4.5 HAZARDS AND HAZARDOUS MATERIALS

4.5.1 INTRODUCTION

This section discusses existing conditions with respect to hazards in the project vicinity and analyzes the potential for the Solar Energy Research Center (SERC) project to increase the exposure to hazards or increase the risk associated with the use, generation, and disposal of hazardous materials. This section also addresses impacts related to the use of certain scientific materials that do not meet the criteria for hazardous materials but whose use in the proposed SERC project could be a matter of concern for some in the surrounding community.

Information used in the analysis below was obtained from the Lawrence Berkeley National Laboratory (LBNL) 2006 Long Range Development Plan (LRDP) Environmental Impact Report (EIR) and environmental documents associated with specific LBNL projects.

In response to the Notice of Preparation for this EIR, several commenters expressed concern regarding the use of nanomaterials and the generation of hazardous waste associated with the proposed project, existing contamination at the project site, high fire danger, and emergency response.

4.5.2 ENVIRONMENTAL SETTING

As stated in **Section 3.0, Project Description**, the SERC project would be constructed, operated, and maintained by the University of California (UC) LBNL. Therefore, current practices and environmental laws and regulations pertinent to the LBNL hill site are discussed in the sections that follow.

Project Site

The proposed SERC project would be centrally located on the LBNL site at the current location of Buildings 25A, 44, 44A, and 44B in the "Old Town" area. The buildings are currently used by the Energy and Environmental Technology Division. The project site currently overlies the Building 25A lobe of the Old Town groundwater solvent plume (see **Figure 4.5-1, Building 25A Lobe of the Old Town Groundwater Plume**). Buildings 25A, 44, 44A, and 44B will be decontaminated and demolished as part of the approved Old Town Demolition and Environmental Restoration project prior to commencement of construction of the SERC project. The contaminated groundwater is being remediated through *in-situ* soil flushing, which involves a groundwater infiltration bed and extraction trench, and a groundwater treatment system located west of Building 44A. There is minimal wildland fuel load (vegetation) present where the building and parking area would be located.

Hazardous Materials

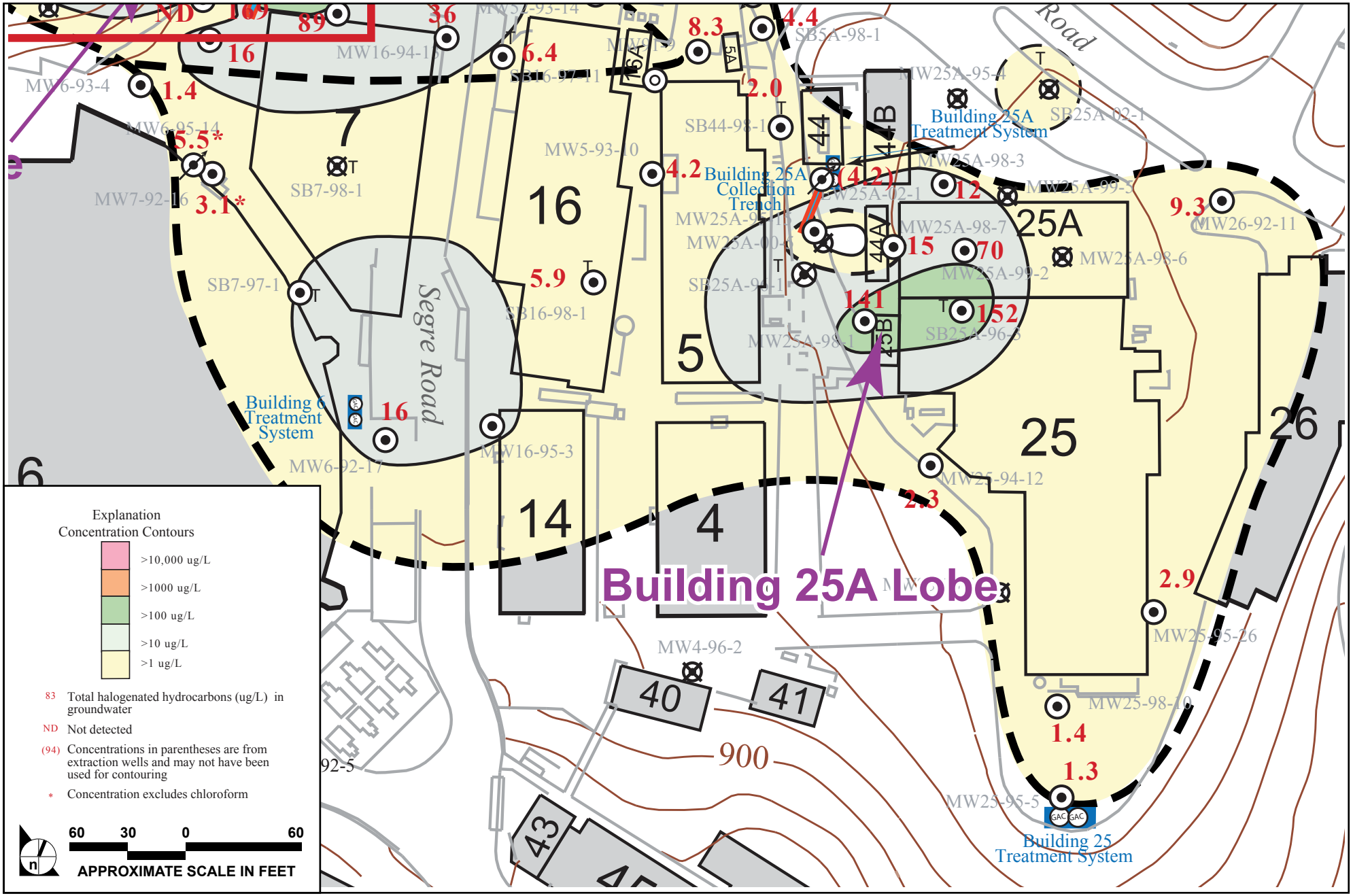
The term "hazardous material" is defined in Section 25501 of the California Health and Safety Code as any material that, because of quantity, concentration, or physical or chemical characteristics poses a significant present or potential hazard to human health and safety or to the environment. Hazardous materials are grouped into the following four categories, based on their properties: toxic (causes human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials), and reactive (causes explosions or generates toxic gases).

