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I. **Executive Summary**

The Proposed Action would create and operate an experimental facility for further advancing the development of laser-driven, plasma-based, particle beam accelerators. An existing, approximately 7,000 square-foot (SF), accelerator laboratory area inside Building 71 at Lawrence Berkeley National Laboratory (LBNL) would be modified to accommodate the new facility. A utility room and stairwell would be placed in an approximately 2,000 SF area of the Building 71 roof. The Berkeley Laboratory Laser Accelerator (BELLA) laser, laser plasma accelerator, ancillary equipment, and radiation shielding would be installed. The laser and laser plasma accelerator would be operated for research and development that would focus the laser system’s laser beam pulses on the entry to a meter-long plasma channel (inside the laser plasma accelerator) to produce and accelerate an electron beam pulse to an energy level on the order of 10 giga electron-volts $^1$ (GeV) within the meter length of the channel. The Proposed Action’s unique attribute would be the comparatively short distance over which the laser plasma accelerator generates a 10 GeV electron beam. The ultimate goal of this undertaking is to support the Department of Energy’s (DOE) need to substantially reduce the size, cost, energy usage, and environmental impacts associated with future electron or positron accelerators.

The Proposed Action, the acquisition and installation of the BELLA laser and laser plasma accelerator and the operation of the laser and laser plasma accelerator for research and development, is subject to environmental review under the National Environmental Policy Act (NEPA) and is the subject of this Environmental Assessment (EA).

This EA provides information and analysis that DOE may use to determine whether the Proposed Action would cause potentially significant, adverse effects to the environment. Proposed Action safety features are identified,

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$^1$ The electron-volt is a unit of energy. A 10 GeV pulse once per second has an average power level of one watt.
such as radiation shielding and a monitoring/control system. This EA examines several other issues, including the following: potential hazards from laser operation; potential impacts to views from public or private properties; potential effects to existing energy and waste disposal capacities; potential noise and air quality impacts; and potential effects on cultural resources. Furthermore, this EA analyzes the potential cumulative effects of the Proposed Action in conjunction with other known past, present, or future projects in the vicinity.
II. INTRODUCTION

A. Purpose and Need

The mission of the Department of Energy’s High Energy Physics (HEP) program is to explore and discover the laws of nature as they apply to the basic constituents of matter and the forces between them. To enable these discoveries, HEP supports the development of particle accelerators at increasingly higher energies. These accelerators can provide intense energy beams for scientific and technological research to explore the properties of materials, probe the structure of atoms and molecules, study biological specimens, and investigate chemical reactions and manufacture microscopic machines. Recent advances at LBNL in the acceleration of particles in plasma have demonstrated an energy gain of one giga electron-volts (1 GeV) within a distance of 3 centimeters, which is several hundred times shorter than in conventional accelerators. This technology holds great promise for dramatic reduction of the size, cost, energy usage, and environmental impact of future accelerators, particularly high-energy electron-positron colliders. It could pave the way for future accelerators to be hundreds of times shorter and more compact than currently required while still producing electron beams with the same energy levels.

The Proposed Action is American Resource and Recovery Act (ARRA) funded and would create an experimental facility for further advancing the development of laser-driven plasma acceleration. It would produce laser light pulses to excite plasma with sufficient amplitude to accelerate electrons by 10 GeV or more in the distance of approximately 1 meter.
III. PROPOSED ACTION AND ALTERNATIVES

A. Proposed Action

The Proposed Action is the acquisition and installation of the BELLA laser and laser plasma accelerator and the operation of the laser and laser plasma accelerator for research and development. It would achieve the identified Purpose and Need. It would be funded by the DOE and operated and managed by the University of California (UC), under contract with the DOE.

1. Introduction

The Proposed Action, to acquire and install the BELLA laser and laser plasma accelerator and operate the laser and laser plasma accelerator for research and development, includes five primary components. These include: 1) modifications to an existing building to house the laser and laser plasma accelerator systems, generally referred to as conventional facility work; 2) the laser system; 3) the laser plasma accelerator system; 4) ancillary systems to support the laser and laser plasma accelerator; and 5) operation of the laser and laser plasma accelerator for research and development.

The Proposed Action’s unique attribute would be the comparatively short distance over which the laser plasma accelerator generates a 10 GeV electron beam. The laser plasma accelerator would be approximately 1 meter in length. Similar systems employing the current accelerator technologies require path lengths of 300 meters or more to obtain the same energy level. For example, the 50 GeV Stanford linear accelerator is over 3,200 meters long. The Proposed Action would support the DOE’s need to reduce the size, cost, energy usage, and environmental impact of future accelerators. Furthermore, on a worldwide scale, multiple accelerators are in operation that generate electron beam energies around or greater than 10 GeV and methods are established to ensure such accelerators do not result in adverse impacts.

Components 1 to 4 of the Proposed Action would take place during an approximately three-year period during 2009 to 2012. Component 5 of the Pro-
posed Action, operation of the laser and laser plasma accelerator for research and development, would follow and continue for an indefinite period thereafter.

2. Location and Existing Conditions
The approximately 200-acre LBNL main site is located in the hills of the cities of Berkeley and Oakland, to the east of the San Francisco Bay. The Proposed Action would be located in Building 71. Building 71 is in the northwest portion of LBNL, within Blackberry Canyon and within the Berkeley City limit. The building location and surroundings are shown in Figures 1 and 2.

The Proposed Action would be housed in Building 71, originally built in 1957 to support nuclear physics research, and integrated into the existing LOASIS\(^2\) Program laser research facilities. The approximately 9,000 SF Proposed Action area would be constructed mainly in existing space within the 53,700 SF, two-story building. Approximately 7,000 SF of interior space that currently comprises a highbay (for locating relatively tall equipment), dry laboratories, shops, and offices would be retrofitted to house the new BELLA research and development facility. The Proposed Action would also construct a stairwell and a Utility Room in an approximately 2,000 SF area on the roof of Building 71.

3. Proposed Characteristics/Components
a. Conventional Facility Work
   i. Room Designations
The Proposed Action includes remodeling space within the existing Building 71. This space comprises:

- A Laser Room where the BELLA laser would be located.
- Expansion of an existing Experimental Cave where the laser plasma accelerator and beam dump would be located.
- A Control Room would hold necessary equipment and staff for remote laser and accelerator operations.

\(^2\) Lasers Optical Accelerator Systems Integrated Studies.
FIGURE 2
AERIAL VIEW OF BUILDING 71 AND POSITION OF EXTERNAL MODIFICATIONS
III. PROPOSED ACTION AND ALTERNATIVES

♦ A Wipe-Down/Gowning Room would provide space to prepare people and equipment prior to entering the Laser Room.

♦ A Staging/Assembly Room would provide space to construct and outfit research equipment and components prior to moving them into the Laser Room.

♦ A Vestibule would reduce the amount of dirt and debris entering the Corridor leading to the Control and Wipe Down/Gowning Rooms.

♦ An Observation Room, Electronics Support Shop, and Optical Storage Facility would comprise the remainder of the support spaces.

♦ A new stairwell would provide access between the ground floor operational spaces and the rooftop Utility Room.

♦ The Utility Room would be constructed directly above the Laser Room and house the laser system’s power, cooling, and vacuum support modules. The Utility Room represents the only expansion of operational area associated with the Proposed Action.

ii. Mechanical Systems

The Proposed Action would include the installation of new mechanical systems for heating, ventilating, air-conditioning (HVAC), and humidification/dehumidification. Most of the mechanical equipment would be located in the utility chase between the ground floor ceiling and the roof of the building. Two or three new air handling units and their associated piping would be located on the Building 71 roof outside the Utility Room.

The existing Building 71 hot water, chilled water, and cooling tower water plants would provide the required HVAC heating and cooling water and laser chiller cooling water for the Proposed Action.

iii. Electrical and Instrumentation Systems

An extension of the existing electrical system would provide power to the Proposed Action components through a power distribution center and power outlets throughout the facility. Instrumentation includes systems that provide for controls, telecommunications, security, and safety.
Ⅲ. PROPOSED ACTION AND ALTERNATIVES

♦ Power Distribution: Power distribution for the Proposed Action would occur through a new 480V, 1,200A circuit breaker installed in an existing spare space in the Building 71 switchgear panel, to feed all of the Proposed Action electrical loads. Feeders from the distribution panel bus fed by the new breaker would serve new mechanical loads, 480/277V panel loads, 480-208/120V transformers, and 208/120V breaker panel loads. The main electrical loads would be the laser system, air handling units, analytical equipment, and lighting.

♦ Security System: The existing LBNL access control system would be extended to include the Proposed Action exterior doors and designated interior doors. System components to be provided at each door would include a proximity card reader, an electric lock, and a local siren.

♦ Laser and Accelerator Interlock System: A safety interlock system would be installed at points of entry to the Laser Room to provide a safe environment in which to operate the laser system. In addition, an interlock system in an existing experimental cave would be modified to provide additional radiation hazard protection for personnel in the expanded Experimental Cave area.

b. Laser System

The laser system would be installed on optical tables in the Laser Room. The laser system’s peak power level would be approximately 1 petawatt (1 PW = 10^15 W). Laser power, cooling, and vacuum pump modules would be installed above the Laser Room in the Utility Room. Pipe chases would be installed between the Utility Room and Laser Room to route power cables, piping for laser cooling, and vacuum hoses between the lasers and their support modules. The laser would feed the laser light pulses through an optical compressor to the final focus assembly that would be located in existing Experimental Cave 146A. This system would deliver to the final focus assembly short duration (40 femtoseconds^3) laser light pulses with an average energy level equivalent to that drawn by a 40-watt light bulb. (The final focus assembly is considered part of the ancillary systems.)

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^3 A femtosecond is 1 quadrillionth of a second, or 1/10^15 of a second.
c. Laser Plasma Accelerator System
The final focus assembly would focus the laser light pulses on the laser plasma accelerator, which would be located in the expanded Experimental Cave where the electron beam would be generated. The laser plasma accelerator would be approximately 1 meter in length by 3 centimeters in diameter, and would generate a 10 GeV electron beam. A dipole magnet would be located downstream of the accelerator to measure the electron beam’s energy level. Physical controls would maintain the electron beam within the optical transport to ensure its termination within a beam dump located at the west end of the Experimental Cave. The electron beam would have an average energy level equivalent to the power drawn by a 1-watt LED lamp.

d. Ancillary Systems
The laser light pulses would continue to the post-focus assembly.

Ancillary systems also would include a final focus diagnostic assembly located in the Laser Room and a post focus diagnostic assembly located in the Staging/Assembly Room. Ancillary systems would also include controls for operating the laser diagnostic systems as well as equipment and personnel protection systems located throughout the BELLA area.

