considered a significant and unavoidable impact. Since the LLNL Livermore site and SNL, Livermore are contributing particulates and precursors

to ozone (nitrogen oxides and volatile organic compounds) to a nonattainment condition, impacts from these emissions are considered significant and unavoidable.

Toxic Air Contaminants

Toxic air contaminants are airborne substances that are capable of causing short-term or long-term human health effects. The LLNL Livermore site and SNL, Livermore emit toxic air contaminants from various research and operation facilities. Emissions from the LLNL Livermore site are within acceptable health risk levels. The toxic air contaminant emissions from LLNL Site 300 have not been completely quantified. The toxic air contaminant emissions from SNL, Livermore are at levels that do not require a health risk assessment and thus are considered acceptable. These are less than significant impacts.

Radionuclides

Members of the public in the area surrounding the LLNL and SNL, Livermore may be exposed to low levels of radioactive materials that are released to the environment as a result of normal operations. The control procedures currently used to protect members of the public and to limit emissions of radionuclides into the environment will continue. The collective dose to the public within a 50-mile radius of LLNL and SNL, Livermore was about 31 person-rem in 1990. The individual radiation doses to the public range from about 7×10^{-6} (0.000007) rem (0.007 mrem) per year at distances of several tens of miles from the two laboratories to 2.5×10^{-4} (0.00025) rem (0.25 mrem) per year at the northeast fenceline. These calculated doses are small compared with the background radiation dose of 0.3 rem (300 mrem) per year and are well within DOE guidelines for protection of the public and the EPA annual dose limit of 0.01 rem (10 mrem) for airborne releases under the National Emission Standard for Hazardous Air Pollutants (40 C.F.R. 61). They are also lower than the National Council on Radiation Protection and Measurements negligible individual risk level of 0.001 rem (1 mrem) per year.

Beryllium

Beryllium is a nonradioactive material regulated under the National Emission Standard for Hazardous Air Pollutants (NESHAP) at the LLNL Livermore site. Beryllium is also regulated by the BAAQMD. Beryllium is used and released in small quantities at the LLNL Livermore site and LLNL Site 300 and occurs naturally in the local soils. Ambient monitoring for beryllium is performed along the perimeters of the LLNL Livermore site and LLNL Site 300. The measured ambient concentrations of beryllium are well below the BAAQMD monthly guidelines at both the LLNL Livermore site and LLNL Site 300. Because beryllium is not machined at the SNL, Livermore site, no emissions of beryllium occur there.

Under the planned expansion at LLNL and SNL, Livermore, the proposed action would not cause a large increase in criteria pollutant and toxic air contaminant emissions. These emission increases are under strict regulatory control. For example, the air districts require the use of Best Available Control Technology (BACT) and the offset of new criteria pollutant emissions that exceed a threshold level. Vehicular traffic and its emissions would grow as the Laboratories' work force grows under the proposed action, but with a transportation management plan these emissions would be mitigated.

Air quality impacts for LLNL and SNL, Livermore under the no action alternative would not change from present conditions because there would be no increase in emissions. However, existing contributions to the nonattainment status of the regional air basins for ozone and particulate matter (PM10) would continue for all the alternatives. The modification of operations alternative, however, would provide a small decrease in air emissions over the proposed action because stationary sources and toxic air contaminant emissions would be reduced. The shutdown and decommissioning alternative would result in substantial reduction of both stationary and mobile sources, although there might be short-term impacts associated with fugitive dust and mobile source emissions from demolition activities.

Surface Water and Ground Water

Surface drainage and natural surface infiltration at the LLNL Livermore site and SNL, Livermore are generally good. Nearly all surface water runoff at the LLNL Livermore site is discharged into Arroyo Las Positas and Arroyo Seco; SNL, Livermore surface runoff is discharged into Arroyo Seco. At LLNL Site 300, three drainages provide runoff discharges from the site.

At both the LLNL Livermore site and SNL, Livermore, highly permeable soils and abundant open, uncovered acreage provide sufficient surface drainage and ground water recharge surface area to prevent flooding or reduction in ground water recharge. Thus, under the proposed action the impact to both surface and ground water resources is less than significant.

Under the no action alternative, only increased intermittent flow in some local streams would be expected during seasonal runoff from the LLNL Livermore site. No impacts are anticipated at LLNL Site 300 or SNL, Livermore. Impacts to water resources from the modification of operations alternative would be consistent with those from the proposed action, which are less than significant. Decommissioning activities under the shutdown and decommissioning alternative would produce some temporary diversions of surface runoff at all three sites, but would have no long-term impacts on ground water resources.

Noise

Existing noise sources at the LLNL Livermore site, LLNL Site 300, and SNL, Livermore include vehicular traffic; stationary noise sources such as heating, ventilating, and air conditioning equipment; and construction activities. In addition, the High Explosives Application Facility (HEAF) at the LLNL Livermore site is an infrequent source of impulse noise from explosives testing; the high explosives tests at LLNL Site 300 are a source of occasional periodic impulse noise; and the pistol and rifle firing ranges at LLNL Site 300 and SNL, Livermore are sources of occasional noise.

The proposed action would result in a short-term increase in noise related to construction activities at all three sites. Because it is assumed that the majority of construction activity would occur during daytime hours, and/or would be remote from noise-sensitive land uses at LLNL Site 300 and parts of the LLNL Livermore and SNL, Livermore sites, impacts from construction noise would be less than significant.

In the long term, the proposed action would result in an increase in vehicular noise on roadways in the vicinity of the three sites due to the projected increase in traffic associated with LLNL and SNL, Livermore operations. This increase would not be significant when added to existing roadway noise levels, but would contribute to significant cumulative roadway noise levels associated with buildout of approved and planned land uses in the vicinity of the LLNL Livermore site and SNL, Livermore. Measures to fully mitigate the cumulative noise impact are not within the jurisdiction or control of DOE or UC.

The no action alternative would result in less extensive construction activity and therefore less construction-related noise at the three sites. Traffic-related noise under the no action alternative would be the same as for existing conditions since traffic conditions would not change. Under the modification of operations alternative, noise conditions would be the same as for the proposed action. The shutdown and decommissioning alternative could result in short-term increases in noise if demolition of facilities is performed; however, the long-term effect would be the virtual elimination of noise from all onsite sources and from Laboratories-related traffic.

Traffic

Regional access to the LLNL Livermore site and SNL, Livermore is primarily from I-580 via the Vasco Road and Greenville Road interchanges. Regional access to LLNL Site 300 is primarily from I-580 via the Corral Hollow Road

interchange. Air transport to and from the LLNL Livermore site and SNL, Livermore moves mainly through the Livermore Municipal Airport. Some materials, primarily for LLNL Site 300, move via the Tracy Municipal Airport. A limited number of shipments, less than 20 a year, move via the Alameda Naval Air Station near Oakland, California and Castle Air Force Base at Merced, California.

The estimated average daily traffic volumes currently generated by the Laboratories are approximately 23,960 vehicles per day at the LLNL Livermore site, 3100 vehicles per day at SNL, Livermore, and 700 vehicles per day at LLNL Site 300. All intersections evaluated in the traffic study of the sites currently operate at acceptable levels of service except the intersections of First Street with Las Positas Boulevard and with North Mines Road. A design study is currently under way in the City of Livermore to improve the level of service at these intersections to acceptable levels.

Under the proposed action, an estimated 4000 additional vehicles per day would be generated at the LLNL Livermore site, with SNL, Livermore contributing an additional 30 vehicles per day and LLNL Site 300 generating an additional 175 vehicles per day. Analysis of a scenario that includes the existing traffic conditions plus increases associated with the proposed action indicated that no intersections, street segments, or interchanges would experience unacceptable traffic conditions. No significant project-specific traffic impacts, therefore, would occur. However, the proposed action would contribute to significant cumulative traffic impacts in the vicinity of the three Laboratory sites in conjunction with buildout of the surrounding areas.

Traffic conditions under the no action alternative are assumed to be the same as those described for the existing traffic setting, because employment at the Laboratories is not expected to increase from current levels. Traffic conditions under the modification of operations alternative would be the same as those described for the proposed action. Under the shutdown and decommissioning alternative, the reduced activity and employment levels resulting from the shutdown of the three Laboratory facilities would result in reduced traffic levels. However, evaluation of traffic impacts associated with subsequent (unknown) uses of the sites is beyond the scope of this EIS/EIR.

Utilities and Energy

The Laboratories have active programs in place to conserve the use of water, electricity, fuel, and sewer discharge. However, for the purposes of analysis, use of these utilities is assumed to increase in proportion to the square footage increase to provide an upper bound of the impacts of the proposed action.

Water

The LLNL Livermore site and SNL, Livermore main water supply is from the Hetch Hetchy water system, with a backup source provided by Zone 7 of the Alameda County Flood Control and Water Conservation District. The LLNL Livermore site and SNL, Livermore have used an annual average of 261.8 million gal and 65.6 million gal, respectively, during the past 5 years. Water consumption rates at both Laboratories, however, have declined since 1986. Water from a system of wells supplies 930,000 gal per day to LLNL Site 300. The LLNL Site 300 5-year consumption average has been 31.8 million gal per year. A project to supply LLNL Site 300 with an estimated 500,000 gal per day from the Hetch Hetchy water system would expand the capacity of the site to 1.2 million gal per day. At the LLNL Livermore site, LLNL Site 300, and SNL, Livermore, water consumption is assumed to increase under the proposed action in proportion to the projected increase in gross square footage.

The cumulative development surrounding these sites would increase demand for and consumption of water. In addition, significant and unavoidable impacts to available water supplies could occur if current drought conditions continue during the 5 to 10 years of the proposed action. Water conservation through reduction of landscape watering, water use monitoring, and landscape irrigation with reclaimed water may reduce this cumulative impact.

Electricity

Electrical power is supplied to the LLNL Livermore site, LLNL Site 300, and SNL, Livermore by the Pacific Gas and

Electric Company and the Western Area Power Administration. Electrical energy is devoted almost entirely to the operation of office buildings and laboratory facilities. Electrical consumption for the LLNL Livermore site increased between 1986 and 1990, while slight electrical use declines were observed at LLNL Site 300 and SNL, Livermore. Under the proposed action, growth at the LLNL Livermore site, LLNL Site 300, and SNL, Livermore would fall within the existing capacity of the utilities to supply energy (on both a total and a peak-load basis) to adequately meet the projected increase in electrical consumption. Because sufficient electric supplies are anticipated to be available in the region, both individual and cumulative impacts from electrical use would be less than significant.

Fuel

Gasoline, jet fuel, diesel, liquid propane gas, and natural gas are the primary fuels consumed at the LLNL Livermore site, LLNL Site 300, and SNL, Livermore. Cumulative total usage has shown a general increase in gasoline use with a decrease in use of other fuels. The proposed action could cause an increase in fuel consumption by all three sites; however, because local suppliers do not anticipate difficulty in providing the Laboratories with fuels, this is considered to be a less than significant impact.

Sewer Discharges

The City of Livermore Water Reclamation Plant (LWRP) handles sewage from the LLNL Livermore site and SNL, Livermore. The 5-year sewer discharge averages for both sites are approximately 113 million gal per year and 28 million gal per year, respectively. Sanitary sewage outside the General Services Area at LLNL Site 300 is disposed of through septic tanks and leachfields or cesspools at individual building locations. Sanitary sewage at the General Services Area is piped into a membrane-lined asphalt oxidation pond at an average rate of 3500 gal per day.

An increase in the volume of sewage might result from implementation of the proposed action. Existing municipal and LLNL Site 300 sewage treatment capacity and near-term upgrades, however, will accommodate new facilities and program upgrades under the proposed action.

Under the no action alternative, water, electricity and fuel use, and sewage discharges would remain at their current levels. Consumption levels under the modification of operations alternative would be the same as under the proposed action. Demand for all these services and supplies during cleanup under the shutdown and decommissioning alternative would change, possibly increasing for a short time, but eventually decreasing to a very low level.

Materials and Waste Management

Materials Management

The wide variety of hazardous and radioactive materials used at LLNL and SNL, Livermore includes chemicals, solvents, high explosives, tritium, and uranium, though the types and quantities vary depending on the activities being conducted. Receipt, storage, and onsite transportation of these materials are managed by Laboratory personnel pursuant to applicable regulations. Under the proposed action, the inventories of hazardous materials at LLNL (not radioactive materials) are conservatively projected to increase proportionally with the growth of the Laboratories. Because more hazardous materials are assumed to be used at the sites, it would follow that more frequent transportation of materials and an increased potential for exposure to workers would occur. These impacts would be mitigated through additional engineered controls, employee training, and adherence to safety procedures.