Numerous hazardous materials, including non-radioactive hazardous chemicals (solvents, organic compounds, reagents) and radioactive materials, are used in research activities at the LBNL hill site. Other hazardous materials are used in facility operations and maintenance. Hazardous materials use at the LBNL hill site generates hazardous and mixed wastes (i.e., radioactive wastes with hazardous waste components). UC LBNL complies with applicable federal, state, and local laws and regulations for the handling, storage, and disposal of hazardous materials and wastes to minimize human exposure and environmental impact. In addition to the above, several sources of non-ionizing radiation (such as lasers, magnets, and microwave generators) are also used at the LBNL hill site to conduct research.

The SERC project would primarily use inorganic materials. No use of radioactive or biohazardous materials is planned. Any hazardous materials used in the processing or research effort at SERC would be handled in accordance with applicable federal, state, and local laws and regulations.

Other Scientific Materials

As stated in **Section 3.0, Project Description**, the research that would be conducted at SERC would focus on developing a materials-based analog to the photosynthetic process found in nature, using nanoscale solar cells (photovoltaics or PVs) and electrical systems to collect sunlight and supply electrical currents that would be used to drive fuel-forming chemical reactions. These nano-scale solar cells (engineered nanomaterials) that would be used in the SERC laboratories are not hazardous materials by definition. SERC would synthesize and use engineered nanomaterials as light collectors and catalysts.



SOURCE: LBNL – 2010

FIGURE 4.5-1

Building 25A Lobe of the Old Town Groundwater Plume

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Nanoscience is an emerging area of research aimed at the development of structures and devices at the atomic, molecular, or macromolecular levels to produce materials with novel properties. Engineered nanomaterials are defined as discrete materials having structures with at least one dimension between 1 and 100 nanometers,[1] and are intentionally created (as opposed to those that are naturally or incidentally formed). Nanoparticles are a type of engineered nanomaterial that are not bound to a surface or are weakly bound to a surface and therefore are, or may become, dispersible. Nanoparticles have two or three dimensions between 1 and 100 nanometers. While some nanoparticles are naturally occurring (e.g., volcanic ash), or produced as unintentional byproducts of human activity (e.g., auto emissions), nanomaterials research focuses on nanoparticles that are intentionally created or engineered. Some of the techniques used in research laboratories to produce nanoparticles include application of heat to liquid chemical mixtures resulting in particles dispersed in solution, or the application of high electric currents to carbon or boron electrodes in metal chambers to produce fine soot-like nanoparticles.

Research involving engineered nanomaterials is currently conducted at various facilities at the LBNL hill site. The research includes both experimental production and characterization of nano materials as well as theoretical studies. Small quantities of nano materials are used in the labs (e.g., one type of nano material research at the LBNL Molecular Foundry produces less than one pound of nano material in a year), in solution or attached to hard surfaces or in closed systems which helps to confine the nano materials. The use of nanomaterials in SERC would also be for basic research and would not involve large-scale manufacture. The quantities used would amount to less than a gram.