4. Proposed Action Activities
Components 1 to 4 of the Proposed Action would take place during an approximately three-year period during 2009 to 2012. The duration of the construction period for Components 1 to 4 would take place over an approximately 18-month period, in the time framework 2010 to 2012, contingent upon funding and results of material sampling. Component 5 of the Proposed Action, operation of the laser and laser plasma accelerator for research and development, would follow and continue for an indefinite period thereafter.

University of California staff at LBNL would manage the construction traffic for the BELLA and other similar activities at LBNL through the Site Con-

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4 The laser plasma accelerator would be shaped similar to a common 3-foot-long fluorescent lamp.
struction Coordinator’s Office. To avoid any adverse effects to local traffic from construction, truck traffic due to the Proposed Action and all other construction and demolition projects at LBNL would be restricted to aggregate levels below significance thresholds. Those significance thresholds have been determined in a recent traffic engineering analysis that focused on LBNL cumulative truck traffic.\(^5\)

Apart from planning activities and actions to secure the site (e.g. locating and deactivating electrical lines as necessary), the main categories of Proposed Action activities would include the following:

- Clean-Out
- Removal of Hazardous Materials
- Demolition for New Construction
- New Construction
- Materials Disposition
- Staffing
- Research and Development Operations
- Decommissioning of the Proposed Action

Each of these Proposed Action activities is described in more detail below as well as in relevant sections in Chapter IV, Affected Environment and Environmental Consequences, of this document.

\textit{i. Clean-Out}

The clean-out phase of the Proposed Action would entail removal of all non-hazardous equipment and materials that are not an integral part of the building structure. This includes all research, shops, and office apparatus, tools, components, furniture, and paperwork that can be relocated or completely removed safely and effectively. Photographs of existing rooms in Building 71 that will be re-structured to contain the BELLA research and development program are presented in Figure 3.

A. Existing Room 195 to Become the Vestibule and Corridor

B. Existing Room 115 to Become the Experimental Cave

C. Existing Room 126 to Become the Staging Area and Assembly

D. Existing Room 131 to Become the Wipe-down and Gowning Room

E. Existing Room 128 to Become Part of the Laser Room

F. Existing Room 146 to Become Part of the Laser Room

FIGURE 3
BUILDING 71 INTERIOR SHOWING LOCATIONS OF PROPOSED BELLA FACILITIES
The active functions in this area that would be moved to different locations at LBNL include the Gould Research Group and LOASIS Electronics Support Shop. The Gould Research Group currently occupies approximately 1,500 square feet of space used occasionally for laser research, office, and equipment storage. This function would be moved elsewhere in Building 71 or to a different building to be determined. The LOASIS Electronics Support Shop occupies approximately 600 square feet of space used for assembly, testing, repair, and storage of electronics equipment. This function would be moved to a different location within the Proposed Action area. Equipment and materials remaining after the clean-out would be disposed of in accordance with LBNL recycling and excess materials policies and programs.

ii. Removal of Hazardous Materials
As part of the LBNL Environment, Health and Safety program, sampling and instrument surveys are conducted at various facilities, including Building 71, to characterize the types, locations, and degree of chemical or radiological contamination. Such monitoring would be continued at Building 71 during the Proposed Action. Potentially contaminated items would be screened and characterized based on their location and the associated degree of potential hazard. Other types of hazardous materials also could be encountered. For example, many surfaces to be demolished are painted with lead-containing paint. All disposable materials would be shipped by truck to previously identified and approved disposal sites. Trucks would be covered to prevent escape of dust or other material in accordance with LBNL standard operating procedures.

Approximately 10 percent of the shipments of materials generated by the Proposed Action would be expected to have some hazardous characteristics. Their selection and disposal, in line with LBNL Standard Operating Procedures, is discussed in more detail in Section IV.B.1, Hazards and Human Health.

iii. Demolition for New Construction
Preparing Building 71 for the Proposed Action would require demolition of structural, non-structural, and mechanical systems. Demolition of all non-structural walls and selective demolition of concrete shear walls would occur
within the designated area. Structural demolition would also include removal of two roof support columns and approximately 2,000 square feet of roof area to construct the Utility Room and a new stairwell. An all-new structural support system for the roof will be added during the New Construction phase. An existing shear wall would be demolished and replaced with a new shear wall designed to support the new Utility Room. Additionally, some existing slab-on-grade concrete floor would be demolished and soil removed to accommodate the new foundations for the concrete walls and ceiling of the Experimental Cave expansion. A Soil Management Plan is required for all excavations of soil at LBNL and would prescribe soil handling and sample collection procedures.

Mechanical systems and components requiring demolition would include all heating, ventilating, and air conditioning equipment, piping and ductwork, as well as fire and sprinkler process piping. Associated existing electrical equipment, panels, conduit, and wiring found throughout the area would also be demolished.

Systems and components would be disassembled using such means as pneumatic impact tools, saw cutting, and possibly torch cutting. The general sequence of demolition activities would be: (1) identification and isolation of building elements to be demolished; (2) removal of all hazardous materials; (3) demolition of the architectural, mechanical, electrical, and plumbing systems and components; and (4) segregation and disposal of the debris.

iv. New Construction

Construction of Proposed Action conventional facilities would begin approximately mid-2010 and end approximately late-2011 or 2012. Staging for construction would take place on the adjacent parking lot immediately west of Building 71.

The Proposed Action would require removal of approximately 100 cubic yards of soil to accommodate the footings of the Experimental Cave. New structural support piles would reach a maximum of approximately 16 feet below floor level, all underneath the existing Building 71 footprint. The soil would be tested for the presence of contamination. If found to be contami-
nated, the soil would be kept in covered storage before being transferred to an appropriate off-site landfill. If found to be clean, some material could be stored on-site (provided space is available at that time) and used for dressing finished slopes and for use in landscaped areas. Clean soil in excess of requirements for on-site fill and landscaping would be hauled off-site to a landfill.

Groundwater entering the holes dug to form the structural support piles would be collected and tested for contaminants. If no contaminants are found, groundwater would be discharged to the storm drain. If contaminants are found, the groundwater would either be treated at the LBNL site and discharged to the sanitary sewer under the conditions of an existing East Bay Municipal Utility District permit or sent to an off-site facility that is permitted for disposing of contaminated groundwater.

The Proposed Action would not require the removal of any trees to accommodate construction activities. Additionally, no new impervious surface would result from the completion of the Proposed Action.

The construction of the Laser Room, Experimental Cave, Utility Room and all other support spaces included in the Proposed Action would involve standardized methods and materials and be performed in accordance with Standard LBNL specifications for code compliance, worker safety, and technical requirements.

On-site construction of the laser system, ancillary systems, and associated appurtenances would take place over an approximately year-long period, beginning approximately late-2011. The laser plasma accelerator system and the beam dump would be designed, built, and installed by LBNL scientific and engineering staff following laser system acceptance, beginning approximately late-2012.

v. Materials Disposition
The Proposed Action would include the removal of approximately 60 to 100 tons of reinforced concrete, structural steel, mechanical and electrical equipment, roofing, other building materials, and soil. The soil for removal would
be excavated under a portion of Building 71’s concrete building floor. Over 90 percent of the shipments of materials that would be generated by the Proposed Action would consist of non-hazardous debris and other items typical of building demolition proposed actions.

Approximately 100 total truck trips would be generated by the Proposed Action, based on the following approximations: 15 trips would transport concrete, soil, steel, and miscellaneous demolition debris for recycling and disposal (including one anticipated truck trip to a licensed hazardous waste disposal facility); 65 trips would transport construction materials to Building 71; and 20 trips would transport research and development equipment for the laser system, ancillary systems, and components associated with the accelerator. The combined truck trips would be temporary, with average weekly traffic during demolition, construction and the initial setup of the research and development equipment phases of the Proposed Action amounting to 1.5 trips per week. However, during the anticipated, one-week truck traffic peak period at construction mobilization, 1 truck trip per day is expected. On-site workers, who would number up to 30 per day, would be encouraged to carpool, although limited parking would be provided. In total, the generation of truck trips and traffic would be temporary, and occur at a level far below the significance threshold for LBNL-related traffic impacts.

All truck trips would follow prescribed truck routes and would comply with all relevant transportation and safety regulations and protocols. Low-level waste, hazardous waste removal, transport, and disposal would follow all applicable federal, state, and environment, health, and safety regulations and protocols.

vi. Staffing
Building 71 currently has approximately 60 occupants. Buildings 71, 71A, and 71B combined currently have approximately 75 occupants. When all of the 71-series trailers are included, the Building 71 Complex has approximately 120 occupants. Approximately five to ten new staff and students would be added to the LBNL employee population as a result of the Proposed Action. Staff would include scientific, technical, and administrative personnel and visiting scientists.
vii. Research and Development Operations
Proposed Action activities would include operation of the laser and the laser plasma accelerator for research and development. Prior to operations, LBNL will prepare, and DOE will review and approve, a Safety Analysis Document (SAD) and Accelerator Safety Envelope (ASE) in accordance with DOE Order 420.2B to ensure the facility’s safe operation. Possible occupant exposure to hazards from radiation is discussed in Section IV.B.1 on Hazards and Human Health, including radiation exposure risk from the laser plasma accelerator.

viii. Decommissioning of the Proposed Action
Eventual decommissioning of the BELLA laser, laser plasma accelerator, and ancillary systems following the end of research and development at the facility may involve the removal of small amounts of low level radioactive waste which would be sent to an offsite DOE-approved disposal facility. All decommissioning and removal activities would follow all applicable Federal, State, and LBNL-specific regulations and protocols, and such activities would be overseen by appropriate Environment, Health, & Safety technical experts. Decommissioning and removal activities are expected to involve approximately the same level of activity (or less) than construction of the same Facilities under this Proposed Action.

B. Alternatives

In accordance with the National Environmental Policy Act (NEPA), Section 102 (2) (E), reasonable alternatives for the construction of the proposed project must be considered. These include a “No-Action Alternative” against which all the other alternatives and their impacts are compared. A discussion is also included on alternatives considered but rejected as infeasible.

1. No-Action Alternative
The “No-Action” Alternative would preclude efforts to build this experimental laser plasma accelerator system and would avoid any environmental consequences. This alternative would not meet the mission objective. If this
technology is not developed it would not become an option to constructing and operating large, conventional accelerators to meet future needs.