At the LLNL Livermore site, the hazardous materials inventory is assumed to increase, under the proposed action, by 19,000 gal of liquids and 210,000 lb of solids and compressed gases. At LLNL Site 300, the hazardous materials inventory is assumed to increase by 7600 gal of liquids, 9000 lb of solids, and 171,000 cu ft of compressed gases.

At SNL, Livermore, the chemical (both hazardous and nonhazardous) inventory is assumed to increase by 210 gal of liquids, 380 lb of solids, and 11,900 cu ft of compressed gases.

Under the proposed action, inventories of radioactive materials will remain consistent with existing levels at LLNL and SNL, Livermore except in the following facilities:

- Currently LLNL's Building 331, the Hydrogen Research Facility, has an *administrative limit* for tritium of 300 g and an *inventory* of less than 20 g. Under the proposed action, the administrative limit would be reduced from 300 g to 5 g, with the inventory reduced accordingly. A portion of the tritium operations in Building 331 might be moved to Building 298, the Fusion Target Fabrication Facility, and to Building 391, the Inertial Confinement Fusion Facility (known as the NOVA-Upgrade/National Ignition Facility). The three buildings would have a combined administrative limit of 10 g, with no more than 5 g in any one building. For these facilities, the administrative limit would therefore be reduced from 300 g in one facility (Building 331) to a total of 10 g among three facilities (Buildings 298, 331, and 391).
- LLNL is currently reducing the plutonium administrative limit for the combined Buildings 332 and 334 from 700 kg to 200 kg, with the inventory (actual inventory quantities are classified) being reduced accordingly. The reduction will be accomplished by shipping inventory to an offsite DOE facility and is targeted for completion during FY 1993.
- At LLNL Site 300, tritium use would resume at the firing tables with an administrative limit of 20 mg.
- SNL, Livermore would reduce its tritium administrative limit for the Tritium Research Laboratory, Building 968, from 50 g to 0 g and decontaminate and decommission the laboratory.

At LLNL, under the no action alternative, the administrative limit for tritium in Building 331 would also be reduced to 5 g, but with no corresponding increase for Buildings 391 or 298. The administrative limit for plutonium in Buildings 332 and 334 would be reduced as in the proposed action. Tritium uses at LLNL Site 300 firing tables would resume under this alternative as in the proposed action.

At SNL, Livermore, under the no action alternative, the tritium administrative limit for Building 968 would be reduced to 0 g, and the laboratory decontaminated and decommissioned, as in the proposed action.

Under the no action alternative, the types and quantities of hazardous and nonhazardous materials would not change significantly from current levels at either LLNL or SNL, Livermore. The modification of operations alternative would result in impacts consistent with the proposed action. The shutdown and decommissioning alternative would reduce all use of hazardous and nonhazardous materials at both Laboratories.

Waste Management

Future waste types are expected to be similar in type to those currently generated. These wastes fall into five categories: radioactive, hazardous, mixed, medical, and nonsewerable industrial wastewater. Nonsewerable industrial wastewater is managed as hazardous waste.

Waste generation levels cannot be predicted with certainty in a research setting because research activities do not involve constant and predictable processes. Because programs and facilities under the proposed action are projected to be similar to existing programs and facilities, it is reasonable to assume that resulting waste streams would also be similar. Therefore, the amounts of wastes generated by LLNL and SNL, Livermore operations under the proposed action are assumed to increase proportional to the increase in gross square footage at the sites. This assumption is intentionally high to provide an upper bound of the impacts associated with the proposed action.

The Laboratories are fully committed to pollution prevention and waste minimization. Both Laboratories have, or are in the process of establishing Laboratory-wide pollution prevention and waste minimization plans and procedures that set waste reduction goals for various sections of the Laboratories; and establish criteria for minimizing waste in those areas where goals cannot be set.

Increased waste generation would result in more frequent waste shipments and a greater need for storage capability. Because there are limited treatment or disposal options currently available for LLNL and SNL, Livermore mixed waste, generation of mixed wastes would require onsite storage beyond allowed statutory periods, resulting in a significant and unavoidable impact. This impact could be somewhat mitigated by waste minimization, treatment of liquid wastes, and storage in accordance with rules and regulations, but would be reduced to less than significant only

when disposal options become available.

Under the no action alternative, there would be no increase in wastes generated, resulting in less than significant impacts, except for those impacts associated with storage of mixed wastes. The modification of operations alternative would reduce impacts below those assessed in the proposed action by potentially improving the efficiency of waste handling practices. The shutdown and decommissioning alternative would in the short term increase the amounts of hazardous, radioactive, and mixed wastes requiring handling and disposal. This waste generation impact, however, would be offset in the long term by the eventual elimination of hazardous, radioactive, and mixed waste generation from operations at LLNL and SNL, Livermore.

Occupational Protection

Radiological Exposures—Occupational

External radiation occurs from sources outside the body, including background radiation from natural sources such as cosmic radiation, and from artificial sources, such as chest x rays, to which members of the public are exposed in their daily lives. This normal ambient level of exposure is separate from radiation directly attributable to specific project activities. In the vicinity of LLNL and SNL, Livermore, the typical background radiation dose is about 0.3 rem (300 mrem) effective dose equivalent per year. The major contributors to background radiation throughout the U.S. are (1) radon and its progeny (contributing about 0.20 rem (200 mrem)); (2) naturally occurring radionuclides, mainly potassium-40, in the body (contributing about 0.04 rem (40 mrem)); (3) cosmic radiation (contributing about 0.03 rem (30 mrem)); and (4) terrestrial radiation (contributing about 0.03 rem (30 mrem)). In addition, most people are commonly exposed to medical x rays, nuclear medicine procedures, consumer products, and other miscellaneous sources. The average annual radiation dose from these common artificial sources of radiation is about 0.065 rem (65 mrem).

Exposure analysis in the EIS/EIR presents a risk estimator for the induction of fatal cancer of 5×10^{-4} (.0005) per person-rem and 7.3×10^{-4} (.00073) per person-rem for total health detriment. A risk estimator is the factor used to convert calculated doses to estimates of the occurrence of latent cancers and other health effects. The 28-person-rem collective dose calculated for 1990 corresponds to 0.014 fatal cancers among the exposed workers. Most of this radiation dose, about 20 person-rem, was incurred by workers in plutonium operations areas.

LLNL. During 1990, annual external radiation doses received by LLNL workers ranged from levels indistinguishable above background, which is 0.3 rem (300 mrem), including radon, to 1.5 rem (1500 mrem) above background, or 30 percent of DOE's regulatory annual occupational dose limit of 5 rem. DOE limits, established by DOE Orders, are based on recommendations of the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP). These limits are compatible with the limits imposed by the Nuclear Regulatory Commission on its licensees.

The vast majority (97 percent) of LLNL employees do not receive any measurable doses above background. The total of all radiation doses above background to all employees is referred to as the collective radiation dose. The collective external radiation dose in 1990 was 28 person-rem, and the dose to the highest-exposed individual was 1.5 rem (1500 mrem). These doses correspond to risks of fatal cancer of 0.014 to the collective group of workers and 0.00075 to the highest-exposed individual.

Internal radiation exposures at LLNL were incurred almost entirely from tritium operations at Building 331, the Hydrogen Research Facility. The collective radiation dose from internal exposures was 0.5 person-rem and the highest-exposed individual received a dose of 0.16 rem (160 mrem), 3.2 percent of DOE's annual dose limit of 5 rem (5000 mrem). These doses have associated risks of fatal cancer of 0.00025 to the collective group of workers and 0.00008 to the highest-exposed individual. The reduction in tritium limits at LLNL facilities would result in reduced worker exposures.

The planned upgrade of the LLNL plutonium facility (Building 332) under the proposed action and the inventory reductions under both the proposed action and the no action alternative would reduce external radiation exposures to workers in these buildings by reducing the frequency and duration of exposures. This would reduce the radiation dose incurred by workers in Building 332 by about 10 to 15 person-rem, and reduce the collective dose to workers at LLNL from about 28.5 person-rem to a range of 13.5–18.5 person-rem. Decontamination and restoration of laboratories in LLNL Buildings 212 and 292 would also reduce exposures to workers in these buildings.

SNL, Livermore. At SNL, Livermore the total collective radiation dose from both internal and external radiation exposures was 3.5 person-rem, with an associated risk of fatal cancer of 0.002. External exposures at SNL, Livermore accounted for a collective radiation dose of 2.4 person-rem, with a radiation dose of 0.24 rem (240 mrem) to the maximum-exposed individual. These doses represent risks of fatal cancer of 0.001 to the collective group of workers and 0.0001 to the highest-exposed individual. The collective dose at SNL, Livermore from internal exposures was due to exposures of workers to tritium at Building 968, the Tritium Research Laboratory, and amounted to 1.1 person-rem, with a dose of 0.20 rem (200 mrem) to the maximum-exposed individual. These doses represent risks of fatal cancer of 0.0005 to the collective group of workers and 0.0001 to the highest-exposed individual.

SNL, Livermore would phase out tritium research under the proposed action and no action alternatives. Tritium-related research at the Tritium Research Laboratory would be transferred to other DOE sites; the building would be decontaminated and put to other research use consistent with SNL, Livermore's mission. The administrative limit for tritium was reduced from 300 g to 50 g during 1991. However, conversion of the Tritium Research Laboratory to alternative uses is contingent on DOE approval. Under the proposed action and no action alternatives, the administrative limit would be reduced to 0 g. The reduction in tritium limits at SNL, Livermore would result in reduced worker exposures.

LLNL and SNL, Livermore Impacts. All individual radiation doses at both LLNL and SNL, Livermore were less than the annual occupational limit of 5 rem established by the DOE; they are therefore less than significant.

The collective radiation dose to workers from current operations at LLNL and SNL, Livermore is about 32 person-rem. About two-thirds of this collective radiation dose, 19.6 person-rem, is received by workers at Building 332, the Plutonium Facility. Reducing the inventory of weapons-grade plutonium and other Special Nuclear Materials would reduce the source of exposure and would result in reduction of radiation doses to workers handling the material. Again, it is estimated that reducing the administrative limit for plutonium from 700 kg to 200 kg would reduce the risk of fatal cancer from about 1 in 70 to a range of about 1 in 100 to 1 in 150. This is considered to be a beneficial impact. The LLNL Plutonium Facility upgrade proposed for FY 1994 would also increase worker protection in that facility. This would result from major improvements to the facility, including new equipment and state-of-the-art gloved enclosures.

Although the collective occupational dose at SNL, Livermore has varied from year to year, showing no trends upward or downward, with the reductions in tritium administrative limits that are included in the proposed action and the no action alternative, occupational exposures would be reduced substantially.

Under the no action alternative, radiation doses to workers within DOE limits would be further reduced. The administrative limit for tritium, for example, would be reduced from 300 g to 5 g for the LLNL Hydrogen Research Facility (Building 331) and from 50 g to 0 g at SNL, Livermore's Tritium Research Laboratory (Building 968). Under the modification of operations alternative, exposures are projected to remain the same. Although the shutdown and decommissioning alternative would potentially cause a temporary increase in worker radiation exposure (within DOE limits), the long-term effects would eventually be reduced to near zero. Because the Laboratories are the largest known users of radioactive materials in the area, the cumulative impacts including the effects from other sources in the area would be essentially the same as the impacts of the Laboratories alone.

Radiological Exposure—General Public

Because of their physical proximity, the analysis considers LLNL Livermore site and SNL, Livermore together in estimating offsite radiation exposures from "routine" releases. During 1990, approximately 97 percent (1577 Ci) of the radioactivity released from the two Laboratories was tritium, 1282 Ci from LLNL and 295 Ci from SNL, Livermore. In addition, LLNL released small amounts of oxygen-15 (24 Ci) and nitrogen-13 (24 Ci) from operation of the

electron-positron accelerator in LLNL Building 194. There were no reported releases of radioactivity from LLNL Site 300.

Potential offsite exposures were calculated using the AIRDOS-PC code, an Environmental Protection Agency–approved code for calculating the downwind spread of contaminant effluents, as well as for calculating inhalation, ingestion, and absorption of contaminants through the skin. The calculations use statistical wind data, derived from meteorological towers at the LLNL Livermore site and LLNL Site 300, and the population distribution (from census information). For an area with a 50-mile radius, estimated to include about 6.3 million people, the model calculated the collective effective dose equivalent to be 31 person-rem. This dose could result in 0.016 fatal cancers in the entire exposed population.