All nanoscale research that could generate engineered nanomaterials is conducted in negative-pressure or isolation enclosures such as gloveboxes, fume hoods, or local capture hoods with High Efficiency Particulate (HEPA) filters and engineered nanomaterials are handled in accordance with the safe laboratory practices established in the laboratory Chemical Hygiene Plans. If a process cannot be enclosed and isolated, other engineered systems are used to control fugitive emissions of engineered nanomaterials or hazardous precursors that might be released. For example, local exhaust systems such as "snorkel hoods" are used.

Procedures in the Chemical Hygiene Plan for safely storing and handling engineered nanomaterials include the use of appropriate personal protective equipment (such as double nitrile gloves or other equipment appropriate for the specific activity), administrative controls (such as housekeeping and inventory control), signage and labeling, designated areas, special storage requirements, and control of engineered nanomaterial-bearing waste. The guidance for spills involving engineered nanomaterials

1 A nanometer is a unit of length equal to one billionth of a meter, or 1×10−9 m.

includes wearing gloves and respiratory protection, and containing the material by either vacuuming the area with a HEPA-filtered vacuum, wiping the area with wet towels, or both.

The UC LBNL Environment, Health and Safety Division (EH&S) conducts annual laboratory safety training for all new graduate students, guests, and employees working in research laboratories. Employees who either handle or who may be exposed to the hazards of engineered nanomaterials are required to complete the Chemical Hygiene and Safety Training and Safe Handling of Engineered Nanoscale Particulate Matter courses administered by EH&S, and to comply with the requirements listed in the Job Hazards Analysis which must be completed by each employee. Principal Investigators for each research group that may be working with engineered nanomaterials are responsible for ensuring that all employees in the work area are trained in the specific hazards and controls of these materials.

Soil and Groundwater Contamination

In 1991, UC LBNL began a rigorous evaluation of potential historical releases of contaminants to the environment as part of an investigation under the Resource Conservation and Recovery Act (RCRA), which was required by its Part B hazardous waste facility permit for the entire LBNL hill site. This process revealed contamination in soil and groundwater due to past site activities at certain locations on the LBNL hill site. The chemicals of concern detected in the soil and groundwater consisted of chlorinated volatile organic compounds (VOCs), mostly degreasing solvents used to clean equipment and their degradation products. Other detected chemicals included Polychlorinated Biphenyls (PCBs), petroleum hydrocarbons, semi-volatile organic compounds (SVOCs), and metals. The radionuclide tritium was also detected. All identified areas of soil contamination were cleaned up to levels consistent with LBNL operations (designated as institutional land use) and acceptable to regulatory oversight agencies (LBNL 2007). LBNL has a groundwater monitoring and cleanup program in place to remediate VOC-contaminated groundwater and prevent its migration off site. This program is being conducted under the regulatory oversight of the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) in accordance with Resource Conservation and Recovery Act (RCRA) Corrective Action Process (CAP) requirements.

As shown in **Figure 4.5-1**, the project site currently overlies the Building 25A lobe of the Old Town groundwater solvent plume which is contaminated with VOCs. The Building 25A lobe groundwater contamination is being remediated under the regulatory authority of the DTSC as part of the RCRA CAP. Soil remediation will be completed as part of the Old Town Demolition and Environmental Restoration project prior to the start of construction of the SERC project.

Fire Hazards

The western boundary of the LBNL hill site is located along a portion of the interface between wildlands and developed lands in the East Bay hills. LBNL is similar in character to other developed hillside areas in the region as it combines developed lands, groves of trees, and non-irrigated grassland areas. Dry summers desiccate plant materials and make them more prone to burning. The fire risk during brief periods of the fall months is even more pronounced when strong offshore winds, often called "Diablo winds," occur in the East Bay hills, which further dry up fuel material and can drive fire fronts and fire brands at extreme speeds.

These winds contributed to the extensive damage that occurred in the devastating Oakland-Berkeley hills fire of October 1991. On average, serious Diablo-wind-driven wildland fires that destroy structures occur in the regional vicinity of LBNL approximately every 20 years. The site where LBNL now is situated last burned in 1923 (LBNL 2007). These fire conditions are now well understood. Although these fires can spread over large areas, it has been shown that each structure is at risk of damage for approximately 10 minutes, since during this interval a Diablo-wind-driven fire will typically consume the adjacent fuel. LBNL researchers have reviewed fire histories, worked with fire researchers, and applied computer models to determine how the fuels adjacent to its buildings can be reduced to levels that will not support fire intensities that pose serious risks to the structures.

The SERC project site is currently managed to minimize wildland fire damage to structures under UC LBNL's vegetation management program. This program provides for annual treatment of vegetation on the LBNL hill site such that ground fuels cannot produce flame heights in excess of 3 feet (and ground plantings within 10 feet of buildings and roadways produce even lower flame heights); trees are "limbed up" so that flammable branches are at least 8 to 10 feet above the ground, and bushes that would allow ground-based fires to rise into tree canopies are removed.