2. **Location Alternatives Considered but Rejected**

Several alternatives for installing and operating the BELLA research and development program in other existing buildings that would be appropriate for use as an accelerator facility were considered. However, each of these options has its own drawbacks:

- Building 51, the former Bevatron accelerator location, is currently vacant and has historically housed accelerator work, but is not seismically safe. It is currently being demolished.

- Building 77 houses mission-critical engineering shops that would be displaced if BELLA were located there. Unlike Building 71, Building 77 was not originally built to house accelerators and lacks the proper building infrastructure, such as electrical capacity, that would be needed. In addition, this building currently is completing a major renovation designed to serve its intended engineering support function.

- Building 88 is the location of the 88-inch cyclotron, which is an active accelerator. However the building does not have adequate spare space for the Proposed Action.

- Building 25 currently is vacant and has historically housed accelerator work, but is not seismically safe. There are current plans for its demolition.

Environmental effects would in general be similar, if BELLA were built in any of these other buildings, as the construction would still be inside an existing building.

The option of constructing a new building for the Proposed Action was rejected on grounds of considerably greater cost. It also could be expected to have greater environmental impacts due to extensive construction activities, including utility extensions, on land that currently is undeveloped.
Off-site locations such as leased space were also considered. These were rejected because vacant accelerator facilities in the area are uncommon, and a large perimeter around the building might have to be leased and secured to provide an equivalent amount of protection from potential risk of radiation exposure to the public.

3. Design Alternatives
The LOASIS group within the Accelerators and Fusion Research Division (AFRD) at LBNL has spearheaded the development of the Proposed Action starting in 2007. During that period, they investigated several laser plasma accelerator design alternatives to meet the mission objective.

The proposed configuration is a new high-repetition rate petawatt-class laser system that would be procured from private industry. This was found to have the lowest technical risk, the lowest initial cost, and the highest value in terms of resulting research capability for the expenditure. This alternative maintains all existing LOASIS research capabilities and provides a new tool to advance the scientific program for laser plasma accelerators for years to come.

The following three alternative designs were considered and compared to the chosen design but rejected for the reasons described.

- A pump laser technology using Nd:glass instead of the conventional high-repetition rate Nd:YAG systems was explored. Up to ten of these systems would be needed and new technology would have to be developed to avoid damaging the laser amplifiers. The estimated cost of this alternative laser system is more than three times higher than the proposed configuration cost.

- A 10x scaling of an existing Chirped Pulse Amplifier system with off-the-shelf pump laser technology would require approximately 120 pump laser units. The optical layout, management of beam paths, and utility distribution of these pump lasers would result in an extremely complex,logistically unmanageable system, and would require a space about 4-times larger than the proposed laser system.

- Upgrading the existing TREX laser in Building 71 to the equivalent power output would result in approximately three years of down time for this system and prevent LOASIS from meeting mission-critical re-
search commitments. Also, the existing TREX front-end is 14 years old and would need replacement to maintain reliability. Effectively, the cost savings would be minimal at best and the loss to research capabilities would be extensive.

As no reasonable design or location alternatives exist, this EA evaluates only a No-Action Alternative in addition to the Proposed Action.
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IV. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

A. Issues Determined not to Warrant Further Discussion

The Proposed Action, the acquisition and installation of the BELLA laser and laser plasma accelerator and the operation of the laser and laser plasma accelerator for research and development, would occur almost exclusively within existing Building 71. In general, issues concerning the installation are minor as the demolition and construction work is largely confined to the internal remodeling of an existing building which would restrict any environmental consequences. Most construction equipment would be located inside the building. Construction staging would take place on an existing paved area. The Proposed Action would therefore not measurably affect any biological resources (including wildlife and habitats, threatened or endangered species, surface water, wetlands, floodplains, rivers, forests, farmland or other natural resources) during construction or operation.

The Proposed Action would improve Building 71’s ability to withstand a seismic event. The active Hayward Fault, a branch of the San Andreas Fault System, runs from northwest to southeast along the base of the hills at the western boundary of LBNL. The inactive Wildcat Fault traverses the site from north to south along the canyon at the Laboratory’s eastern edge. Work completed in 2009 restored the seismic stability of the building to standards for safe occupancy and the conduct of operations. The Proposed Action would further enhance the structural system supporting the Utility Room to meet current building codes for seismic stability.

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A portion of the slope to the northeast of (but not adjacent to) the Proposed Action area is of “medium risk” for slope instability occurring at some point in the future. From time-to-time, there are small, shallow surface slides that deposit soil and rock on the roadway separating Building 71 from the hillsides to the north and east, but these cause no damage to the building. Deposits from these surface slides are easily removed and the vacated hillsides are typically filled in with retaining wall rock to prevent further erosion. As such, the hazards to Building 71 or the Proposed Action from soil and rock sliding off of the adjacent hillside are not considered substantial.

Relevant issues resulting from demolition/construction and operation of the equipment to conduct research and development activities are discussed further below. Information on existing environmental conditions is taken from the 2006 Long Range Development Plan (LRDP) and/or the LRDP Environmental Impact Report (EIR) except where otherwise stated.

B. Issues for Further Discussion

1. Hazards and Human Health

The Proposed Action would present potential hazards during the demolition phase and from operation of the BELLA laser and laser plasma accelerator for research and development. These hazards have been identified and are the same as those encountered on other conventional construction projects and other accelerator operations at LBNL. The Laboratory has policies and procedures to address and minimize such hazards.

LBNL hazard prevention and mitigation policies and procedures are defined in the Laboratory’s Health and Safety Manual, Publication-3000. During demolition, any hazardous materials would be handled in accordance with LBNL Standard Specifications 026113-Excavation and Handling of Contaminated Material, 028200-Asbestos Abatement, and 028300-Lead Abatement. A licensed asbestos abatement professional would remove asbestos-containing materials, a process to be overseen by asbestos-certified LBNL staff. Radioac-

tive waste would be transported to the LBNL Hazardous Waste Handling Facility (HWHF) in Building 85 and disposed of in accordance with LBNL Publication 3692, Guidelines for Waste Generators to Meet HWWF Acceptance Requirements for Hazardous, Radioactive, and Mixed Wastes at Berkeley Lab.

a. Chemical and Radioactive Release during Demolition

A screening survey was conducted to determine if hazardous materials are present in the sections of Building 71 to be affected by the Proposed Action. This screening survey followed the LBNL Environment, Health and Safety (EHS) program sampling protocol for chemical and radiological contamination. Any radioactive materials were identified and classified following volumetric sampling and external radiation measurements using survey instrumentation and swipe samples, as appropriate, per DOE sampling protocol defined in DOE Order 5400.5 Radiation Protection of the Public and the Environment.

Surfaces that are newly-exposed during demolition and thus not screened in the original survey, such as the under-side of cabinetry, will be screened for chemical and radiological contamination. Any contamination discovered during demolition activities is anticipated to be localized and in trace quantities. Decontamination is not anticipated to involve any risk of releases to the environment. The following hazardous materials are known or are likely to be present in the Proposed Action area:

♦ **Asbestos.** Building 71 was built at a time when asbestos was common in construction materials. Various types of lung cancer and other serious health problems are attributed to asbestos fibers, which may become airborne when disturbed. Inhalation of airborne fibers is the primary mode of asbestos entry into the body, making friable (easily crumbled) materials the greatest health threat. The screening survey has shown that the floor tiles, tiling mastic, and sheetrock compound in the area contain asbestos.

♦ **Lead.** The architectural and structural elements of Building 71 to be demolished as part of the Proposed Action, and any settled dust, are assumed to be coated with lead-based paint. Lead is a hazardous neuro-
toxin that accumulates in soft tissue over time and may cause serious blood and brain disorders. The sheet vinyl flooring is known to contain lead.

♦ Beryllium. Beryllium has a direct corrosive effect on tissue, and it is also capable of producing a chronic life-threatening allergic disease called berylliosis in susceptible persons. Beryllium was detected in an existing cabinet during the screening survey and was cleaned in accordance with LBNL standard procedures. The area has since been re-sampled and no beryllium found above acceptable levels requiring mitigation defined in the LBNL EH&S Manual PUB-3000.

♦ Poly-Chlorinated Biphenyls (PCBs). The demolition component of the Proposed Action would include removal of some existing Building 71 electrical equipment including transformers, switchgear, distribution panels, conduit, wiring, and lighting. The transformers and lighting ballasts could contain PCBs which are known to cause cancer in animals and a variety of immune, reproductive, nervous, and endocrine system problems in humans. All known PCBs have been removed from Building 71, so the risk of encountering additional PCBs is very low.

♦ Radioactive Materials. The Building 71 complex housed the Super HILAC and associated support facilities. The Super HILAC has not been in operation since 1993. As a consequence of this historic operation, several instances of low-level surface radioactivity have been detected on existing Building 71 equipment. This radioactivity includes the following:

• Americium-241 has been found in trace amounts on the outer surface of a 3-foot section of fire sprinkler piping and on legacy experimental equipment. Americium is a synthetic, radioactive element most commonly used as a source of ionizing radiation in household smoke detectors.

• Cesium-137 has been found in trace amounts on legacy experimental equipment and on the floor in the former experimental areas.

8 Lower than the radioactivity found in a common home smoke detector
b. Radiation Produced by Operating the Laser Plasma Accelerator

The Proposed Action would accelerate electrons in a laser plasma accelerator to an energy level of 10 GeV. When the electron beam terminates in the beam dump, its energy would be converted to radiation in the form of gamma-rays, neutrons, and photomuons. The system and infrastructure would be designed to absorb the electron beam radiation to a level where a full-time worker positioned outside the Experimental cave at the point of highest exposure (next to the beam dump) would receive less than 20% of the radiation allowed by the regulatory limit over the course of the year. Since radiation levels diminish by a factor of four as distance from the source doubles, there is no foreseeable risk of radiation exposure above regulatory limits outside of Building 71 and the Laboratory site boundaries.

Several features of the system design would minimize personnel exposure to radiation. Limited access, engineered interlocks, and safety controls would prevent accelerator operation while the Experimental Cave was occupied. The Experimental Cave concrete wall would be 3 feet thick at the west end where the electron beam would terminate. There would be an additional 16 inches of lead, 36 inches of steel, and another 6 feet of concrete to absorb the radiation and reduce exposure levels outside the Experimental Cave for LBNL personnel in accordance with 10 CFR Part 835, Occupational Radiation Protection.

The north and south walls and the roof that are perpendicular to the electron beam direction would be 18 inches thick. Active radiation monitors outside

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the shielding (wall and roof) would be installed to confirm the performance of the shielding. The Experimental Cave would be located directly above solid ground so human exposure to radiation below this room would not be possible.