The maximum individual doses that might occur offsite from normal operations are estimated by calculating the dose to a hypothetical person spending all of his or her time at the boundaries of the LLNL Livermore site and SNL, Livermore. The calculated fenceline dose (i.e., the exposure to a person standing at the property boundary) ranged up to 0.25 mrem, with the highest potential dose occurring in the east-northeast area. These doses are well below the background level of 300 mrem, and would result in a risk of fatal cancer to the highest-exposed individual of about 1 in 8 million.

Under the proposed action and the no action alternative, the reduction in tritium operations at the Laboratories, particularly in the hydrogen research facilities, would reduce public exposures still further below existing levels. The annual DOE public exposure dose limit is 100 mrem above background from all sources and pathways of exposure. The dose estimates given above are well below background, as well as below regulatory standards established by the EPA. Impacts from tritium operations are, therefore, less than significant.

The modification of operations alternative would also include a reduction in radiation exposures through technical and administrative measures that would be equivalent to or improved over those of the proposed action. The shutdown and decommissioning alternative would eventually reduce the contribution to radiological exposures to the public from operations of the LLNL Livermore site and SNL, Livermore to near zero, although it should be emphasized that offsite exposure levels are already well below all regulatory standards.

Toxic Exposures and Physical Hazards—Occupational

Toxic exposures to workers at the LLNL Livermore site, LLNL Site 300, and SNL, Livermore are consistent with those at similar research and development facilities. There are very few ongoing processes in which long-term exposure to toxic materials might occur.

Physical hazards to workers at the LLNL Livermore site, LLNL Site 300, and SNL, Livermore were also reviewed and evaluated for the 5 years between 1986 and 1990. Physical hazards include such items as electrical shocks, noise, and other typical workplace accidents. The number of recorded cases of occupational injuries at LLNL, per 200,000 hours worked, has averaged 2.1 each year over the past 5 years. This compares well to a 1989 national occupational injury rate of 3.2 injuries per 200,000 hours worked in industrial research and testing facilities. The number of recorded cases of occupational injuries at SNL, Livermore per 200,000 hours worked has averaged 1.55 over the past 5 years.

At LLNL Site 300, high explosives and high explosive–contaminated materials are treated by open burning (burning outdoors). If workers are present during this operation, they may be potentially exposed to airborne emissions resulting from the ignition of specific chemicals. Worker exposure to toxic chemicals is usually evaluated by comparing workplace airborne concentrations to occupational health criteria. The estimated airborne chemical concentrations at LLNL Site 300 were well below Occupational Health and Safety Administration criteria.

The discussion in the Draft EIS/EIR concerning estimated airborne chemical concentrations due to open burning at LLNL Site 300, and the corresponding hazard index developed from these estimates, was deleted because there are currently no agency-approved methods for estimating emissions for the open burning operations; therefore LLNL is currently obtaining approval for emission testing procedures for the open burning from the San Joaquin Valley Unified Air Pollution Control District and the California Air Resources Board to determine the emissions for the open burning operations. Once the emission testing is implemented, the results will be submitted to the air district as part of the

comprehensive plan and emission inventory for LLNL Site 300 to comply with AB2588. At that time the plan will be reviewed by the air district which will determine if a risk assessment is required for LLNL Site 300.

Under the no action alternative there would be no additional impacts because there would be no increases in toxic materials handled at the Laboratories. Impacts under the modification of operations alternative would be equivalent to those of the proposed action, with some potential reductions from technical and administrative changes to hazardous operations. Under the shutdown and decommissioning alternative, the impacts from toxic substances would eventually be reduced to near zero.

Toxic Exposures—General Public

Persons living in the area surrounding LLNL and SNL, Livermore are potentially exposed to air emissions from the Laboratories and from other area industrial sources. LLNL and SNL, Livermore are required by California law to estimate the amount of toxic substances being released by each site. This requirement, based on California House Assembly Bill 2588 (AB2588), passed in 1987, is known as the Toxic "Hot Spots" Program. LLNL and SNL, Livermore have prepared detailed emissions inventories in accordance with this requirement. In a risk assessment prepared by LLNL, the maximum individual carcinogenic risk was determined to be 3 in 1 million (3×10^{-6}), which is below the 10 in 1 million (10×10^{-6}) that the Bay Area Air Quality Management District has designated as the level of concern. The chronic and acute hazard indices were 0.089 and 0.42, respectively. Both of these noncarcinogenic hazard indices are below the benchmark criterion of 1. The AB2588 report for LLNL Site 300 will be completed and submitted to the San Joaquin Valley Unified Air Pollution Control District after specific emission testing is performed as required by the regulatory agency. This will complete the emission inventory. At that time the district will determine whether a risk assessment is necessary. SNL, Livermore's emissions have been evaluated and are so small that no risk assessment was required to be performed. Impacts from the releases evaluated by this program are therefore deemed to be less than significant. These impacts would be the same under the no action and modification of operations alternatives, and would be reduced to near zero under the shutdown and decommissioning alternative.

Site Contamination

Both the LLNL Livermore site and LLNL Site 300 are on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (Superfund), and environmental restoration programs are currently being implemented.

LLNL Livermore Site

Some soils and ground water underlying the LLNL Livermore site have been degraded by a variety of volatile organic compounds, gasoline, chromium, and tritium. Most of the potential volatile organic compound source areas in the soil at the site have been identified. Major source areas have either been remediated through excavation, or have been identified for remediation planning. Volatile organic compounds are present in some of the ground water onsite and in the vicinity of the LLNL Livermore site. A plume of volatile organic compound–contaminated ground water is moving slowly northwest along the Arroyo Seco alignment from the southwest corner of the LLNL Livermore site. It is estimated that if not remediated, it would require several hundred years to reach the nearest offsite municipal well. At the present time, an extensive ground water remediation project is under way, and the impacts of volatile organic compound–contaminated ground water are considered less than significant.

A gasoline spill, located near the south central portion of the LLNL Livermore site, has affected both soils and ground water. The distribution of fuel hydrocarbons at the gasoline spill site is relatively localized, and remediation is planned for both soils and ground water under the proposed action as well as all of the alternatives.

Tritium in ground water has historically exceeded the maximum contaminant level (MCL) of 20,000 pCi/L in two wells in the southeastern part of the LLNL Livermore site, although tritium levels in one of the wells no longer exceed the maximum contaminant level. Boreholes in that area have had measured tritium activities as high as 105,000 pCi/L.

The highest tritium detected elsewhere in ground water was near Building 292, in the northwest part of the area, where tritium activities in ground water are below regulatory limits. Other tritium contamination occurs at the site, but does not represent a threat to ground water.

If no remedial action is performed, continued degradation of the Livermore area ground water will occur as the volatile organic compound–contaminated plumes continue to migrate. This could inhibit future beneficial uses of increasingly greater portions of the aquifer system. At an average ground water velocity of 70 ft/year, it is estimated that the closest municipal supply well will not be affected for about 270 years. Given the length of time predicted for such an impact to occur, and the estimated volatile organic compound concentration after 270 years of 1.5 ppb, this impact would be less than significant.

LLNL Site 300

Ground water has been impacted to varying degrees in more than 10 locations at LLNL Site 300. Contaminants include volatile organic compounds, high explosives, and tritium. The greatest ground water impacts have occurred at the General Services Area, at the southeast edge of the site. Three trichloroethylene (TCE) plumes originate there and move offsite beneath private rangeland south of Corral Hollow Road. Three private water supply wells (one of which is inactive, one active well used by the California Department of Forestry and one by the Connolly Ranch) are located near the plume. Four onsite wells have been taken out of service, because of either trichloroethylene contamination or the threat of cross-contamination between aquifers.

Ground water and soil contamination at the LLNL Livermore site and LLNL Site 300 is a significant impact, and DOE and UC have been and are committed to its remediation and to the prevention of more contamination. Remediation action has begun, and will continue under the proposed action and the alternatives.

SNL, Livermore

Ground water at SNL, Livermore has not been significantly affected by volatile organic compounds or other constituents. Significant soil contamination was found to a depth of 101 ft at an old fuel oil spill site, however, only trace concentrations of benzene were identified in ground water samples from three wells until May 1986. In all subsequent ground water sampling investigations at the fuel oil spill site since May 1986, benzene has not been detected in any well.

Bounding Case Accidents

NEPA requires the inclusion of hypothetical accident scenarios at LLNL and SNL, Livermore in the Draft EIS/EIR. These analyses include evaluations of hypothetical accidents on an individual basis and for bounding conditions, i.e., those accident conditions with potentially the greatest impacts. Table S-5, at the end of this summary, presents a comparison of the postulated accidents under the proposed action and the alternatives.

Postulated Radiological Accident

The bounding radiological accident scenario for individual LLNL and SNL, Livermore facilities is an inadvertent nuclear criticality yielding 1018 fissions within Building 332 (Plutonium Facility). In a review of 41 recorded inadvertent criticalities that have occurred nationally, only 10 have had estimated yields of 1018 fissions or greater. Of these 10, 3 occurred in aqueous processing plants, 2 occurred in heavy-water-natural-uranium systems, 4 occurred in water-moderated reactors or reactor prototypes, and 1 occurred in an aircraft engine prototype reactor. All involved a combination of physical parameters and/or processes that are found in reactor or nuclear materials processing facilities, but are not present in the research and plutonium metals fabrication activities in Building 332. No criticality accidents have occurred in DOE plutonium metals fabrication facilities. Previous safety analyses have analyzed the consequences of an inadvertent criticality yielding 1018 fissions without postulating a method of initiation. The estimated frequency of occurrence is less than 1×10^{-6}/year (1 in one million) and, in fact, such an event may not be possible under the

operational conditions and procedures existing in Building 332.

Nonetheless, *should this event occur*, it could result in a dose of 37 rem (37,000 mrem) or more to workers within 100 m and the immediate exposure ("prompt dose") for unshielded personnel would be greater than 450 rem (450,000 mrem) out to 13 m, possibly causing death. The calculated west fenceline dose would be 0.38 rem (380 mrem). The collective dose offsite would be 440 person-rem, equivalent to a risk of 0.2 cases of fatal cancer among the 1.4 million people inhabiting the downwind sector.

An assessment performed for this accident to estimate the maximum number of health effects associated with the postulated event bounds the number of severe health effects from any other postulated radiological accident at LLNL or SNL, Livermore. Three wind directions were chosen for analysis. The first direction was toward the nearest site boundary, the second in the direction that maximized both onsite and offsite effects, and the last in the direction that would have the potential for the greatest number of severe health effects. The estimated maximum number of deaths resulting from this postulated accident is 4 persons onsite. In addition, it is estimated that not more than 30 persons would incur an elevated risk of a severe health effect (associated with a radiation dose of ^{3}50 rem) and approximately 1900 persons, both onsite and offsite, would receive a radiation dose of ^{3}0.5 rem with a nominal risk of 7.3×10^{-4} (1 in 73,000) health effects per rem (1000 mrem).

Postulated Chemical Accident

The bounding single chemical accident scenario for the LLNL and SNL, Livermore facilities is the release of 100 lb of liquefied chlorine gas over a 30-minute period at Building 518, the Industrial Gas Yard. A release of this type is estimated to have a probability of 1×10^{-7} (1 in 10 million) per year. Although the estimated probability is extremely low, analysis of the consequence would provide an upper bound for consequences of chemical accidents for the LLNL Livermore site and SNL, Livermore. *Should this event occur,* it could result in a maximum predicted concentration of chlorine at the site boundary (East Avenue, 10 m) of 14,000 mg/m^3. Airborne lethal concentrations at the point of release and near the site boundary could occur. Potentially lethal concentrations of chlorine could exist as far as 750 m from the point of release. The maximum number of onsite persons exposed to these lethal concentrations would be expected to be fewer than 270. Additionally, reversible sublethal health effects could be expected out to 4.1 km from the point of release.

Postulated Explosive Accident

The bounding single high explosive accident is the crash of an aircraft carrying 2200 lb of the explosive LX-10 and 300 lb of aviation fuel. A detonation caused by the burning aircraft fuel could result in a blast force of 1 pound per square inch (psi), or more, out to a distance of 490 ft in all directions. *Should this event occur,* the 1-psi overpressure could cause sufficient damage to a standard dwelling to render it uninhabitable. The crash would result in the deaths of the crew and property damage within 490 ft of the explosion. The aircraft accident rate per departure for large commercial jets is 3.1×10^{-6} (3.1 chances in one million), and the associated probability that a crash-caused fire would exceed 1-hour duration is 1×10^{-2} (1 chance in one hundred). The probability of detonation with respect to burn time was not determined, but is estimated not to exceed that of a fire with 1-hour duration. Although the transporting aircraft in this scenario is a turboprop, the increased risk associated with the lighter aircraft is estimated to be no more than 10 times higher. Finally, two shipments per year double the risk of a single departure. The overall probability of occurrence is therefore $(3.1 \times 10^{-6}) \times (1 \times 10^{-2}) \times 10 \times 2 = 6.2 \times 10^{-7}$ (6 chances in ten million) per year.