These features would ensure that radiation doses to workers and the general public are maintained below regulatory limits, which are 5 rem per year for trained radiation workers\textsuperscript{10} and 100 mrem (0.1 rem) per year for members of the public.\textsuperscript{11} The administrative procedures, shielding design, and monitoring/shutdown systems incorporated within the Proposed Action would ensure compliance with 10 CFR Part 835, *Occupational Radiation Protection* for radiation exposure and DOE Order 5400.5. LBNL’s commitment is to use As Low As Reasonably Achievable (ALARA) to ensure that doses to workers and the public are kept well below regulatory limits.

c. Potential Eye Injuries from Laser Use
The hazard of greatest concern when using lasers of this type is eye safety. Exposure to direct or reflected beam can cause eye injury, skin burn, or ignition of clothing. The dangers would be reduced through use of optical shielding, physical beam controls, and administrative measures. Administrative measures include national standards, such as American National Standards Institute (ANSI) Z136.1, and procedures outlined in the EH&S Manual (Pub 3000, Chapter 16 – Lasers), as well as site-specific reviewed and approved operating procedures (an Activity Hazard Document). The Proposed Action would implement precautionary protocol with respect to eye safety, which would minimize human health risks.

d. Fire and Explosion Risk from Operating the Laser Accelerator
The risk of fire and/or explosion from operating the BELLA laser and laser plasma accelerator is essentially the same as that from any other piece of manufacturer-built electronic research equipment. The equipment is constructed to operate safely and to withstand repeated use and a variety of oper-

\textsuperscript{10} Title 10 CFR, Part 835-Occupational Radiation Protection.

\textsuperscript{11} United States Department of Energy, Order 5400.5, Radiation Protection of the Public and the Environment.
ating conditions. There would be no flammable material in the path of the laser beam or the electron beam. The fire sprinkler system serving the area which encompasses the Proposed Action would be upgraded to meet current fire safety codes. Consequently, there would be no change to the risk from fire and explosion as a result of the Proposed Action.

e. Chemicals used during Operation
The quantity of the following optical surface cleaning solvents stored for use during operations by the BELLA research and development program is anticipated to be less than 1 gallon each: methanol, ethanol, isopropyl alcohol, and acetone. Due to the limited quantities of these chemicals, there would be no adverse impacts related to toxic waste generated as a result of the Proposed Action.

f. External Radioactive Sources used during Operations
Operations during the Proposed Action would include the handling of small amounts of radioactive materials in sealed sources used for calibrating safety monitoring devices, the use of which is governed by LBNL standard operating procedures. Existing sealed sources currently used by the LOASIS program would be used for the Proposed Action operations. No new sealed sources are anticipated to be added to the building as a result of the Proposed Action. Also, no additional sources of radiation would be used in conjunction with the laser plasma accelerator. (For example, there would be no use of targets in the electron beam path.)

2. Hydrology, Water Quality and Soil
Low levels (tens of micrograms per liter) of various volatile organic compounds (VOCs) are present in groundwater emanating in a historic plume from Building 71B. However, this is downgradient of the BELLA construction site.

Radioactive curium-244 was released to the environment accidentally in 1959 as a result of research activities being conducted within Building 71 at that time. Curium-244, which has a half-life of approximately 19 years, was found at very low levels (maximum activity of 2.6 pCi/g) in soil around the building.
during investigations in 2003. Analysis of groundwater samples taken from around Building 71 in 2003 did not detect measurable levels of curium-244. As a result, the DOE approved a No Further Action (NFA) status for the radiation release.\(^\text{12}\)

Holes dug to construct drilled piers to support the Experimental Cave walls and roof would reach a maximum of approximately 16 feet below floor level. A Soil Management Plan is required for all excavations of soil at LBNL and would describe soil handling and sample collection. For BELLA, the removed soil would be sampled and analyzed for hazardous substances such as: VOCs, toxic metals, PCBs, gross alpha/beta-radiation, curium-244, cesium-137, and americium-241. If found to have no more than naturally-occurring radioactivity levels, the soil would be used at LBNL as needed or disposed of in an appropriately-licensed commercial landfill. If found to contain contamination above regulatory levels, the soil would be stored in a covered on-site area before being transported to appropriate offsite facilities.

3. Energy Use and Greenhouse Gases
   a. Electricity

LBNL purchases electrical power from the Western Area Power Administration (WAPA), and it is delivered to LBNL by the Pacific Gas and Electric Company (PG&E). PG&E delivers electricity via the on-site Grizzly Substation through two overhead transmission lines with a total capacity of 100 Megawatts. A secondary source, the UC Berkeley’s Hill Area Substation, provides power as a backup in the event of a power failure from the primary source. According to the LBNL Energy Manager, 70,458 megawatt hours (MWh) of electrical energy was consumed at LBNL in 2008 with a maximum demand of approximately 13 megawatts. The existing infrastructure would allow a maximum of 50 megawatts with complete system backup.

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As a result of the Proposed Action additional electrical energy would be consumed by the laser system, chiller, air handling units, analytical equipment, the cooling tower, and lighting. In total, the new electrical energy usage is projected to range from 500,000 to 600,000 kilowatt hours per year, less than a one percent increase in the Laboratory’s annual electrical consumption. As Building 71 was originally built to house accelerators, the building infrastructure is already suitable to handle loads five times greater than those that would be required for the Proposed Action. Therefore, the Proposed Action would not be expected to cause an adverse impact to the electrical supply and distribution system.

b. Natural Gas
Natural gas for the Proposed Action would be used for space heating. Natural gas at LBNL is purchased from the Defense Fuel Supply Center and is delivered by PG&E through a 6-inch high-pressure pipe system. This system connects to the LBNL distribution system at a meter vault near the Laboratory’s Blackberry Gate. The LBNL distribution system consists of 4- and 6-inch high pressure lines that are all equipped with earthquake emergency shut-off valves and pressure reducing stations. In 2008, approximately 1.8 million therms of natural gas were consumed at LBNL. Additional natural gas usage as result of the Proposed Action is projected to range from 15,000 to 17,000 therms/year, less than a one percent increase in LBNL’s annual natural gas consumption.

The existing supply and distribution infrastructure for natural gas would be adequate to accommodate the Proposed Action, and therefore DOE does not expect an adverse impact to the natural gas supply and distribution system.

c. Renewable Energy Sources
Three percent of the energy at LBNL is purchased from green energy sources, as defined by DOE. In addition, approximately 20 percent of the purchased power at LBNL is generated by hydro-electric plants. There is a commitment at LBNL to increase the purchase of energy from green energy sources to 7.5 percent beginning in 2010 and into the foreseeable future.
d. Greenhouse Gases from Energy Use
Greenhouse gas (GHG) emissions would be generated as a result of the additional electrical energy and natural gas consumption described above. New GHG emissions would total approximately 480 metric tons of carbon dioxide equivalents (MTCO$_2$e) annually according to DOE calculations.$^{13}$ This additional GHG emissions contribution would be less than a one percent increase over 2008 LBNL emissions of MTCO$_2$e for electricity and natural gas. In addition, it represents 0.6 percent of comparable electricity and natural gas GHG emissions from neighboring UC Berkeley, emissions that totaled 71,913 MTCO$_2$e in 2007.$^{14}$ This additional amount of GHG emissions that would result from the Proposed Action is not substantial relative to the amount of GHG emissions currently generated by LBNL, UC Berkeley and the surrounding region, and DOE does not expect an adverse impact to result.

4. Other Utilities
a. Water
Water service at LBNL is distributed and supplied by the East Bay Municipal Utility District (EBMUD). Water enters through a gravity-fed, loop distribution system that enables water operations to continue through water system maintenance activities. In addition to this distribution system, three 200,000-gallon water tanks are maintained at LBNL to supply water in the case of an emergency. Less than 10 percent of the water capacity at LBNL was consumed in 2008.

The Proposed Action would increase water usage at LBNL by less than one percent with most of this consumption due to the operation of the cooling tower. There would also be a marginal increase in personal water demand as there would be a slight increase in new employees at LBNL resulting from the Proposed Action. Overall, the Proposed Action would not be expected to adversely affect water supply and distribution systems.

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$^{14}$ University of California, Berkeley, *UC Berkeley 2020 Long Range Development Plan Amendment and LRDP EIR Addendum to Address Climate Change*, June, 2009.
b. Solid waste
The demolition phase of the Proposed Action would entail the removal of 60 to 100 tons of construction waste, including reinforced concrete, structural steel, mechanical and electrical equipment, roofing, other building materials, and soils. Approximately 10 percent of these materials is anticipated to have hazardous characteristics, and the disposal of these materials is discussed in Section IV.B.1, Hazards and Human Health, of this chapter.

The other 90 percent of the demolition materials would be disposed of by the contractor according to the standard operating procedures defined in LBNL Standard Specification Section 017419-Construction Waste Management. Prior to the start of demolition, landfills would be consulted to ensure that sufficient capacity is available to accept the amount of waste generated by the Proposed Action. DOE anticipates no adverse impacts to landfill capacity from disposal of Proposed Action construction debris.

Items removed during demolition would be reused and recycled as much as practicable. Any active functioning equipment in Building 71 that would need to be removed would be relocated for future use. Equipment that is beyond its useful life would be disposed of according to the LBNL recycling and excess materials policies and programs. All recyclable materials, including metals, would be screened for hazardous materials pursuant to DOE specifications and delivered to appropriate recycling centers according to the LBNL standard operating procedures. The disposal of scrap metals would be subject to the DOE Metals Moratorium. Concrete may be sent to commercially operated locations throughout the region to be broken into rubble for use as fill in other construction projects and road building.

Non-recyclable materials removed from the site would be segregated and taken to a landfill such as the Altamont Landfill in Livermore, California. The 80 to 100 cubic yards of soil that would be removed to construct the Experimental Cave drilled piers would be stockpiled at LBNL for use in dressing finished slopes and landscaping on-site if possible, or otherwise hauled to a landfill. The soil would first be tested as described in the Hydrology, Water Quality and Soil section.
Even if nothing were sent for recycling and reuse, the quantity of demolition materials and the soil would not be expected to substantially affect Altamont Landfill capacity. Therefore, the Proposed Action would not adversely impact solid waste disposal systems.

c. Wastewater
The LBNL sanitary sewer system connects to the City of Berkeley’s public sewer system and flows to the EBMUD treatment facility in Oakland, California. To do this, effluent from Building 71 flows through the sewer main on Hearst Avenue.\textsuperscript{15} This connection is functioning within capacity.

The sewage system is at highest capacity during wet weather conditions, because aging sewer infrastructure can collect stormwater runoff. Sanitary sewer infrastructure at LBNL has been replaced over the last 15 years and has reduced discharge volumes by 50 percent. The peak daily flow of wastewater from LBNL during wet weather was approximately 821,000 gallons per day (gpd) in 2006. The peak is anticipated to grow to 893,000 gpd by 2025, which is within the capacity of the existing wastewater system and leaves additional capacity for future growth.\textsuperscript{16} Therefore, DOE would not expect the Proposed Action adversely impact wastewater infrastructure and treatment capacity.

5. Visual Quality
Building 71 is one of several buildings at the northwestern portion of the LBNL site (Figure 1). Surrounding land uses include residential uses to the north of the LBNL property line near Grizzly Peak Boulevard; and LBNL buildings to the south, east, and west, including the Bevatron, which is currently being demolished.

Building 71/71A is a complex of low-lying, grey, interconnected box-like structures (Figure 2). Building 71B is a separate structure south of 71/71A. A

\textsuperscript{15} Facilities Division, Lawrence Berkeley National Laboratory, University of California, 2006, \textit{2006 Long Range Development Plan}, page 83.

\textsuperscript{16} Facilities Division, Lawrence Berkeley National Laboratory, University of California, 2006, \textit{2006 Long Range Development Plan}, page 84.
variety of trailers (Building 71 trailers) are located to the south of Building 71 and west of 71B. A one-lane paved road runs along the north of the building complex.

Building 71 sits on a plateau with a general downslope view. As shown in Figure 4, the Proposed Action site is surrounded by parking areas, roadways, other LBNL research structures, and an undeveloped hillside. The associated parking areas immediately west of Building 71 would be used as a staging area for construction. The area directly upslope from Building 71, to the north and east, is vegetated with tall trees, mostly clusters of Eucalyptus and some Oak trees, and grassland. Close-up views of the Building 71 roof (Figure 5) show corrugated metal, grey roofing materials, wooden stairs and metal piping.

Building 71 is located in a portion of Blackberry Canyon that is partially visible from nearby private single-family residences to the north. To the west of the Lab are residential neighborhoods, comprised of single- and multiple-family homes. The nearest residences to Building 71 are approximately 448 feet to the west and north. The Lawrence Hall of Science is approximately 516 feet to the east.

Views of Building 71 and the staging area would be available from short-range distances (Figure 6) although, due to the topography and the presence of many large trees, there are limited and filtered public viewpoints of the Proposed Action site. Figure 4 marks vantage points 1 through 3 from the hillside above Building 71. A description of the views available from each vantage point is described below:

♦ Vantage Point 1 looks over the hillside from northwest of the Lawrence Hall of Science parking lot and provides limited views of the roof on Building 71, through and between clusters of trees.

♦ Vantage Point 2 offers limited views of the roof from the western edge of the plaza at the Lawrence Hall of Science.
FIGURE 4

VANTAGE POINTS OF BUILDING 71 ROOF MODIFICATIONS AND CONSTRUCTION STAGING AREA
A. Building 71 roof area to be altered

B. Building 71 roof area to west showing variety of existing roof structures
A. Vantage Point #1

C. Vantage Point #2

D. Vantage Point #3

FIGURE 6
VIEWS FROM SELECTED VANTAGE POINTS
LOOKING TOWARDS BUILDING 71
IV. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

♦ From Vantage Point 3 near Olympus Avenue, potential views of the roof and the staging area are buffered by a dense stand of existing eucalyptus trees and are therefore not available.

Approximately 7,000 square feet of the existing 53,700-gross-square-foot two-story building interior space of Building 71 would be gutted and remodeled, leaving the footprint of the existing structure intact. The Proposed Action would result in two additional structures on the roof, the Utility Room and the stairwell, (Figure 2) and approximately two or three new rooftop air handling units. Construction activities affecting the roof would be temporary, lasting approximately three months. Although the equipment and Utility Room would slightly alter the appearance of the Building 71 roof, these features are not expected to substantially alter or degrade the existing viewshed.

The Utility Room would be approximately 60 feet long by 20 feet wide and 10 feet high. This height would be the same as the roofs to the south, east, and north to be consistent with the existing roof contours. The stairwell would be of varying height up to 10 feet. The Utility Room and stairwell would be built in the same architectural style and color as Building 71 in order to diminish its visual impact. The new rooftop mechanical equipment would be similar to existing equipment being demolished. These improvements would blend in with the existing roofing materials and the addition of these roof elements would not be expected to substantially change the existing viewshed or views of the building.

6. Air Quality
The Bay Area as a whole does not meet State or federal ambient air quality standards for ground level ozone (O₃) or State standards for particulate matter (both particulate matter greater than 10 microns in diameter, or PM₁₀, and particulate matter between 2.5 and 10 microns, or PM₂.₅). Because of this, projects that would generate O₃ precursors, or considerable dust or other sources of particulates, are under increased agency scrutiny.

Demolition and construction included in the Proposed Action would be almost entirely within the existing building shell. Therefore the majority of
the dust generated by demolition would be contained. An exception to this would be a period of around one week when a hole would be cut through the metal and concrete roof for the construction of the rooftop additions such as the Utility Room and stairwell. LBNL Standard Specification Section 024116 – Structure Demolition would be enforced to restrict the amount of dust to minimal levels.

Ventilation air that is warmed in the process of maintaining temperature control would be exhausted from the Utility Room and from the rooftop HVAC air handlers serving the interior spaces. This is not expected to cause any adverse consequences and therefore the operational impacts to air quality would be minor.

Another source of emissions would be temporary diesel emissions from trucks traveling to and from the site during the construction period. As indicated in the Proposed Action and Alternatives Section 4.a.v, Materials Disposition, approximately 100 total truck trips would be generated by the Proposed Action. The combined truck trips would be temporary, with average weekly traffic during demolition, construction and the initial setup amounting to 1.5 trips per week, or less than one trip per day. During the anticipated, one-week truck traffic peak period at construction mobilization, one truck trip per day is expected.

The Laboratory considered the health impacts from air emissions exhausted from heavy-duty diesel powered vehicles traveling through the streets of Berkeley when it conducted its human health risk assessment for its 2006 LRDP and EIR. As part of this assessment, LBNL modeled its bus routes around campus and through downtown Berkeley for both existing conditions (i.e. year 2000) and future year LRDP conditions. The Laboratory’s buses are in a comparable class of vehicles for emissions analysis purposes as trucks expected to visit the site during construction of the Proposed Action. The diesel particulate matter emissions from both types of vehicles are comparable and any differences are considered minor.17 The ensuing risk results from the

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17 Emission estimates along the bus routes were derived using the California Air Resources Board’s most recent EMFAC model.
LBNL bus route modeling therefore serve as a reliable indicator of the risk that could be expected from construction vehicles traveling through Berkeley as well.

Two adjustments were made to the modeling to ensure that the outputs were useful in terms of assessing adverse health effects from diesel emissions. The first adjustment involved exposure duration. For the human health risk assessment, all off-site receptors, including sensitive receptors, were assumed to be exposed to the predicted diesel particulate matter concentrations for essentially 70 continuous years (i.e. 350 of 365 days each year). This follows standard industry risk assessment methodology. In the case of construction traffic for the Proposed Action, the exposure duration would be considerably less at 18 months, which is 2.1 percent of the 70-year time period.

The second adjustment relates to the daily activity level of heavy-duty diesel-powered vehicular traffic. The risk modeling of the Laboratory’s bus route assumed approximately 100 round trips per day. Truck traffic estimates for the Proposed Action are one trip per day for a one-week peak period, but otherwise 1.5 truck trips per week, on average. Therefore, the volume of truck traffic during the 18 months of construction for the Proposed Action would be approximately 1 percent of the volume that was modeled for the Lab’s health risk assessment.

The maximum estimated risk under the 100 round trips a day scenario was approximately 25 in 1 million (.0025 percent). In that truck trip volume would be one percent or less of the volume modeled under the health risk assessment, the health impact due to diesel emissions would be much less than the cancer risk significance threshold of 10 in 1 million. In addition, these trips would be temporary in nature and would cease following completion of facility preparation activities. During ongoing operation and maintenance of the facility, truck trips to the site would be even fewer and limited to those required for maintenance and certain deliveries. As a result, diesel emissions from truck trips during construction would not be expected to cause adverse health effects.
7. Noise

For construction and demolition projects at LBNL, the University voluntarily observes whether City of Berkeley and the City of Oakland noise ordinances would be exceeded. These noise ordinance limits identify the maximum permissible noise at receiving property lines, although these ordinances do not legally apply to LBNL. The closest houses in the City of Berkeley are in a residential area zoned R-1H for which the daytime noise level limit (7 a.m. to 11 p.m.) at the property line is 55 dBA\(^{18}\) for stationary source, not to be exceeded for more than 30 minutes of any hour. The maximum acceptable noise level for mobile equipment, including construction vehicles that would travel to and from the Proposed Action site, is 75 dBA.

The 2006 LRDP EIR included a noise measurement of 60 dBA for the Leq\(^{19}\) taken at Building 71 (not at the residential property line) in 2003-04. Assuming this noise level at the building, the noise measurement at the City of Berkeley property line nearest to Building 71, approximately 448 feet away, would be substantially lower and within the City of Berkeley property-line noise limit. The City of Oakland property line nearest to Building 71 is even farther away. Noise at the City of Oakland property line, assuming noise of 60 dBA at Building 71, would also be within the City of Oakland property line noise limit.

Proposed Action-generated construction noise levels would be at their maximum during the period of approximately one week when a hole would be cut through the metal and concrete deck of the roof for the construction of the rooftop additions. The work would usually be performed during business hours on weekdays. However, construction work might occasionally take place during the weekend. Overall, the construction noise is expected to be well below the 55 dBA (and 75 dBA for mobile construction noise) specified by the City of Berkeley at the border fence between the UC Berkeley land.

\(^{18}\) The unit of measurement is A-weighted decibels, which de-emphasizes lower frequencies and over-emphasizes higher frequencies in a way that corresponds to the sensitivity of the human ear.

\(^{19}\) Leq is the equivalent steady-state noise level over a one-hour period produced by the same noise energy as the variable noise levels during that period.
and City of Berkeley residential neighborhood, and well within City of Oakland property-line noise limits.

Building 71 already contains several noise-producing fixtures, most notably the cooling towers and associated primary and secondary treated water pumps. In addition, rooftop, packaged air conditioning units operate as needed, and exhaust fans and built-up air handling units operate continuously to serve the HVAC needs of the building.