Based on a fatal blast radius of 31 ft for 200 psi overpressure, the area of lethality would be 0.0003 km^2. Assuming a rural population density of 6 people/km^2 (the glide path into Tracy Municipal Airport is currently over farmland), only the onboard crew of 3 would likely be subjected to a blast of lethal force. Emergency response personnel would potentially be at risk, but the actual number would depend on the timing of their activities and the number of response personnel within the 0.0003-km^2 area at the time of detonation. No number is assigned, as it would be too speculative.

Postulated Facility-Wide Accident

The bounding facility-wide accident scenario for LLNL and SNL, Livermore is an earthquake with ground motion strong enough to breach building confinement barriers (a severe seismic event of this nature is discussed in Appendices D and I). Under the existing conditions, this would result in a multiple-building release of radioactive materials from four buildings (Buildings 968, 331, 251, and 625) and the release of hazardous chemicals from three others (Buildings 131, 151, and 322). The multiple-building event accident scenario combines individual building bounding case accident scenarios and assumes that, at the time of the earthquake, the maximum allowable quantity of material is present in each of the buildings. It also assumes that this material is in the worst at-risk position. While the probability of this occurring for any individual accident scenario is extremely low, the probability of this occurring for all scenarios simultaneously is clearly much lower. Although some smaller additional releases of similar materials might result from the seismic event, the additional contribution to health effects from these smaller releases would be insignificant.

Radioactive Materials. Under the proposed action, the administrative limit for tritium at SNL, Livermore Building 968 would be reduced from 50 g to 0 g. The tritium administrative limit at LLNL Building 331 would be reduced from 300 g to 5 g. Commensurate with this change, the inventory would be reduced from less than 20 g to 5 g. A portion of the tritium operations from Building 331 might be moved to Building 298, the Fusion Target Fabrication Facility, and to Building 391, the Inertial Confinement Fusion Facility, known as the NOVA Upgrade/National Ignition Facility. In this event, the three buildings would have a combined administrative limit of 10 g with no more than 5 g in any one building and no more than 5 g in Buildings 298 and 391 combined. For these LLNL facilities, the administrative limit would therefore be reduced from 300 g in one facility (Building 331) to a total of 10 g among three facilities (Buildings 298, 331, and 391).

The postulated accident effects of tritium use at Building 298 would bound that for Building 391 with respect to the dose at the site boundary due to the closer proximity of Building 298 to the site boundary and the expected larger part of the administratively limited inventory being in Building 298. Therefore, under the full implementation of the proposed action, the bounding amount of tritium gas at risk would be 2 g from Building 331, 5 g from Building 298, and 0 g from Building 968. *Should the severe seismic event occur at these administrative levels,* it could result in a collective radiation dose of 580 person-rem from the combined tritium release. An additional 4460 person-rem due to Am241 releases from Buildings 251 and 625, which are the same as for the existing environment, would result in a total of 5080 person-rem for the 70-year committed effective dose equivalent to a population of 1.4 million people. This total dose would result in 3 cases of fatal cancer over 70 years.

Under the no action alternative, the tritium administrative limit would be reduced from 300 g to 5 g in LLNL Building 331; the inventory would be reduced from less than 20 g to 5 g. The maximum tritium gas at risk for this facility, however, would be 2 g. The administrative limit for tritium at SNL, Livermore Building 968 would be reduced from 50 g to 0 g. Therefore, the amount of tritium gas at risk under the no action alternative would be 2 g from Building 331 and 0 g from Building 968. *Should the severe seismic event occur at these administrative levels,* it could result in a collective radiation dose of 160 person-rem from the tritium release. An additional 4460 person-rem due to Am241 releases from Buildings 251 and 625 would result in a total of 4600 person-rem for the 70-year committed effective dose equivalent to a population of 1.4 million people. This dose would result in 2 cases of fatal cancer over 70 years.

An interim period would exist until the proposed action or any of the alternatives could be fully implemented; the initial tritium inventory at risk for any of these alternatives would be 3.5 g from Building 331 and 50 g from Building 968. *Should the severe seismic event occur at these administrative levels,* it could result in a collective radiation dose of 4520 person-rem from the combined tritium release (4460 person-rem due to Am241 releases from Buildings 251 and 625) for a total of 9000 person-rem for the 70-year committed effective dose equivalent to a population of 1.4 million people. This dose would result in 5 cases of fatal cancer over 70 years. For comparison, natural background radiation to the same population is expected to deliver a 70-year collective effective dose equivalent of 29.8 million person-rem, with 10,000 cases of fatal cancer over 70 years. Under the shutdown and decommissioning alternative, the postulated initial accident results would be the same as under the proposed action; however, no release with an offsite impact could be postulated for the decommissioning phase after inventory reductions.

Hazardous Chemicals. Toxic effects might result from the chemicals released as a result of a severe earthquake. *Should this seismic event occur under the proposed action,* hydrogen cyanide, ammonia, and hydrogen chloride could

be released. For the hydrogen cyanide release, deaths would be expected near the point of release with tolerable levels of hydrogen cyanide (54 mg/m^3 for 51 min) at the site boundary (0.28 km) and beyond. For the ammonia release, however, no deaths would be expected. The predicted average concentration of ammonia (451 mg/m^3 for 41 min) at the site boundary (0.34 km) could produce symptoms ranging from eye, nose, and throat irritation to decreased blood pressure. For the hydrogen chloride release, no deaths would be expected. The predicted average concentration of hydrogen chloride (11 mg/m3 for 19 min) at the site boundary (0.55 km) would not impair the ability to take protective actions.

Under the no action alternative, the postulated chemical accident results would be consistent with the proposed action. Under the modification of operations alternative, Building 322 would be reinforced to withstand the postulated earthquake and/or the use of cyanides would be eliminated. These changes would eliminate the release of hydrogen cyanide from Building 322. Under the shutdown and decommissioning alternative, the postulated initial accident results would be the same as under the proposed action; however, no release with an offsite impact could be postulated for the decommissioning phase after inventory reductions.

Postulated Transportation Accident

The bounding radiological accident during transportation is obtained from calculations made for radioactive waste shipments to the Waste Isolation Pilot Plant in New Mexico, published in the *Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant*. This accident analysis postulates three transportation containers (the maximum permitted by highway weight limits) maximally loaded with transuranic waste, which are breached on a highway passing through a densely populated urban zone, and then engulfed in a fire. *Should this accident occur,* the resulting collective dose to the public was calculated to be 55,800 person-rem, which corresponds to 28 fatal cancers in the exposed population.

MITIGATION

The majority of the impacts outlined in Table S-3 and Table S-4 are less than significant and require no specific additional mitigation measures except the continuation of current control procedures to protect workers and the public. A few impacts, on the other hand, are listed as significant. In many cases, mitigation measures are proposed to reduce or eliminate significant impacts. Programs to monitor implementation of these mitigation measures will be conducted as appropriate. The Mitigation Monitoring and Reporting Program required under CEQA is being published and distributed by UC as a part of this EIS/EIR.

Table S-1 Issues Raised Through the EIS/EIR Scoping Process

Issues	Number of Comments
Topical or Issue-Oriented Comments	
Air quality issues	6
Alternative actions	17
Community and institutional issues	8
Comprehensive Test Ban Treaty and nuclear weapons	12
Cost and benefits of the project	10
Emergency preparedness issues	4

Environmental releases and monitoring	23
Fish and wildlife issues	8
Health and safety issues	13
Land use issues	7
Mitigation measures	7
Need for the project	6
Nevada Test Site issues	7
Noise issues	1
Perceived psychological and social issues	8
Power line and low frequency radiation	1
Prehistoric and historic sites	1
Procedural issues	14
Project description	9
Regulatory compliance and oversight	14
Remediation, decontamination, and decommissioning	13
Risk assessment and accident analysis	12
Seismology issues	2
Sewage issues	8
Threatened and endangered species	5
Traffic and transportation issues	10
Waste management	40
Water resources	5
Statements in Opposition or Support	11
Total:	282

Table S-2 Issues Raised Through the Draft EIS/EIRPublic Comment Process

Issues	Number of Comments
Policy issues	255
Materials and waste management	116
Site contamination and remediation	58
Releases/public health hazards	42
Accident scenario analysis	39

Out of scope comments	25
U-AVLIS	16
Traffic and transportation	17
Air quality	16
Occupational protection	13
Ground water	13
Geology	12
Comments in general support or opposition	10
Mitigation measures	9
EIS/EIR alternatives	8
Environmental compliance	8
Socioeconomic characteristics	6
Miscellaneous	41
Total:	704

Table S-3 Comparison Summary of Proposed Action and Alternativesa Lawrence Livermore National Laboratoryb

Environmental Component Existing Conditions	Proposed Action	No Action	Modification of Operations	Shutdown and Decommissioning
Land Use				
Land uses at both LLNL Livermore site and LLNL Site 300 are compatible with surrounding areas and with the land use plans of local jurisdictions.	LLNL Livermore site and LLNL Site 300: Additional development would occur (a 9 percent increase in square footage is projected at each site) with uses consistent with existing facilities (LS); potential for limiting access to a segment of East Avenue upon acquisition by DOE (LS); no contribution to cumulative losses of agricultural land or open space resulting from buildout of surrounding areas.	No change to existing land uses or amount of onsite development (no impact). No contribution to cumulative land use changes.	Consistent with proposed action (LS); acquiring property east of LLNL Livermore site (and SNL, Livermore) for an additional buffer zone could affect local land uses within the acquired property and require changes to county land use plans (S).	No direct impacts on land uses at the LLNL Livermore site or LLNL Site 300 (LS); evaluation of potential impacts of future land uses is beyond the scope of this EIS/EIR.

Socioeconomics				
Existing employment LLNL Livermore site - Approx. 11,200 LLNL Site 300 - Approx. 200	Assumed to increase by approximately 20 percent over 10 years (total increase of approximately 2,050) (LS); cumulative effect would be creation of additional employment opportunities in region (B).	No increase over present levels (no impact).	Consistent with the proposed action (LS, B)	Eventual loss of most jobs at both LLNL sites; employment reduced to maintenance staff in 5–10 years (SU).
Population and Housing				
Alameda County population approximately 1.3 million; population of four local cities 164,000; San Joaquin County population approximately 480,600; present housing supplies adequate.	Residential population in region is estimated to increase by about 3800 people (LS) and demand for housing is estimated to increase by approximately 2050 units (SU). Cumulative development could result in an increase in housing demand in the region that may not be accommodated by the existing supply (SU).	No increase over present levels; no contribution to cumulative housing demand (no impact).	Consistent with the proposed action (SU)	Some LLNL employees would leave the area in search of employment opportunities; decrease in local area population and demand for housing; no contribution to cumulative housing demand would result (LS).
Economic factors				
Annual payroll - $432 million Other local expenditures - $467 million	Increase in payroll of approximately $86.4 million (20 percent increase) could result; expenditures on goods and services would also be expected to increase (B).	No increase over present levels (no impact).	Consistent with the proposed action (B)	Substantial short-term loss of payroll and local procurement; local economies anticipated to be adversely impacted (SU).
Community Services				
Fire protection and emergency services				
LLNL provides onsite services at LLNL and SNL, Livermore sites and has mutual aid agreements with local communities.	May result in an increased demand for services both on- and offsite (LS). Planned and proposed projects in the region would contribute to a cumulative demand for fire protection and emergency services in the area; however, the proposed action would not contribute to this impact (no impact).	Demand for services is expected to be the same as under existing conditions (no impact). Planned and proposed projects in the area would contribute to a	Consistent with the proposed action (LS)	Eventual decrease in demand for services to maintenance level; mutual aid agreements with local communities would eventually cease (LS). Planned and proposed projects would contribute to the