New sources of noise associated with the Proposed Action would consist of air handling units on the roof and laser support equipment in the Utility Room. Inside the Utility Room, there would be rack-mounted laser chillers and vacuum pumps. The Utility Room walls and roof would be metal on the exterior with insulation to minimize sound transfer to the environment. LBNL Standard Specifications require such equipment to have sound ratings that meet the Air Movement and Control Association (AMCA) Standard 301.

Operation of the BELLA laser and laser plasma accelerator usually would take place during normal business hours of 8 a.m. to 5 p.m., Monday to Friday. However, the new air handling units for the BELLA area would operate continuously. The existing chiller and cooling tower would operate as needed, which is anticipated to be primarily daytime both weekdays and weekends. Noise levels at the border of LBNL with the City of Berkeley residential zone and the City of Oakland would be very similar to current levels. Based on distances of neighboring property lines, intervening terrain, and experience with other similar construction and operation activities in the Building 71 area, the maximum allowable noise of 75 dBA at the nearest property line for mobile equipment and of 55 dBA for stationary equipment is not expected to be exceeded.\footnote{20 Berkeley Noise Ordinance, Section 13.40.070 of the Municipal Code.}

As previously stated in Section III.4.a.v, Materials Disposition, truck traffic associated with the Proposed Action is not expected to exceed more than one trip per day during the peak construction period. Otherwise, average weekly
truck traffic during demolition, construction, and the initial setup of the research and development equipment phases would amount to 1.5 trips per week, or less than a single round trip per day. As previously stated, the applicable noise standard, as identified in the City of Berkeley Noise Ordinance, is 75 dBA at the nearest property line for mobile equipment. Due to the relatively limited volume of anticipated truck traffic and the mobile nature of the noise associated with passing trucks, applicable noise standards would not be exceeded.

Based on the analysis above, the DOE does not expect the Proposed Action to result in substantially adverse noise effects.

8. Traffic
The approximately 18-month construction period of the Proposed Action would result in temporary increases in traffic volumes on area roadways. This temporary increase is associated with the movement of construction workers and equipment used for construction truck trips (defined here as round-trips involving large hauling, flatbed, cement trucks, or similar). Truck traffic associated with the Proposed Action is not expected to exceed more than one trip per day during the peak construction mobilization period. Otherwise, average weekly truck traffic during demolition, construction, and the initial setup of the research and development equipment phases would amount to 1.5 trips per week, or less than a single trip per day. Accordingly, truck trips would tend to be spaced apart and few would occur on the same days. Finally, construction truck traffic for the Proposed Action would be closely monitored and managed by the Lab’s Site Construction Coordinator, who would ensure that aggregate construction traffic at LBNL would stay below established significance threshold levels.21

Operation of the Proposed Action in Building 71 would result in 5 to 10 additional staff being added to the total Building 71/71A/71B population of 73. This additional new staff represents a minor portion of the 860-person increase in LBNL population that is analyzed in the 2006 LRDP and EIR (for

2025 horizon year). Statistically, only about 60 percent of the LBNL employees drive to the main site in single-occupied vehicles. The new employees are expected to use other options such as vanpooling, carpooling, bicycling, or LBNL shuttles from a Bay Area Rapid Transit (BART) station at similar rates. These options are described by LBNL’s Transportation Management Demand Plan. Parking issues resulting from the small increase in population have been adequately addressed in that plan. The increase in staff is therefore not expected to result in a noticeable increase in parking demand.

9. Cultural Resources

Building 71 was built in phases from 1957 to 1974 to house the Heavy Ion Linear Accelerator (HILAC), Super-HILAC, and Bevelac particle accelerators, in succession, and their associated support facilities.\(^22\) In 2007, the DOE determined that Building 71 was eligible for the National Register of Historic Places (National Register) because of the important role that the building had played in the nuclear physics and accelerator development and research activities at LBNL. In 2008, accelerator remnants and associated blocks were removed as part of seismic upgrades to the building.\(^23\) This was performed in consultation with the California State Historic Preservation Officer (SHPO). As per agreement with the SHPO and the National Park Service, concurrently with the seismic upgrades, a Historic American Engineering Record (HAER)\(^24\) with photo documentation was prepared. The HAER documentation took place during the facility retrofit due to the inaccessibility of the various HILAC components until the outer layers of the machine were removed. The final HAER is due to be published in July 2009.

\(^{22}\) Historic American Engineering Record, University of California Radiation Laboratory, SuperHILAC, HAER No. CA-186-B, prepared by David Harvey, ENTRIX, Inc., April, 2009.


\(^{24}\) The same acronym, HAER is also used for Historic Architectural Evaluation Report.
IV. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

The last remnants of the Super HILAC, which were removed in 2008, represented the remaining (albeit largely incomplete) connection to the historically significant elements of the building. With the HAER documentation and removal of those last remnants, Building 71 became available for renovation without negative impacts to cultural or historical resources.

10. Intentional Destructive Acts

Intentional destructive acts such as sabotage and terrorism from internal or external sources are required to be considered in NEPA documents, according to interim guidance from the DOE Office of General Counsel.\textsuperscript{25} Although the Proposed Action would take laser plasma accelerator capabilities beyond other facilities, it is the most recent development in a series of accelerator technology advances at LBNL going back to the 1950s. Operations during the Proposed Action would include the handling of small amounts of radioactive materials in sealed sources used for calibrating safety monitoring devices, the use of which is governed by LBNL standard operating procedures. Existing sealed sources used by the LOASIS program would also be used for the Proposed Action operations.

The Proposed Action is not expected to require security in addition to that already in place for the LBNL site. The entire LBNL site is fenced, and controlled access is available only at three entry gates. For safety reasons, LBNL laser laboratories are protected by a combination key and keypad access controller that only allows entry by personnel with laser safety training. If any laser room door opens without the appropriate key inserted or the correct access code being entered, the laser system within the room is shut down immediately. Access to the Laser Room included in the Proposed Action would be controlled in this manner. As there would be no change to the existing security system in place on the LBNL campus and at Building 71, DOE considers that the Proposed Action would present no change to the potential for intentional destructive acts.

\textsuperscript{25} Need to Consider Intentional Destructive Acts in NEPA Documents. Office of NEPA Policy and Compliance, Department of Energy, December 1, 2006.
11. Socioeconomics and Environmental Justice
There would be a temporary increase in onsite labor during the construction of the Proposed Action; this activity would span a period of approximately 18 months. Labor would likely be drawn from the local area at the discretion of subcontractors selected to perform the work. There is a substantial amount of construction in the local area and an adequate pool of labor is expected to be available for Proposed Action construction. Operational staff would be minimal (approximately 5 to 10 new employees) and most would likely be from local or regional origin. Therefore, impacts to the local population, services, and economy would not be expected.

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires agencies to identify and address disproportionately high and adverse human health or environmental effects its activities may have on minority and low-income populations. There would be no expected disproportionate adverse impacts on minority and economically disadvantaged populations in the local area, because no adverse environmental or socioeconomic impacts are expected from any aspects of the Proposed Action. In addition, residential areas nearest to the Building 71 Proposed Action site do not qualify as relatively low-income or minority neighborhoods.

C. Environmental Consequences of the No-Action Alternative

Adopting the No-Action Alternative would result in Building 71 remaining in its current condition. The BELLA research and development program would not be located at LBNL. Further investigations and mitigation of remnant contamination on the internal structures of Building 71 would not proceed. There would be no demolition or construction and no noise or dust would be emitted. If the Proposed Action were not completed, there would be no radiation emitted from an electron beam developed by the BELLA laser plasma accelerator. However, the Building 71 space would be available for other uses – these would likely be related to accelerators. Future accelerators would be more likely to be become larger, not smaller, with increasingly greater environmental impacts.
IV. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

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V. **Cumulative Impacts**

Cumulative impacts consider the Proposed Action in combination with past, present, and anticipated future actions, and their combined impacts to the environment. To assess potential cumulative impacts, an inventory of planned, pending, and/or reasonably foreseeable Proposed Actions are considered in combination with the Proposed Action and past actions.

A. *Construction Projects in the Vicinity of the Proposed Action*

1. **LBNL Projects**

   ♦ **Seismic Phase 1**
   The Seismic Phase 1 project will correct structural deficiencies in LBNL Buildings 50 and 74 in order to improve their performance in a seismic event and upgrade the seismic rating of the buildings from “Poor” to “Good.”

   Work is expected to span from January 2009 to March 2010.

   ♦ **Seismic Phase 2**
   This project involves the demolition of multiple seismically unsafe buildings throughout the LBNL site, seismic stabilization of Building 85, modernization of Building 74 and construction of an approximately 43,000 gsf General Purpose Laboratory (GPL). The GPL will be safe and energy efficient, with approximately 60 percent office space and 40 percent wet chemistry lab facilities.

   Construction of the Seismic Phase 2 project is intended to begin by 2010 and continue through 2015.

   ♦ **The User Support Building**
   The three-story, approximately 30,000 gsf User Support Building (USB), will include assembly space, support laboratories and offices. An existing 16,038
gsf structure, Building 10, which housed approximately 24 full-time LBNL staff was demolished to create space for the USB. An Initial Study/Mitigated Negative Declaration was prepared and circulated in the fall 2006 and certified by the UC Regents in January, 2007. Demolition of Building 10 was completed in 2007. Construction of the USB was initiated in June 2008 and is expected to be complete by July 2011.

♦ Building 51 and the Bevatron Demolition
An EIR was certified in July 2007 for the demolition and removal of the Building 51 complex, including the Bevatron (a retired particle accelerator), and the concrete blocks and building shell surrounding it. This EIR was tiered from the 1987 LRDP EIR, as amended. Demolition commenced in August 2008 and is expected to continue through December 2011.

♦ Building 77 Rehabilitation
The Building 77 Rehabilitation will upgrade the mechanical and electrical systems in Building 77, a 68,500 square foot, high-bay shop building. The Proposed Action will replace a 40-year-old mechanical system with new heating, ventilating and air conditioning systems to provide temperature control, which is required for precision fabrication and testing. This project is scheduled for completion in November 2009.

♦ Building 6 Seismic Upgrade
This project will seismically upgrade LBNL Building 6 Advanced Light Source (ALS) dome structure, as per the University of California (UC) seismic safety policy. The work will occur during annual, one month shut-down periods over the course of four years. The first phase was completed in 2007 and included the repair of five of 24 planned column bents. The second phase, in May 2008, included the repair of seven bents. Six bents each will be repaired in both May 2009 and May 2010.