		cumulative demand for service in the area; however, the no action alternative would not contribute to this impact (no impact).		cumulative demand for service; however, the shutdown alternative would not contribute to this impact (no impact).
Police and security services				
LLNL has its own security services and has emergency response agreements with local communities.	May result in an increased demand for services onsite (LS). Planned and proposed projects in the area would contribute to a cumulative demand for police service in the area; however, the proposed action would not contribute to this impact (no impact).	The demand for services is expected to be the same as under existing conditions (no impact). Planned and proposed projects in the area would contribute to a cumulative demand for service in the area; however, the no action alternative would not contribute to this impact (no impact).	Consistent with the proposed action (LS)	Eventual decrease in demand for services to maintenance levels; emergency agreements with local communities would eventually cease (LS). Planned and proposed projects in the area would contribute to the cumulative demand for service; however, the shutdown alternative would not contribute to this impact (no impact).
Schools				
Some school districts in the region have existing capacity problems, including the Livermore Valley Joint Unified School District, which serves approximately 1700 students who have at least one parent employed at LLNL.	Would generate an estimated 800 students in communities where workers reside (SU). Cumulative development in the area would contribute additional students who may not be accommodated in some school districts (SU).	No change from present levels expected (no impact). Planned and proposed projects in the region would contribute to a cumulative demand for service in the area; however, the no action alternative would not contribute to	Consistent with the proposed action (SU)	Eventual decrease in demand for school facilities to near zero (B); funding through federal Impact Aid Program would be reduced accordingly (S). Planned and proposed projects in the region would contribute to a cumulative demand for school service, but this alternative would not contribute to

		this impact (no impact).		cumulative school service demands (no impact).
Nonhazardous solid waste disposal				
LLNL Livermore site				
Approximately 24,000 cu yd of waste are collected onsite annually and disposed of in the Vasco Road Sanitary Landfill, which has a remaining lifespan of approximately 17 years; Alameda County has plans to increase landfill capacity within the county.	Would increase demand for disposal services at Vasco Road Sanitary Landfill due to an estimated additional 4400 cu yd of nonhazardous solid waste annually (LS). Although cumulative development in the region would also increase the need for disposal services at the landfill, this increase in the demand could be accommodated (LS).	No change from present generation rate (no impact); no contribution to increase in cumulative demand for services (no impact).	Consistent with the proposed action (LS)	Could result in a short-term increased need for nonhazardous solid waste disposal services of Vasco Road Sanitary Landfill and, due to cumulative development in service area, would contribute to increased demand for these services (LS).
LLNL Site 300				
Approximately 2200 cu yd of waste are collected onsite annually and disposed of in the Corral Hollow Sanitary Landfill. The Corral Hollow Sanitary Landfill is scheduled to close in 1995, and San Joaquin County has yet to identify alternative disposal sites.	Would increase demand for disposal services at Corral Hollow Sanitary Landfill due to an estimated additional 550 cu yd of nonhazardous solid waste annually (SU); cumulative development in the area would increase demand for disposal services beyond capacity of landfill (SU).	No change from current generation rate; however, due to capacity problems at this landfill, no action would contribute to potentially significant effects (SU).	Consistent with the proposed action (SU)	Could result in a short-term increased need for nonhazardous solid waste disposal services of Corral Hollow Sanitary Landfill (scheduled to close in 1995) and, due to cumulative development in service area, would contribute to increased demand for these services (SU).
Prehistoric and Historic Cultural Resources				
LLNL Livermore site				
No prehistoric resources recorded on the LLNL Livermore site. Historic value of the LLNL Livermore site currently being determined.	No prehistoric or historic cultural resources are known or anticipated. Compliance with the National Historic Preservation Act will identify and delineate mitigation for potential impacts to prehistoric and	Consistent with the proposed action (LS)	Consistent with the proposed action (LS)	Possible increased effect on these resources from cleanup activities (LS).

	historic resources (LS).			
	Because the full extent of cumulative impacts to regional prehistoric and historic resources cannot be determined as part of this EIS/EIR, a potentially significant cumulative impact is identified (S).	Cumulative impacts are potentially significant (S).	Consistent with the proposed action (S)	Cumulative impacts are potentially significant (S).
LLNL Site 300				
Twenty-four cultural resources recorded on LLNL Site 300: 3 prehistoric sites, 20 historic sites, and 1 site with a prehistoric and historic component. Historic sites at LLNL Site 300 may also be eligible for listing in National Register of Historic Places.	No prehistoric or historic cultural resources are expected to be affected. Compliance with the National Historic Preservation Act will identify and delineate mitigation for potential impacts to prehistoric and historic resources (LS).	Consistent with the proposed action (LS)	Consistent with the proposed action (LS)	Possible increased effect on these resources from cleanup activities (LS).
	Because the full extent of cumulative impacts to prehistoric and historic resources within the study area cannot be determined as part of EIS/EIR, a potentially significant cumulative impact is identified (S).	Cumulative impacts are potentially significant (S).	Consistent with the proposed action (S)	Cumulative impacts are potentially significant (S).
Aesthetics and Scenic Resources				
Facilities are visible from various land uses and roadways in the vicinity. Designated scenic corridors in the vicinity of the LLNL Livermore site and LLNL Site 300 include parts of Greenville Road, So. Vasco Road, Patterson Pass Road, Tesla Road, and I-580.	Minor alteration of the existing visual character of the sites; minor changes to views from designated scenic roadways (LS); could potentially contribute a small increment to cumulative effects on visual resources; however, it is too speculative to determine whether or not these potential effects are significant.	Minor construction-related visual effects would result (LS); no contribution to cumulative visual effects would occur (no impact).	Individual impacts at both sites consistent with proposed action (LS), except that visual impacts associated with possible land acquisition for buffer zone at LLNL Livermore site cannot be determined at this time; cumulative impacts consistent with	Potential short-term impacts during demolition of existing structures (LS); evaluation of potential visual impacts of new uses is beyond the scope of this EIS/EIR.

			proposed action.	
Geology				
Geologic resources				
Nearby resources include aggregates, clay, coal, silica, a few fossils, and a small oil field to the east. These are too far away to be affected.	No individual or cumulative impacts anticipated (LS).	No individual or cumulative impacts anticipated (LS).	Consistent with the proposed action (LS).	No impact anticipated (LS).
Geologic hazards				
Area seismicity makes earthquake-resistant construction necessary; little potential for landslides.	Earthquake-resistant construction required at both the LLNL Livermore site and LLNL Site 300 (LS); potentially strong ground motion at LLNL Site 300 would require that all new structures be located more than 50 ft from active fault trace (potentially S).	No individual or cumulative impacts anticipated (LS).	Earthquake-resistant construction required (potentially S).	Earthquake-resistant shutdown and demolition procedures required (potentially S).
Ecology				
Vegetation				
LLNL Livermore site				
Vegetation in built-up areas highly altered by human activity. Relatively undeveloped introduced grasslands in security zone and a remnant area of wooded riparian vegetation along Arroyo Seco.	No additional individual or cumulative impacts anticipated (LS).	No additional individual or cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	Consistent with the no action alternative; evaluation of future impacts from new uses is beyond the scope of this EIS/EIR.
LLNL Site 300				
Most vegetation unaltered by human activity. Mosaic of diverse plant communities, including large stand of native perennial grasslands.	Loss of 2.4 acres of disturbed and introduced grassland plant communities. No cumulative impact anticipated (LS).	Loss of 18.5 acres of introduced grassland plant communities. No cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	May result in degradation of existing plant communities and loss of the native perennial grasslands. Cumulative impacts cannot be determined at this time and are beyond the scope of this EIS/EIR.

Wildlife				
LLNL Livermore site				
Site supports species adapted to living in areas that are highly altered by human activity. Grassland and remnant riparian habitats support additional species.	No additional individual or cumulative impacts anticipated (LS).	No additional individual or cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	Consistent with the no action alternative (LS).
LLNL Site 300				
Highly diverse assemblage of wildlife species due to unaltered nature of habitats.	Loss of 2.4 acres of marginal wildlife habitat. No cumulative impacts anticipated (LS).	Loss of 18.5 acres of introduced grassland wildlife habitat. No cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	Altering existing land use controls could result in degradation of wildlife habitat and reduction in wildlife species diversity. Cumulative impacts cannot be determined until new land uses are determined (S).
Threatened and Endangered Species				
LLNL Livermore site				
No threatened or endangered or other sensitive species observed.	Threatened, endangered, or other sensitive species not observed. No cumulative impacts anticipated (LS).	Threatened, endangered, or other sensitive species not observed. No cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	Consistent with the no action alternative (LS).
LLNL Site 300				
One endangered and seven candidate species and/or species of concern occur onsite. Potential habitat for one endangered, two threatened, and one candidate species occurs onsite.	Sensitive species and sensitive-species habitats may be impacted by proposed action. This impact, including any potential cumulative impacts, can be mitigated (LS).	Sensitive species and sensitive-species habitats may be impacted. This impact, including any potential cumulative impacts, can be mitigated (LS).	Consistent with the proposed action (LS)	Altering existing land use controls could result in degradation of sensitive-species habitat and potential reduction in sensitive species could occur. Cumulative impacts cannot be determined until new land uses are

				determined (S).
Wetlands				
LLNL Livermore site				
0.36 acres of wetlands along Arroyo Los Positas.	No additional or cumulative impacts anticipated (LS).	No additional individual or cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	Consistent with the no action alternative (LS).
LLNL Site 300				
4.88 acres of natural wetlands, including one vernal pool, and 1.88 acres of artificial wetlands occur onsite.	Loss of 0.5 acre of artificial wetlands. This individual impact, including any potential cumulative impacts, would be less than significant (LS).	No additional individual or cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	Elimination of artificial wetlands may occur. Degradations of natural wetlands may occur. Cumulative impacts cannot be determined (S).
Air Quality				
Criteria pollutants				
Area is currently in attainment of the ambient air quality standards except for ozone and particulates. The LLNL area is considered "moderate" nonattainment for ozone. Offsite monitoring combines emissions of both the LLNL Livermore site and SNL, Livermore. Output of criteria pollutants is 0.2 ton per day, of which 17 percent is volatile organic compounds, 46 percent NOx, 2 percent particulates, 1 percent SOx, 9 percent CO, and 25 percent chlorofluorocarbons.	These outputs may increase 9 percent for the LLNL Livermore site, 9 percent for LLNL Site 300. Particulates and NOx, an ozone precursor, are less than 0.03 percent of area releases (LS), but any release into a nonattainment area is significant. Impacts would occur on both individual and cumulative bases (SU).	These emissions would remain at present levels (LS), but any release into a nonattainment area is significant and unavoidable (SU).	Consistent with the proposed action (LS, SU)	Short-term impacts during decommissioning (SU); when cleanup operations cease, exposures will be near zero (B).
Toxic air contaminants				
Toxic air contaminant emissions from LLNL Livermore site are at levels of human health risk and hazard index that are deemed acceptable by the	Toxic air contaminant emissions may increase 9 percent at LLNL Livermore site, but would remain within acceptable human health risk and hazard	These emissions would remain at existing levels (LS).	Toxic air contaminant emissions would be reduced from current levels	Toxic air contaminant levels would be reduced to zero (B).