2. University of California Projects
♦ South Campus Integrated Projects
In May 2006, UC Berkeley published a tiered, focused Draft EIR for the Southeast Campus Integrated Proposed Actions (SCIP). The SCIP EIR was certified on December 5, 2006. The SCIP EIR identified significant and un-
avoidable impacts in the areas of aesthetics, cultural resources, geology, noise, traffic, and utilities and service systems. In May 2007, a fault-rupture hazard investigation for the Student Athlete High Performance Center was prepared and released as an addendum to the EIR.

SCIP projects include seismic and program improvements to California Memorial Stadium, including a 158,000 gsf athletic training center; construction of a parking structure and sports field at the current site of Maxwell Family Field; construction of a 186,000 gsf building linking the Law and Business Schools, landscape improvements at the Southeast Campus and Piedmont Avenue; interior improvements at selected buildings at the School of Law and the Haas Business School; and renovation and restoration of four historic houses on Piedmont Avenue. Construction of the athletic training center, School of Law facilities, and retrofit of the Piedmont Avenue houses is underway.

♦ Northeast Quadrant Science and Safety Projects
The NEQSS projects entail demolition of 100,000 gsf of existing buildings and construction of 430,000 gsf of laboratory, office and classroom space. The Proposed Action would also include the addition of 140 parking spaces and add approximately 400 full-time equivalent (FTE) employees to the northeastern quadrant of the UC Berkeley campus. The projects are currently under construction.

♦ The Computational Research and Theory Building
As currently proposed, the 165,000 gsf Computational Research and Theory Building (CRT) building would be constructed near the Blackberry Gate entrance to the LBNL main site. It would provide high-end computing floor space and accompanying office space. CEQA review was completed and an EIR was circulated for public review in approximately mid-2007. The EIR was certified by the UC Regents in May 2008. Construction of the Proposed Action is currently on hold.

♦ The Helios Research Facility
As currently proposed, the Helios Research Facility project would be a four-story, 120,000 to 160,000 gsf laboratory constructed just south of LBNL
Buildings 66 and 62. The goal of the Helios Research Facility project is to accelerate the development of renewable and sustainable solar energy sources by developing new materials for use in collectors, efficient processing steps and energy handling. CEQA review has been conducted and the Final EIR has been completed.

♦ Guest House
The Guest House is a 25,000 gsf facility that ranges in height from 2.5 to 4 stories. The facility, currently under construction, includes 60 guest rooms and associated spaces. The facility is located in the center of the LBNL main site between Buildings 2 and 54, with access via Lawrence Road. The Guest House will provide for short term accommodations for visitors. This project is scheduled for completion in August 2009.

B. Potential Cumulative Impacts

This section discusses the cumulative impacts from the Proposed Action and the projects listed above. Each of the issues considered in this analysis was determined to be affected in a minor way in the previous chapter. The analysis in Chapter IV supports the conclusion that the Proposed Action would not affect biological resources, cultural resources, or result in greater risk of intentional destructive acts. An abbreviated discussion of these issues is included at the end of this section.

1. Hazards and Human Health
As discussed in Chapter IV, none of the potential hazards such as radiation produced from the accelerator, potential eye injuries from the laser, laser fire, or explosion risk, or chemical and radioactive releases during demolition are expected to result in adverse impacts. Accordingly, the Proposed Action would not be expected to have an adverse cumulative impact in combination with other LBNL or UC Berkeley projects.

2. Hydrology, Water Quality, and Soil
The Proposed Action would not be expected to add to cumulative hydrology, water quality, and soil impacts from the projects listed above. The Proposed
Action would not add impervious surface area, which would have the potential to increase pollutant loading in storm water runoff, to the LBNL campus. Soil excavation, sampling, and analysis at Building 71 would be controlled by a Soil Management Plan as required by LBNL. If the excavated soil was found to contain contamination, the soil would be stored onsite prior to being moved to an appropriate off-site landfill. The Proposed Action would not have adverse hydrology, water quality, and soil impacts, and it would not be expected to contribute to an adverse cumulative impact.

3. Energy Use and Greenhouse Gases
The Proposed Action would not substantially add to cumulative energy use and GHG emissions. The Proposed Action would increase annual electricity consumption at LBNL by less than 1 percent. Usage of natural gas at LBNL would also increase by less than 1 percent as a result of this Proposed Action. Therefore, the effect of the Proposed Action would not substantially change LBNL energy consumption.

GHG emissions would be generated as a result of the additional electrical energy and natural gas consumption described above. New GHG emissions would total approximately 480 metric tons of carbon dioxide equivalents (MTCO2e) annually according to DOE calculations. This additional GHG emissions contribution would be less than a one percent increase over LBNL’s 2008 emissions of MTCO2e for electricity and natural gas. This additional amount of GHG emissions is very small relative to the amount of GHG emissions currently generated by LBNL and the surrounding region.

The Proposed Action would temporarily generate GHG emissions due to construction truck traffic. The largest project that would be under construction simultaneous to the Proposed Action would be the Building 51 demolition project. It is possible that the CRT project (near the main Blackberry gate), the Helios Research Facility, and the Seismic Phase 2 project would also have begun. As noted in Section V.B.8, construction traffic is monitored by LBNL to limit the number of construction trucks entering and leaving the Lab on a daily basis. Therefore, GHG emissions associated with construction trips for the Proposed Action would be limited by the number of trips allowed per day. In addition, since construction activity is limited to the con-
struction period, potential GHG emissions are considered short-term and would not be expected to substantially contribute to long term effects.

Vehicle trips generated by the additional LBNL staff operating the Proposed Action would also contribute to GHG emissions. LBNL encourages the use of alternative transportation as a means of reducing vehicle trips made by employees and visitors. The existing LBNL shuttle system transports employees from the City of Berkeley and the UC Berkeley campus to numerous locations on the LBNL site. LBNL supplies bicycle racks on shuttle buses, outside of buildings, and at the entrances to open space areas for employees who bike to work and/or around the LBNL campus. LBNL also provides pedestrian trails, such as the existing pedestrian path that connects Building 71 with the rest of the main site.

Given the small increase of LBNL personnel associated with the Proposed Action, and the available multi-modal alternatives to the single occupancy vehicle, potential GHG emissions associated with vehicle trips made by new staff is considered very minor and would not be expected to contribute to an adverse cumulative impact related to GHG emissions.

4. Other Utilities and Service Systems

The Proposed Action demand for other utilities, such as water, solid waste transport, and wastewater, would not be expected to contribute to an adverse cumulative impact. The demand for utilities as a result of the Proposed Action is consistent with the marginally increasing demand projected in the 2006 LRDP and EIR.

With respect to water demand, the Proposed Action would constitute less than a one percent increase to the demand for the entire LBNL site, according to 2005 figures, which is not considered to be an adverse impact on the Lab’s existing water infrastructure and water capacity. Furthermore, water demand for the Proposed Action is within the Lab’s long-term use projections. These projections have been reviewed by the East Bay Municipal Utility District, which issued the Lab a ‘will serve’ letter in February 2006, confirming the District’s ability to
meet the Lab’s long term demands. The solid waste resulting from demolition as a result of the Proposed Action is expected to be recycled and reused to the extent practicable, as with solid waste from all other LBNL projects, according to LBNL standard operating procedures. In addition, LBNL procedures require the demolition contractor to consult with receiving landfills prior to the start of demolition, to ensure that sufficient landfill capacity is available. LBNL peak wastewater discharge during wet weather is expected to increase by approximately 72,000 gpd by 2025, which is well within the capacity of the existing sanitary sewage disposal infrastructure. The additional wastewater generated by the Proposed Action, less than 1 percent of the overall LBNL wastewater discharge, would be a fraction of this increase and would not be expected to have an adverse impact on cumulative wastewater services.

In summary, the impacts to utilities by the Proposed Action are not considered to be substantial, and the Proposed Action would not contribute to an adverse cumulative impact.

5. Visual Quality
The Proposed Action’s contribution to any cumulative impacts to the LBNL viewshed would be very minor, and likely not noticeable to off-site viewers. The Proposed Action would result in minor improvements on the roof of Building 71, which would be consistent with the roof’s existing character. The improvements would not result in a change to the viewscape or to views of the building. While a significant cumulative impact to visual resources may arise from aggregate buildout of the LBNL site through 2025, as described in the 2006 LRDP and EIR, the Proposed Action would not be expected to contribute to such an adverse cumulative impact, especially because those cumulatively impacted areas are not considered to be near the Building 71 site.

6. Air Quality
The Proposed Action would not directly violate air quality standards or adversely affect air quality, nor would it be expected to result in any substantially cumulative air quality impacts. The Proposed Action would be consistent with the growth projections in 2006 LRDP and EIR, and it would nei-
ther conflict with nor obstruct implementation of the Bay Area 2005 Ozone Strategy, which is the most recently approved regional Clean Air Plan.

The Proposed Action would not violate any applicable air quality standard or contribute substantially to any existing or projected air quality violations. The Proposed Action would not result in a considerable net increase in any criteria pollutant for which the Proposed Action region is in non-attainment (federal and State), including \( \text{O}_3 \) and State PM\(_{2.5} \) and PM\(_{10} \), or toxic air contaminant (TAC). Demolition and construction of the Proposed Action would occur almost entirely within the existing shell of Building 71, effectively containing any dust produced by demolition and construction. The exception would be the period of approximately one week when a hole would be cut through the metal and concrete roof of Building 71; however, LBNL Standard Operating Procedures would reduce the amount of dust to below significance standards as identified by the Bay Area Air Quality Management District (BAAQMD). Potential adverse effects from truck trip diesel emissions are previously analyzed in Section IV (6) of this document. As concluded in that analysis, the volume of truck trips is such that adverse health effects would not occur due to diesel emission exposure throughout the 18-month construction period.

In terms of operational emissions, Section IV of this EA concludes that the heated air exhausted from the Utility Room and BELLA area air handling units would not cause any adverse impacts to air quality.

Given the preceding analysis, the DOE does not expect that the Proposed Action would result in any cumulatively considerable air quality impacts.

### 7. Noise

Construction-related noise from the Proposed Action has the potential to combine with noise from other construction projects to generate cumulative impacts. However, construction of the Proposed Action and other projects would be staggered over a period of several years and there would not be a point at which all were under construction concurrently. In addition, LBNL voluntarily observes the City of Berkeley Noise Ordinance, which regulates construction and demolition noise, and the City of Berkeley’s General Plan.
Environmental Management Element, which is consistent with the City of Berkeley Municipal Code noise guidelines for determining the compatibility of various land uses with different noise environments. Furthermore, various construction and demolition activities that might coincide with the Proposed Action are located throughout the LBNL main hill site, and thus are separated physically by intervening terrain and structures, which reduces or eliminates combined construction noise.