Bay Area Air Quality Management District. Toxic air contaminant emission measurements from LLNL Site 300 are currently being completed.	indices (LS).		(B).	
Beryllium				
Maximum monthly beryllium concentrations at the perimeter of the LLNL Livermore site and downwind of LLNL Site 300 are less than 0.6 percent of the Bay Area Air Quality Management District standard.	At LLNL Livermore site, beryllium emissions are well below standards (LS). At LLNL Site 300, beryllium emissions may decrease with construction of contained firing facility (B).	Emissions would remain at current levels (LS).	Consistent with the proposed action (LS)	Specific beryllium information not identified. Short-term impacts during decommission-ing (S); when cleanup operations cease, exposure will be near zero (B).
Radiation				
Radiation exposure to the public during 1990 primarily from tritium (14 percent through inhalation, the remainder through ingestion of locally grown foodstuffs):	Individual and cumulative exposures are anticipated to remain the same or decrease as tritium and plutonium limits decrease (B).	Individual or cumulative exposures to remain the same or decrease (LS).	Exposures consistent with the proposed action (B).	Same as present conditions until operations cease, with eventual reduction to near zero (LS).
Offsite exposures are calculated for LLNL Livermore site and SNL, Livermore combined. Eighty percent of the tritium release is from the LLNL Livermore site. No tritium releases from LLNL Site 300. Collective dose to 6.3 million people: 31 person-rem (0.02 risk of a fatal cancer).	Individual and cumulative exposures are expected to remain the same or be reduced (LS).	Individual and cumulative exposures to remain the same or decrease (LS).	Exposures consistent with the proposed action (B).	Continued exposure during cleanup (LS), but eventual cumulative reduction to near zero (B).
Maximally exposed individual dose on northeast fenceline 0.25 mrem (1×10^{-7} risk of a fatal cancer).	Individual and cumulative exposures are expected to remain the same or be reduced (LS).	Individual and cumulative exposures to remain the same or decrease (LS).	Exposures reduced from the proposed action (B).	Continued exposure during cleanup (LS), but eventual cumulative reduction to near zero (B).
Water				
Surface water				
No perennial streams or bodies of water present. For wetlands, see the *Ecology* section. There are virtually	No individual or cumulative impacts anticipated (LS).	No individual or cumulative impacts anticipated due	Consistent with the proposed action (LS)	No individual or cumulative impacts anticipated (LS).

no floodplains of concern.		to continued maintenance and upgrade projects (LS).		
Ground water				
Underlies the LLNL Livermore site and SNL, Livermore, flowing generally westward. Contamination of this water is discussed below in the *Site Contamination* section.	Ground water flows would not be affected; no individual or cumulative impacts anticipated (LS).	Consistent with the proposed action (LS)	Consistent with the proposed action (LS)	No individual or cumulative impacts anticipated (LS).
Noise				
LLNL Livermore site				
Noise sources include vehicular traffic; heating, ventilating, and air conditioning equipment; and the High Explosives Application Facility construction activities. No noise standards are currently being exceeded.	Short-term increase in noise levels during construction (LS); long-term increase in noise levels because of increased traffic volumes (up to 0.7 dBA increase for LLNL Livermore site and SNL, Livermore combined) (LS); increase in roadway noise levels (up to 4.7 dBA increase due to cumulative traffic volumes) (SU).	Increase in short-term construction noise (LS); long-term roadway noise levels would be same as existing conditions (no impact); no contribution to increases in cumulative roadway noise levels (no impact).	Short-term construction noise and existing plus project traffic–related noise effects consistent with the proposed action (LS); cumulative traffic-related noise effects consistent with the proposed action (SU).	Short-term increase in noise levels associated with demolition (LS); long-term reduction in roadway noise levels (B).
LLNL Site 300				
Noise sources include vehicular traffic; heating, ventilating, and air conditioning equipment; construction activities; and high explosives testing. No noise standards are currently being exceeded.	Short-term increase in noise during construction (LS); proposed contained firing facility may reduce high explosive testing noise (B); additional impulse-type noise generation from Cheap Access to Orbit Project (LS); increase in roadway noise levels from increased traffic volume (up to 0.5 dBA increase along Corral Hollow Road) (LS); increase in cumulative roadway noise levels (up to 2.0 dBA increase along Corral Hollow Road) because of cumulative traffic volumes	Increase in short-term construction noise (LS); long-term roadway noise levels same as existing conditions (no impact); no contribution to increases in cumulative roadway noise levels (no impact).	Short-term construction noise and onsite noise sources consistent with the proposed action (LS); existing plus project and cumulative roadway noise levels consistent with the proposed action (LS).	Short-term increase in noise levels associated with possible demolition activities (LS); long-term reduction in roadway noise levels (B).

	(LS).			
Traffic				
LLNL Livermore site				
The Laboratory currently generates approximately 23,960 vehicle trips per day. Two study intersections near the LLNL Livermore site are congested during peak hours beyond the acceptable level of service.	LLNL traffic is projected to increase by 4000 vehicles, for a total of approximately 27,960 vehicle trips per day. Increased employee traffic would lead to increased traffic congestion in the vicinity of the site (LS).	Consistent with existing conditions (no impact).	Consistent with the proposed action (LS)	Short-term increase in traffic from cleanup activities (LS); long-term reduction in traffic congestion (B).
	Under the cumulative scenario, increased LLNL traffic would contribute to significant and unavoidable traffic congestion at certain intersections (SU).	Cumulative buildout of the surrounding area would result in increased traffic congestion; however, LLNL would not contribute to this increased congestion (no impact).	Cumulative impacts consistent with the proposed action (SU).	Beneficial impact on cumulative traffic congestion in the vicinity (B).
LLNL Site 300				
LLNL Site 300 currently generates approximately 700 vehicle trips per day. No unacceptable traffic congestion at present.	LLNL traffic is projected to increase by 75 vehicles for a total of 875 vehicle trips per day at this site; increased employee traffic would contribute to congestion in the vicinity (LS).	Consistent with existing conditions (no impact).	Consistent with the proposed action (LS)	Short-term increase in traffic from cleanup activities (LS); long-term reduction in traffic congestion (B).
	Under the cumulative scenario, increased LLNL traffic would contribute to significant traffic congestion at the I-580/Corral Hollow Road interchange (SU).	Cumulative buildout of the surrounding area would result in increased traffic congestion; however, LLNL would not contribute to this congestion (no impact).	Consistent with the proposed action (SU)	Beneficial impact on cumulative traffic congestion in the vicinity (B).
Utilities and Energy				
Water				
LLNL Livermore site				

Primary water source is Hetch Hetchy aqueduct. The 5-year average consumption was 261.8 million gal per year. The projected FY 1992 estimate is 239.7 million gal per year.	Assumed 9 percent growth of the Laboratory would result in increase of water use to approximately 261.3 million gal per year. Given the continuing drought, cumulative use is significant (S).	No increase in current use (LS).	Consistent with the proposed action (LS)	Demand during cleanup unknown; eventual decrease to maintenance level (B).
	Cumulative development of LLNL, SNL, Livermore, and nearby industry would further impact this use (S).			
LLNL Site 300				
Primary water source is ground water wells. Consumption is trending downward. The 5-year average consumption was 31.8 million gal per year; FY 1992 estimated consumption is 30 million gal.	An assumed increase of 9 percent would result in use of an additional 2.7 million gal per year.	No increase in current use (LS).	Consistent with the proposed action (LS)	Demand during cleanup unknown; eventual decrease to maintenance level (B).
Electricity				
LLNL Livermore site and LLNL Site 300				
Power is purchased from PG&E and the Western Area Power Administration. Power use has been gradually increasing. The 5-year average at LLNL Livermore site was 321 million kWh annually; the annual usage at LLNL Site 300 is estimated at 1.5 million kWh. The projected 1992 estimate for LLNL Livermore site is 345 million kWh.	A 9 percent increase proportional to program growth on individual and cumulative basis would amount to 376.5 million kWh per year at LLNL Livermore site and 1.64 million kWh per year at LLNL Site 300 (LS).	No individual or cumulative increase in current usage (LS).	Consistent with the proposed action (LS)	Demand during cleanup unknown, eventual cumulative decrease to maintenance level (B).
Fuel				
LLNL Livermore site and LLNL Site 300				
Gasoline, jet fuel, diesel, liquid propane gas, and natural gas consumption rates vary year to year. The 5-year average annual	Projected 9 percent increase proportional to program growth, with little individual or cumulative impact on supply, amounting to a total	Individual and cumulative consumption will continue at current levels	Consistent with the proposed action (LS)	Demand during cleanup unknown; eventual cumulative decrease to maintenance level

usage at both sites was gas, 496,000 gal; diesel, 86,600 gal; jet fuel, 156,000 gal; LPG, 10,400 gal. The projected 1992 estimate is 815,000 gal of total fuel (gasoline, jet fuel, diesel, and LPG) per year. In additional, the 5-year average fuel oil usage at LLNL Site 300 was 78,000 gal annually.	of 888,200 gal (LS).	(LS).		(B).
Sewage discharge				
LLNL Livermore site				
The 5-year average of sewage discharge is 113 million gal per year, which is disposed of via City of Livermore sewer system. LLNL Site 300 discharges approximately 3500 gal per day into its own septic systems.	Increase of 9 percent, constituting a significant individual and cumulative impact (S).	Continued individual and cumulative discharge at current levels (LS).	Consistent with the proposed action (S, LS)	Demand during cleanup unknown; eventual cumulative decrease to near zero (LS).
LLNL Site 300				
Disposed of in septic tanks and leach fields or cesspools.	Increase of 9 percent. No individual or cumulative impact expected, as discharge and treatment are self-contained (LS).	Continued individual and cumulative discharge at present levels (LS).	Consistent with the proposed action (S, LS)	Demand during cleanup unknown; eventual cumulative decrease to near zero (LS).
Materials and Waste Management				
Materials Management				
Controlled materials include explosives, radioactive materials, special nuclear materials, classified substances and parts, and precious metals.				
LLNL Livermore site				
About 210,000 gal and 2.3 million lb of various chemicals are stored onsite. The administrative limit for tritium in Building 331, with the greatest quantity of this radionuclide, is 5 g (50,000 Ci); the limit for	Quantities of chemicals may increase by as much as 9 percent. The administrative limit for plutonium at Buildings 332 and 334 will be reduced from 700 kg to 200 kg. Safe handling and operating procedures will	Individual and cumulative quantities and limits will remain at current levels except that the administrative	Consistent with the proposed action (LS)	Initial increase in handling and disposal of wastes, although all transport in accordance with DOT policies (S); eventual cumulative

plutonium in Buildings 332 and 334 is 700 kg; the limit for natural and depleted uranium in Building 493 is 80,000 kg.	continue to be emphasized (LS).	limit for plutonium at Buildings 332 and 334 will be reduced from 700 kg to 200 kg (LS).		decrease to near zero (B).
LLNL Site 300				
About 84,000 gal, 100,000 lb, and 1.9 million cu ft of various chemicals are stored onsite. Plutonium, tritium, and uranium are sometimes present onsite in small quantities for individual experiments.	Quantities of chemicals may increase by as much as 9 percent. The tritium administrative limit for the firing tables would resume at 20 mg. Safe handling and operating procedures will continue to be emphasized. This applies on both an individual and a cumulative basis (LS).	Chemical quantities would remain consistent with current levels (LS); the tritium administrative limit for firing tables would resume at 20 mg.	Consistent with the proposed action (LS)	Initial increase in handling and disposal of wastes, although all transport in accordance with DOT policies (S); eventual contribution to cumulative impacts decreasing to near zero (B).
Waste Management				
LLNL Livermore site				
The site produces radioactive, hazardous, mixed, and medical waste. Quantities in 1992 are projected to be: radioactive, 22,000 gal and 287,000 lb of low-level plus 2,700 cu ft of transuranic waste; hazardous, 309,000 gal and 567,000 lb; mixed, 23,000 gal and 45,000 lb; and medical, 2600 lb.	Quantities of waste are projected to increase by 9 percent, resulting in additional waste volumes of: radioactive, 2,000 gal and 26,000 lb of low-level plus 240 cu ft of transuranic waste; hazardous, 28,000 gal and 51,000 lb; mixed, 2,100 gal and 4,600 lb; and medical, 230 lb (LS).	Quantities of waste generated would remain at current levels (LS).	Consistent with the proposed action (LS)	Initial increase in hazardous, radioactive, and mixed waste generation from decommissioning activities; eventual cumulative decrease to near zero (LS).
	Mixed waste generation would require onsite storage beyond RCRA-prescribed limits (SU). Storage of these wastes would exceed available capacities in the next 5–10 years (S). The Mixed Waste Treatment Facility and the Decontamination and Waste Treatment Facility would provide increased waste processing capabilities (B).	Mixed waste generation would require onsite storage beyond RCRA-prescribed limits (SU). Storage of these wastes would exceed available capacities in the next 5–10 years (S).	Centralized LLNL and SNL, Livermore waste management facility could improve efficiencies (LS).	Eventual decrease in mixed waste generation to near zero (LS)
	Waste shipments would	Waste	Consistent	Initial increase in

	increase proportional to waste generation (LS).	shipments would remain at current levels (LS).	with the proposed action (LS)	waste shipments; eventual decrease to zero (LS).
LLNL Site 300				
The site produces radioactive hazardous, mixed, and medical waste. Quantities in 1992 are projected to be: radioactive, 300,000 lb; hazardous, 41,000 gal and 37,000 lb plus 4500 lb of explosives waste; mixed, 2000 lb; and medical, 12 lb. The site's mixed waste is sent to the LLNL Livermore site for interim storage.	Quantities of waste are projected to increase by 9 percent, resulting in additional waste volumes of: radioactive, 27,000 lb of low-level waste; hazardous, 3700 gal and 3,300 lb plus 405 lb of high explosive waste; mixed, 180 lb; and medical, 1 lb (LS).	Quantities of waste generated would remain at current level.	Consistent with the proposed action	Eventual decrease in waste generation to near zero (B).
	Cumulative impacts on national treatment and disposal capacity are beyond the control of UC. DOE is addressing the issue as part of a Programmatic EIS for Environmental Restoration and Waste Management (SU).	Individual and cumulative quantities of waste generated will remain at current levels (LS).	Consistent with or less than the proposed action if a central waste processing facility is constructed for LLNL and SNL, Livermore (LS).	Initial increase in hazardous and radioactive wastes from decontamination and disposal (S); eventual cumulative contribution to near zero (B).
Occupational Protection				
Radiological Exposures				
Radiation exposure of workers during 1990 (a representative year) at the LLNL Livermore site and LLNL Site 300 resulted in doses to about 300 people:	Exposure levels are anticipated to remain the same or decrease on individual and cumulative bases at both the LLNL Livermore site and LLNL Site 300 as planned operational and equipment improvements are made (B).	Exposures are anticipated to remain the same or decrease on individual and cumulative basis as operational and equipment improvements are made (LS).	Exposures consistent with the proposed action (B).	Continued exposure during cleanup, but less than DOE limits (LS); eventual cumulative reduction to near zero (B).
External gamma dose (mostly during plutonium operations): 28.5 person-rem (0.014 risk of a fatal cancer)	Would remain the same or would decrease on individual and cumulative bases (B).	Would remain the same or would decrease on individual and cumulative	Exposures consistent with the proposed action (B).	Continued exposure during cleanup, but less than DOE limit (LS); eventual cumulative

		bases (B).		reduction to near zero (B).
Internal tritium dose: 0.5 person-rem (0.0002 risk of a fatal cancer)	Exposure levels would remain the same or would decrease on individual and cumulative bases (B).	Would remain the same or would decrease on individual and cumulative bases (LS).	Exposures consistent with the proposed action (B).	Continued exposure during cleanup, but less than DOE limit (LS); eventual cumulative reduction to near zero (B).
LLNL Livermore site and LLNL Site 300—maximum individual doses:				
External gamma dose: 1.5 rem (0.0007 risk of a fatal cancer)	Exposure levels are anticipated to remain the same or decrease on individual and cumulative bases (B).	Would remain the same or would decrease on individual and cumulative bases (LS).	Exposures reduced from the proposed action (B).	Continued exposure during cleanup, but less than DOE limits (LS); eventual cumulative contribution reduced to near zero (B).
Internal tritium dose: 0.16 rem (0.00008 risk of a fatal cancer)	Exposure levels would remain the same or would decrease on individual and cumulative bases (B).	Would remain the same or would decrease on individual and cumulative bases (LS).	Exposures consistent with the proposed action (B).	Continued exposure during cleanup, but less than DOE limits (LS); eventual cumulative contribution reduced to near zero (B).
	LLNL Site 300: Upgrade of FXR would add to potential for external exposure; this increase will be less than DOE guidelines (LS).	FXR would not be upgraded (LS).	Exposures consistent with the proposed action (LS).	Eventual individual exposures and cumulative contribution reduced to near zero (B).
LLNL Livermore site and LLNL Site 300				
Some research and development work requires workers to be exposed to toxic materials and physical hazards in the workplace.	Several proposed projects would improve facilities for handling toxic substances, control physical hazards, and improve working conditions. This would reduce both individual and cumulative impacts (B).	Exposures expected to remain the same or decrease as facilities and operational procedures are improved (LS).	Consistent with the proposed action (LS)	Initial increase in exposure during decommissioning but within DOE guidelines (LS); eventual cumulative contribution reduced to near zero (B).
Site Contamination				
Soils and ground water				
Present activities are not	Possibility of both	Environmental	Consistent	Environmental

increasing this contamination; instead, it is being cleaned up.	individual and cumulative impacts from exposure to contaminants or of contaminant release to air or surface or ground water; however, present and planned activities are designed to minimize contamination. Existing contamination being cleaned up under remediation program (LS).	restoration will continue until remediation is complete (LS).	with the proposed action (LS)	restoration would continue until remediation is complete (B).

[a]In accordance with CEQA and the UC CEQA Handbook, four descriptive categories are used in this EIS/EIR to discuss and analyze environmental impacts: less than significant (LS), significant (S), significant and unavoidable (SU), and beneficial (B). These categories are used consistently throughout the EIS/EIR. Under NEPA, however, the significance of environmental impacts determines the need for the NEPA document; once that decision has been made, specific impacts are not categorized according to level of impact in an EIS.

[b]The impacts associated with the EIR proposed action of renewing the DOE and UC contract for UC's continued operation and management of LLNL would be consistent with the impacts analyzed under the EIS proposed action and alternatives that are summarized in this table.

Table S-4 Comparison Summary of Proposed Action and Alternatives SNL, Livermore*

Environmental Component Existing Conditions	Proposed Action	No Action	Modification of Operations	Shutdown and Decommissioning
Land Use				
Land uses at SNL, Livermore are compatible with surrounding areas and with the land use plans of local jurisdictions.	Additional development would occur (a 6 percent increase in square footage is projected) consistent with types of usage at existing facilities; potential exists for limiting access to a segment of East Avenue upon acquisition by DOE; no contribution to losses of agricultural land or open space from buildout of surrounding areas.	No change to existing land uses or amount of onsite development.	Consistent with proposed action plus potential changes to land uses and land use plans for property acquired east of SNL, Livermore (and LLNL Livermore site) for additional buffer zone.	No direct impacts on land uses; potential impacts of future land uses are beyond the scope of this EIS/EIR.
Socioeconomics				
Employment				
1500 total employees and contract workers	Assumed to increase approximately 1 percent in 10 years (approximately 15	No increases over present levels.	Consistent with the proposed action	Eventual loss of most onsite jobs; employment reduced to

	people); creation of additional employment opportunities adds to cumulative employment in region.			maintenance staff in 5–10 years.
Population and housing				
Alameda County population is 1.3 million; population of four local cities is 164,000; present housing supplies are adequate.	Residential population in region is estimated to increase by about 30 people; demand for housing is estimated to increase by approximately 9 units. Planned and proposed projects onsite and in the area would contribute to a cumulative demand for housing in the region that may exceed supply in some areas.	No increases over present levels expected; no contribution to cumulative housing demand.	Consistent with the proposed action	A small decrease in the residential population level and the housing demand would result.
Economic factors Annual payroll - $51.6 million Other local expenditures - $91.8 million	Payroll is estimated to increase by $561,000; expenditures on goods and services are also expected to increase.	No increase from present levels.	Consistent with the proposed action	Substantial short-term loss of payroll and local procurement.
Community Services				
Fire protection and emergency services				
LLNL provides SNL, Livermore with fire protection support services.	Growth would increase demand for these services. Planned and proposed projects in the area would contribute to the cumulative demand but the proposed action would not contribute to this impact.	No impact to existing service levels; planned and proposed projects in the area would contribute to the cumulative demand in the area but the no action alternative would not contribute to this impact.	Consistent with the proposed action	Eventual decrease in site service to maintenance level; mutual aid agreements with local communities would cease.
Police and security services				
SNL, Livermore has its own services and has emergency response agreements with local communities.	Growth would increase demand for these services. Planned and proposed projects in the area would contribute to cumulative demand but the proposed action would not	No impact to existing service levels; planned and proposed projects in the area would contribute to the	Consistent with the proposed action	Eventual decrease in site services down to maintenance level; emergency response agreements with

	contribute to this impact.	cumulative demand for service in the area but the no action alternative would not contribute to this impact.		local communities would eventually cease.
Schools				
Some school districts in the region have existing capacity problems, including the Livermore Valley Joint Unified School District, which serves approximately 205 students who have at least one parent employed at SNL, Livermore.	Approximately 4 additional students expected. Cumulative impact from regional development would be significant.	No change from present levels expected; planned and proposed projects in the area could contribute to cumulative demand for service in the region, but the no action alternative would not contribute to this impact.	Consistent with the proposed action	Eventual decrease in demand for school facilities to near zero; funding through the federal Impact Aid Program would be reduced accordingly.
Nonhazardous solid waste disposal				
Approximately 3600 cu yd of waste are collected onsite annually and disposed of at the Vasco Road Sanitary Landfill.	An estimated 6 percent increase in SNL, Livermore nonhazardous solid waste (approximately 216 cu yd annually), which can be handled at Vasco Road Sanitary Landfill. Planned and proposed projects in the area would contribute to a cumulative demand for disposal services.	Vasco Road Sanitary Landfill handles present SNL, Livermore waste adequately. Planned and proposed projects in the area would contribute to a cumulative demand for service.	Consistent with the proposed action	Short-term increase in demand due to cleanup; eventual decrease to maintenance levels.
Prehistoric and Historic Resources				
No National Register of Historic Places listed or eligible properties are located at SNL, Livermore.	No anticipated project-specific impacts to prehistoric or historic cultural resources. Too speculative to determine the full extent of cumulative impacts to prehistoric and historic cultural resources as part	Consistent with the proposed action	Consistent with the proposed action	Consistent with the proposed action

	of this EIS/EIR.			
Aesthetics and Scenic Resources				
Facilities are visible from various land uses and roadways in the vicinity. Designated scenic corridors in vicinity of the site include parts of Greenville Road, So. Vasco Road, Patterson Pass Road, Tesla Road, and I-580.	Minor alteration of the existing visual character of the sites; minor changes to views from designated scenic roadways; small incremental contribution to cumulative impacts to visual resources.	Minor short-term visual impacts during construction of no action projects; no contribution to cumulative visual effects on surrounding areas would occur.	Individual impacts consistent with the proposed action; visual impacts associated with possible land acquisition cannot be determined at this time; cumulative impacts consistent with the proposed action.	Potential short-term impacts during possible demolition of existing structures; evaluation of potential visual effects of new uses is beyond the scope of this EIS/EIR.
Geology				
Geologic resources				
Nearby resources include aggregates, clay, coal, silica, a few fossils, and a small oil field to the east, all too far away to be affected.	No impact anticipated	No impact anticipated	No impact anticipated	No impact anticipated
Geologic hazards				
Area seismicity makes earthquake-resistant construction necessary. Little potential for landslides.	Because no proposed construction would occur near a fault, no impact anticipated.	No impact anticipated	Consistent with the proposed action	Earthquake-resistant shutdown and demolition procedures required.
Ecology				
Vegetation				
Vegetation in built-up areas highly altered by human activity. Relatively undeveloped introduced grasslands in security area and a remnant area of wooded riparian vegetation along Arroyo Seco.	No additional impacts anticipated, because proposed activities would occur in already built-up areas; no cumulative impacts anticipated.	No additional individual or cumulative impacts anticipated.	Consistent with the proposed action	Cleanup may produce further disturbance; cumulative impacts cannot be determined.
Wildlife				
Site supports wildlife species	No additional impacts	No additional	Consistent with	Cleanup may

adapted to living in areas highly altered by human activity. Grassland and remnant riparian habitat support additional species.	anticipated because proposed activities would occur in already built-up areas; no cumulative impacts expected.	individual or cumulative impacts anticipated.	the proposed action	produce further disturbance; cumulative impacts cannot be determined.
Threatened and endangered species				
No threatened or endangered or other sensitive species observed at SNL, Livermore.	Because threatened, endangered, or other sensitive species not observed, no individual or cumulative impacts anticipated.	Because threatened, endangered, or other sensitive species not observed, no individual or cumulative impacts anticipated.	Consistent with the proposed action	Consistent with the no action alternative.
Wetlands				
1.44 acres of wetlands along Arroyo Seco.	Because no proposed construction would occur near present wetlands, no individual or cumulative impacts anticipated.	Site activities would not affect present wetlands; no individual or cumulative impacts anticipated.	Consistent with the proposed action	Consistent with the no action alternative.
Air Quality				
Criteria pollutants				
Area is currently in compliance except for ozone and particulates, but is considered "moderate" nonattainment for ozone. Offsite monitoring combines emissions of both the LLNL Livermore site and SNL, Livermore. Output of criteria pollutants is 0.02 ton per day, of which 40 percent is volatile organic compounds, 52 percent NOx, 1 percent particulates, .03 percent SOx, and 7 percent CO.	Emissions may increase 6 percent at SNL, Livermore. Particulates and NOx, an ozone precursor, are less than 0.003 percent of area releases, but any release into a nonattainment area is a significant impact.	Although no increase in emissions, existing releases into a nonattainment area are a significant impact.	Consistent with the proposed action	Consistent with the no action alternative until cleanup operations cease, then near zero.
Toxic Air Contaminants				
Toxic air contaminant emissions at SNL, Livermore are at levels that do not require a risk assessment and are considered acceptable.	Toxic air contaminant emissions may increase 6 percent, but would remain within acceptable human health risk and hazard	Consistent with existing levels.	Toxic air contaminant emissions would be reduced from	Toxic air contaminant emissions would be reduced to near zero.