While the Proposed Action may result in some degree of noise impacts during the construction phase, this noise would not contribute adversely to an adverse cumulative impact. The highest level of noise would be limited to a period of approximately one week, when a hole would be cut through the metal and concrete deck of the roof. The interior construction noise would be of longer duration; however, the sound would be buffered by the existing shell of Building 71. In addition, the work would usually be performed on weekdays during normal work hours. The resulting noise is expected to be well below the 75 db standard established in the City of Berkeley Noise Ordinance for mobile sources. In addition, as determined in Section IV.B.7, due to the volume of truck trips and the mobile nature of noise from passing trucks, city ordinance threshold noise levels would not be exceeded because of truck traffic. As a result, the construction noise would not be expected to contribute to an adverse, cumulative impact.

During the operational phase, the Proposed Action would not result in a substantial increase to noise in the area. Existing noise-producing equipment and new Building 71 equipment would contribute to the ambient noise level at the LBNL main site, however, the operational noise anticipated by the Proposed Action would be similar to existing noise levels. Consequently, the noise levels at the LBNL border with the City of Berkeley residential zone are expected to be very similar to current levels and the cumulative noise level is not expected to exceed the standards in the City of Berkeley Noise Ordinance. As a result, the Proposed Action would not be expected to produce an adverse, cumulative noise impact during operation.

27 LBNL General Requirements, Section 1.06(B), page 01010-5.
8. Traffic

Construction traffic at LBNL is carefully monitored and controlled. A cumulative traffic study was completed in April 2009 which identified significance levels or thresholds for LBNL aggregate construction truck trips.\(^{28}\) The Lab’s Site Construction Coordinator oversees all construction truck trips at LBNL and ensures that all projects – including the Proposed Action – in combination would stay at or below these significance thresholds.

Operations activities in Building 71 included as part of the Proposed Action would cumulative traffic significance thresholds. The Proposed Action would bring an additional 5 to 10 new staff members to the LBNL site, each of whom may be eligible to receive a parking pass. Given the 860 new staff persons and the issuance of 500 new parking passes identified in the 2006 LRDP and EIR, the traffic generated by the new staff associated with the Proposed Action is considered relatively minor and not likely to cause an adverse impact.

As determined in the 2006 LRDP EIR, projected buildout of the LRDP, of which this Proposed Action would be a part, would contribute to a level of service (LOS) degradation at specified local intersections. As a result, three intersections would ultimately operate at an unacceptable level of service (LOS E or F) in 2025. The EIR identified this as a significant and unavoidable impact. Based on the proximity of the three intersections to LBNL entry/exit points, it is reasonably foreseeable that operational trips generated by the Proposed Action would use some or all of these intersections.

As previously indicated, the Proposed Action would bring 5 to 10 new staff to the LBNL site. Approximately 40 percent of LBNL staff use alternate modes of transportation to the single occupancy vehicle. Among this percentage, LBNL shuttle, bicycling, BART, and carpooling are the most commonly used modes of travel.\(^{29}\) Based on this pattern and the multi-modal options that would be available to the 5 to 10 staff members, approximately 40


\(^{29}\) 2007 LBNL LRDP EIR, Transportation/Traffic Section, page IV.L-19.
percent (2 to 4) of them would be expected to travel to and from LBNL by means other than the single-occupancy vehicle. Using a conservative, increased estimate, it can be expected that the Proposed Action would generate 12 daily round trips, including six AM peak hour trip, and six PM peak hour trips.

In relation to the intersection volumes that would be experienced at the three stressed intersections in 2025, six AM peak period trips and six PM peak period trips would not further degrade intersection level of service or even likely be noticeable to fellow motorists. Furthermore, it is not foreseen that all of these peak hour trips to and from LBNL would use the same routes or intersections due to the availability of three access gates and the varying trip origins and destinations. This distribution of trips among the street/intersection network would further reduce the potential impact on any one of the three intersections.

Therefore, although the trips generated by the Proposed Action could marginally contribute to degradation at three impacted intersections under the cumulative buildout scenario (in 2025), the number of peak hour trips would be very minor in proportion to the total number of trips utilizing those intersections. As a result, DOE expects that the Proposed Action and the Lab as a whole would fall below significance levels identified for cumulative traffic impacts.

9. Biological Resources
The Proposed Action would not affect biological resources, as discussed in the previous chapter. Therefore, the Proposed Action would not be expected to contribute to a cumulative biological resources impact when considered in conjunction with other projects on the LBNL main site or on the UC Berkeley campus.

10. Cultural Resources
The Proposed Action would not affect cultural resources, as discussed in the previous chapter. Therefore, the Proposed Action would not be expected to contribute to a cumulative cultural resources impact when considered in con-
junction with other projects on the LBNL main site or on the UC Berkeley campus.

11. Intentional Destructive Acts
The Proposed Action would not adversely affect the potential for intentional destructive acts, as discussed in the previous chapter. Therefore, the Proposed Action would not be expected to contribute to a cumulative impact when considered in conjunction with other projects on the LBNL site or on the UC Berkeley campus.

12. Socioeconomics and Environmental Justice
The Proposed Action would be expected to cause impacts with regard to socioeconomics and “Environmental Justice,” as discussed in the previous chapter. Therefore, the Proposed Action would not be expected to contribute to a cumulative impact when considered in conjunction with other projects on the LBNL site or on the UC Berkeley campus.
VI. GLOSSARY OF TERMS AND ACRONYMS

A. Glossary

**accelerator**: in physics and chemistry, an accelerator is a device that uses an electric or magnetic field to excite charged particles to move at high speeds. The Proposed Action would employ a laser plasma accelerator as described below.

**Bevatron**: a retired particle accelerator once in service in Building 51 at Lawrence Berkeley National Laboratory.

**Categorical Exclusion (CX)**: A level of environmental review under the National Environmental Protection Act for Proposed Actions that do not have a significant individual or cumulative effect of the environment.

**Categorical Exemption (CE)**: A level of environmental review under the California Environmental Quality Act for Proposed Actions that do not have a significant individual or cumulative effect of the environment.

**California Environmental Quality Act (CEQA)**: California State legislature that requires a written analysis of the potential environmental impacts of a development Proposed Action, including an assessment of alternative Proposed Action designs and a disclosure to the public about why the Proposed Action was approved.

**cyclotron**: A type of accelerator first developed by Ernest Lawrence at the University of California, Berkeley, in 1929. The cyclotron uses a perpendicular magnetic field that causes particles to form a spiral and re-encounter the accelerating voltage multiple times.

**Environmental Impact Report (EIR)**: A report required of general plans by the California Environmental Quality Act and which assesses all the environmental characteristics of an area and determines what effects or impacts will result if the area is altered or disturbed by a Proposed Action. (See “California Environmental Quality Act.”)
electron beam: a stream of electrons which would be produced in the laser plasma accelerator.

positron: the anti-particle or counterpart of an electron

gamma-rays: high energy radiation created by the collision of charged subatomic particles.

Laser Plasma Accelerator: A capillary tube (similar in shape to a common 3-foot-long T12 fluorescent lamp) made of sapphire, approximately 1 meter in length by 2 to 3 centimeters in outer diameter and 300-600 micrometers in internal diameter filled with plasma. When the BELLA laser light pulses are focused on the entry to the plasma channel, an electron beam with an energy level of 10 GeV would be generated.

National Environmental Protection Act (NEPA): a federal law very similar to CEQA which requires its own environmental review process.

neutrons: a subatomic particle with no electric charge.

optical compressor: a device that uses optical components to compress light pulses in time, thereby increasing the peak power level of the light pulses. This is a passive device, i.e. uses no electricity or other external energy sources.

photomuons: high energy photon pairs

plasma wakefield: An oscillatory charge separation wave of electrons and ions in an ionized medium that results in electric fields that can be used to accelerate electrons.

radiation: energy that is emitted by electrons as they propagate through magnetic fields or material. It is absorbed by suitable material such as concrete, lead, and steel.

radioactive: a mass with an unstable atomic nucleus or nuclei.

Soil Management Plan: To be developed by a Proposed Action proponent for the purposes of abiding by LBNL institutional controls when a Proposed Action involves the distribution, removal, and/or disposal of soil.

structural/non-structural: weight bearing/ non-weight bearing.
therms (thm): a non-SI unit of heat energy commonly used to measure natural gas and equal to 1,000 British thermal units.

B. Acronyms

ADA: Americans with Disabilities Act
AFRD: Accelerators & Fusion Research Division
ALARA: As Low As Reasonably Achievable
AHU: Air handling unit
ALS: Advanced light source
AMCA: Air Movement and Control Association
ANSI: American National Standards Institute
BAAQMD: Bay Area Air Quality Management District
BART: Bay Area Rapid Transit
BELLA: BErkeley Lab Laser Accelerator
CEQA: California Environmental Quality Act
CRT: Computational Research and Theory Building
DOE: United States Department of Energy
EA: Environmental Assessment
EBMUD: East Bay Municipal Utilities District
EH&S: Environment, Health & Safety Department
EIR: Environmental Impact Report
FFU: Fan filter units
FTE: Full-time equivalent
GeV: Electron-Volts
gpd: Gallons per day
GPL: General Purpose Laboratory
GHG: Greenhouse gas
HAER: Historic American Engineering Record
HEP: Department of High Energy Physics
HEPA filter: High Efficiency Particulate Air filter
HILAC: Heavy Ion Linear Accelerator
HVAC system: Heating, venting and air conditioning system
HWHF: Hazardous Waste Handling Facility
LBNL LRDP EIR: Lawrence Berkeley National Laboratory Long Range Development Plan Environmental Impact Report
LBNL: Lawrence Berkeley National Laboratory
Leq: Leq is the equivalent steady-state noise level over a one-hour period produced by the same noise energy as the variable noise levels during that period
MTCO₂e: Metric tons of carbon dioxide equivalents
MUA: Outside air make-up unit
MWh: Megawatt hours
NEPA: The National Environmental Protection Act
NFA: No Further Action
O₃: The molecular formula for the element Ozone
PG&E: Pacific Gas and Electric Company
PM₁₀: Particulate matter 10 microns or less in diameter
PM₂.₅: Particulate matter 2.5 microns or less in diameter
SCIP: Southeast Campus Integrated Proposed Actions
SHPO: California State Historic Preservation Officer
TAC: Toxic air contaminant
UC: University of California
**USB:** User Support Building

**VOC:** volatile organic compound

**WAPA:** Western Area Power Administration
VII. REPORT PREPARERS

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