	indices.		current levels.	
Beryllium—None released from SNL, Livermore				
Radiation				
Radiation exposure to the public during 1990 primarily from tritium (14 percent through inhalation, the remainder through ingestion of locally grown foodstuffs):	These exposures are expected to decrease as tritium limits decrease.	Consistent with the proposed action.	Consistent with the proposed action	Consistent with the proposed action
Offsite exposures are calculated for the LLNL Livermore site and SNL, Livermore combined. Collective dose to 6.3 million people: 31 person-rem (0.02 risk of a fatal cancer). Twenty percent of the tritium release was from SNL, Livermore.	Exposures would remain the same or would decrease.	Exposures would remain the same or would decrease.	Reduced from the proposed action.	Continued exposure during cleanup, but eventual reduction to near zero.
Maximally exposed individual dose on northeast fenceline: 0.25 mrem (1×10^{-7} risk of a fatal cancer).	Exposures would remain the same or would decrease.	Exposures would remain the same or would decrease.	Reduced from the proposed action.	Continued exposure during cleanup, but eventual reduction to near zero.
Decommissioning Tritium Research Laboratory				
Stack releases from the Tritium Research Laboratory account for all tritium releases from SNL, Livermore mentioned above.	Possible short-term increases in tritium releases during decontamination and decom-missioning of Building 968.	Consistent with the proposed action.	Consistent with the proposed action.	Consistent with the proposed action.
Water				
Surface water				
No perennial streams or bodies of water present onsite. For wetlands, see discussion in *Ecology* section. Virtually no floodplains of concern exist onsite.	No impact anticipated	No impact anticipated	No impact anticipated	No impact anticipated
Ground water				
Underlies LLNL Livermore site and SNL, Livermore, flowing generally westward. Contamination of this water is discussed below in *Site*	Ground water flows would not be affected; no impact anticipated.	No impact anticipated	No impact anticipated	No impact anticipated

Contamination section.				
Noise				
Noise sources include vehicular traffic; heating, ventilating, and air conditioning equipment; construction activities; and a pistol and rifle firing range. Currently, noise standards are exceeded.	Short-term increase in noise levels during construction. Long-term increase in roadway noise levels due to increased traffic volumes (up to 0.7 dBA increase for LLNL Livermore site and SNL, Livermore combined); increase in cumulative roadway noise levels (up to 4.7 dBA increase) due to increase in regional traffic volumes.	Short-term increase in noise levels anticipated during construction.	Consistent with the proposed action	Although short-term increase in noise levels associated with demolition is anticipated, long-term reduction in roadway noise levels could follow.
Traffic				
SNL, Livermore currently generates approximately 3100 vehicle trips per day. Two intersections near the Laboratory are congested during peak hours beyond the acceptable level of service.	SNL, Livermore traffic is projected to increase by 30 vehicles for a total of 3130 vehicle trips per day. Increased employee traffic would result in increased traffic congestion.	Consistent with the existing conditions.	Consistent with the proposed action	Short-term increase in traffic from cleanup activities; long-term reduction in traffic congestion.
	Increased SNL, Livermore traffic would contribute to cumulative traffic impacts associated with buildout of surrounding lands.	Buildout of surrounding lands would increase congestion; however, SNL, Livermore would not contribute to this cumulative traffic congestion.	Cumulative impacts consistent with the proposed action.	Beneficial impact anticipated on cumulative traffic congestion in vicinity.
Utilities and Energy				
Water				
Primary water source is Hetch Hetchy aqueduct. Usage was approximately 56 million gal per year in 1990. The projected 1992 usage will be 58 million gal.	An assumed 6 percent growth of the Laboratory could result in increased water use of approximately 61.5 million gal per year. Given the continuing drought, this use is significant. Cumulative development of SNL, Livermore, LLNL, and	No increase from existing levels anticipated.	Consistent with the proposed action	Demand during cleanup unknown; eventual decrease to maintenance level.

	nearby industry will further impact this use.			
Electricity				
Power is purchased from PG&E and the Western Area Power Administration. Power use is approximately 38.7 million kWh per year and has been slowly increasing. The projected 1992 usage will be 40.1 kWh.	An assumed 6 percent increase proportional to program growth could add approximately 2.4 million kWh per year.	No increase from existing levels anticipated.	Consistent with the proposed action	Demand during cleanup unknown; eventual decrease to maintenance level.
Fuel				
Annual gasoline, diesel, liquid propane gas, and natural gas consumption rates are projected to amount to a total of 16,600 gal in 1992.	Fuel use is assumed to increase 6 percent; amounting to 17,600 gal/yr.	Consumption continues at existing rates.	Consistent with the proposed action	Demand during cleanup unknown; eventual decrease to maintenance level.
Sewage discharges				
Combined with LLNL Livermore site sewage and disposed of via City of Livermore sewer system. SNL, Livermore discharges estimated to be 28 million gal/yr.	An assumed increase of 6 percent could add 1.6 million gal per year.	Continued discharge at existing levels.	Consistent with the proposed action	Demand during cleanup unknown; eventual decrease to maintenance level.
Materials and Waste Management				
Materials Management				
Controlled materials include explosives, radioactive materials, special nuclear materials, classified substances and parts, and precious metals. About 3420 gal, 6320 lb, and 197,000 cu ft of various chemicals are stored onsite. The existing administrative limit for tritium is 50 g (500,000 Ci).	Quantities of chemicals may increase by as much as 6 percent; radionuclide limits will not increase; those for tritium will decrease to zero when the Tritium Research Laboratory is decommissioned.	Quantities of chemicals would remain at present levels; radionuclide limits will not increase; those for tritium will decrease to zero when the Tritium Research Laboratory is decommissioned.	Consistent with the proposed action	Eventual decrease to zero.
Waste Management				
The site produces radioactive, hazardous, mixed, and medical waste. Quantities in 1992 are projected to be: radioactive, 7670 gal and 8860 lb of low-level waste;	Quantities of waste may increase by as much as 6 percent, resulting in additional waste volumes of: radioactive, 460 gal and 540 lb of low-level	Quantities of waste generated would remain at existing levels.	Consistent with the proposed action	Initial increase in hazardous, radioactive, and mixed waste generation from decommissioning

hazardous, 3947 gal and 6320 lb; mixed, 250 lb of liquids and 73 lb of solids; and medical, 124 lb.	waste; hazardous, 240 gal and 380 lb; mixed, 15 lb of liquids and 4 lb of solids; and medical, 7lb.			activities; eventual decrease to near zero.
	Mixed waste generation would require onsite storage beyond RCRA-prescribed limits.	Mixed waste generation would require onsite storage beyond RCRA-prescribed limits.	Consistent with the proposed action	Eventual decrease in waste generation to near zero.
	Waste shipments would increase proportional to waste generation.	No increases anticipated from present quantities.	Consistent with the proposed action	Eventual decrease to near zero.
	DOE is addressing this cumulative impact as part of a Programmatic EIS for Environmental Restoration and Waste Management.	No cumulative increase anticipated from present quantities.	Consistent with the proposed action	Eventual decrease to near zero.
Decommissioning Tritium Research Laboratory				
In 1990, the Tritium Research Laboratory generated 7550 lb of tritium contaminated low-level and 237.5 lb of mixed wastes. SNL, Livemore typically ships one low-level waste shipment per year.	During the 3-year period of decontamination and decom-missioning of the Tritium Research Laboratory, 100,000 lb of low level and 310 gal of mixed waste may be generated. Decommissioning of the Tritium Research Laboratory may add 15 to 20 shipments from SNL, Livermore during the 3 years of this project	Consistent with the proposed action. Consistent with the proposed action.	Consistent with the proposed action. Consistent with the proposed action.	Consistent with the proposed action. Would be included in the total shipments associated with shutdown and decommissioning.
Occupational Protection				
Radiation				
Radiation exposure of workers during 1990 (a representative year) is summarized below.				
Collective doses to about 200 people:				
External gamma dose: 2.5 person-rem (0.001 risk of a fatal cancer)	Exposures would remain the same or would decrease.	Exposures would remain the same or would decrease.	Exposures would remain the same or would decrease.	Continued exposure during cleanup, but less than DOE limits, with eventual

				reduction to near zero.
Internal tritium dose: 1.0 person-rem (0.0005 risk of a fatal cancer)	Exposures would remain the same or would decrease.	Exposures would remain the same or would decrease.	Exposures would be consistent with the proposed action.	Continued exposure during cleanup, but less than DOE limits, with eventual reduction to near zero.
Maximum individual dose:				
External gamma dose: 0.24 rem (0.0001 risk of a fatal cancer)	Exposures would remain the same or would decrease.	Exposures would remain the same or would decrease.	Exposures would be consistent with the proposed action.	Continued exposure during cleanup, but less than DOE limits, with eventual reduction to near zero.
Internal tritium dose: 0.2 rem (0.0001 risk of a fatal cancer)	Exposures would remain the same or would decrease.	Exposures would remain the same or would decrease.	Exposures would be consistent with the proposed action.	Continued exposure during cleanup, but less than DOE limits, with eventual reduction to near zero.
Decommissioning Tritium Research Laboratory				
The internal radiation doses to workers summarized above also apply to the Tritium Research Laboratory.	Decommissioning of the Tritium Research Laboratory may increase radiation exposure to decontamination workers.	Consistent with the proposed action.	Consistent with the proposed action.	Consistent with the proposed action.
Toxic Substances and Physical Hazards				
Toxic exposure				
Site workers: Some research and development work requires workers to be exposed to toxic materials and physical hazards in the workplace.	Several proposed projects would improve facilities for handling toxic substances, control physical hazards, and improve working conditions.	Exposures anticipated to remain the same or decrease as facilities and operational procedures are improved.	Consistent with the proposed action	Consistent with the no action alternative, with eventual reduction to near zero.
Site Contamination				
Soils and ground water				
Existing activities are not increasing site contamination,	Present and planned activities are designed to	Environmental restoration	Consistent with the proposed	Consistent with present

but rather are cleaning it up.	minimize further contamination. Existing contamination being cleaned up under the environmental restoration program.	activities will continue.	action	conditions.

* Designations of levels of significance for impacts are not included on this table because SNL, Livermore is not subject to CEQA.

Table S-5 Comparison of Postulated Accidents Under the Proposed Action and the Alternatives

Postulated Accident[a]	Proposed Action	No Action	Modification of Operations	Shutdown and Decommissioning
Inadvertent plutonium criticality (B-332)	Applies[b]	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Tritium release during severe earthquake (B-968)[c]	Applies initially, not applicable after inventory reduced to zero.	Applies initially, not applicable after inventory reduced to zero.	Applies initially, not applicable after inventory reduced to zero.	Applies initially, not applicable after inventory reduced to zero.
Release of plutonium into Laboratory (B-332)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Tritium release during severe earthquake (B-331)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Americium-241 release during severe earthquake (B-251)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Transuranic waste involved in fire after spill (B-612 area)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Uranium fire (B-493)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Transuranic waste (Americium-241)	Applies	Applies	Applies	Applies initially, not applicable after

release during severe earthquake (B-625)				inventory reduced to zero.
Truck accidents, trucks carrying low specific activity waste (2 scenarios)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Truck accident, truck carrying transuranic waste	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Tritium release during severe earthquake (B-298)	Applies	Not applicable (currently, no inventory)	Not applicable (currently, no inventory)	Not applicable (currently, no inventory)
Sulfuric acid spill (B-514)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Chlorine gas release (B-518)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Aircraft high explosive accident (Tracy Municipal Airport)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Site 300 high explosive accident (firing table)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Truck accident, truck carrying high explosive (Interstate 580)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Ammonia gas release during severe earthquake (B-131)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Hydrogen chloride gas release during severe earthquake (B-151)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Arsine gas release (B-166)	Applies	Applies	Applies	Applies initially, not applicable after inventory reduced to zero.
Hydrogen cyanide	Applies	Applies	Applies initially, not	Applies initially,

release during severe earthquake (B-322)			applicable after inventory reduced to zero or building reinforced.	not applicable after inventory reduced to zero.

[a] See section 5.6 and Table 5.6-1 for details.

[b] Applies means that the conditions of the postulated accident as described in Appendix D apply to the alternative.

[c] Building 968 is at SNL, Livermore; all other buildings listed in this table are at the LLNL Livermore site or LLNL Site 300. While they are distinct operations managed and operated by different contractors, for the purposes of this multiple-facility accident the three sites are addressed together.