The LBNL hill site is provided firefighting services by the Alameda County Fire Department, which staffs a fire station on LBNL grounds (Alameda County Station 19 is located in LBNL Building 48). At least four firefighters are on duty at all times. Equipment at the station includes one fire engine, one reserve fire engine, a hazardous materials vehicle, and a light-duty four-wheel drive "brush rig" that can be used for low-intensity wildland fires (LBNL 2007). Through an Automatic Aid Agreement between UC LBNL and the City of Berkeley Fire Department, the Alameda County Fire Department, who has been contracted by UC LBNL, would provide emergency response to the SERC project. As Station 19 is the closest fire station, it would provide first response, with Berkeley Fire Department augmenting response with other fire apparatus as needed. The Alameda County Fire Department has mutual aid agreements with other

agencies, including Oakland and the East Bay Regional Park District, which can be activated in the event of a major emergency (LBNL 2007).

LBNL Emergency Response Plan

UC LBNL has developed a Master Emergency Program Plan (MEPP) that establishes policies, procedures, and an organizational structure for responding to and recovering from a major disaster at the LBNL hill site (LBNL-PUB-533-2009). The MEPP was developed in accordance with the U.S. Department of Energy (DOE) Order 151.1c, the Standardized Emergency Management System for managing response to multi-agency and multi-jurisdiction emergencies in California, and the National Incident Management System which is a nationwide standardized approach to incident management prescribed by Homeland Security Presidential Directive 5. The MEPP also references the 2008 Hazard Survey and the 2008 Risk Assessment which finds that hazards for the LBNL hill site includes the potential for a major earthquake along the Hayward Fault and an urban-wildland fire in the Berkeley Hills to the east of the LBNL hill site. In view of these primary hazards, the plan includes four phases of emergency management, including mitigation, preparedness, response, and recovery. Mitigation includes activities that eliminate or reduce the occurrence or effects of a disaster. For instance to address earthquake hazard, UC LBNL uses both structural and non structural measures to make buildings and work area seismically safe, and to address wildland fires, as discussed above, UC LBNL implements vegetation management. Preparedness includes planning as to how to respond when an emergency occurs; UC LBNL provides regular training to employees so that they are prepared to respond to an emergency. For response, UC LBNL relies on local fire and police services and also maintains response equipment on site for use by employees. Recovery includes short and long term actions necessary to return all systems to normal or near-normal conditions. UC LBNL's plan includes a planned transition from response to recovery. The MEPP also includes a Hill-Wide Evacuation Plan and evacuation map.

4.5.3 REGULATORY CONSIDERATIONS

UC LBNL is subject to environmental, health, and safety regulations applicable to the transportation, use, management, and disposal of hazardous materials and wastes. This section provides an overview of the regulatory setting and describes current health and safety policies and procedures.

The primary federal agencies with responsibility for hazardous materials management include the United States Environmental Protection Agency (U.S. EPA), U.S. Department of Transportation (DOT), and DOE. The applicable federal laws, regulations, and responsible agencies are discussed in detail in this section. In many cases, California state law mirrors or is more restrictive than federal law, and enforcement of these laws has been delegated to the state or a local agency. In January 1996, the California

Environmental Protection Agency adopted regulations implementing a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program). The program has six elements: hazardous waste generators and hazardous waste on-site treatment, underground storage tanks, aboveground storage tanks, hazardous materials release response plans and inventories, risk management and prevention programs, and Unified Fire Code hazardous materials management plans and inventories. The local agency responsible for implementation of the Unified Program is called the Certified Unified Program Agency (CUPA). Since the LBNL hill site is located within the city limits of Berkeley and Oakland, both Cities are the designated CUPAs. In order to streamline their oversight of CUPA regulations at LBNL, Berkeley and Oakland have entered into a Memorandum of Understanding that established the City of Berkeley as the lead agency for all CUPA activities (other than emergency release reporting) (LBNL 2007).

Hazardous Materials Management

Federal and state laws require detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of, and in the event that such materials are accidentally released, to prevent or to mitigate injury to health or the environment. These laws require hazardous materials users to prepare written plans, such as a Hazardous Materials Management Plan. The City of Berkeley, through its CUPA program, requires any business that handles hazardous materials above certain thresholds to prepare a Hazardous Materials Business Plan, which must include the following:

- Details of the facility and business conducted at the site;
- An inventory of hazardous materials that are handled or stored on site;
- An emergency response plan and contact information; and
- A safety and emergency response training program for new employees with annual refresher courses.

UC LBNL complies with these state requirements as implemented and enforced by the CUPA.

Hazardous Waste Handling

The federal Resource Conservation and Recovery Act of 1976 (RCRA) created a major new federal hazardous waste "cradle-to-grave" regulatory program administered by U.S. EPA. Under RCRA, U.S. EPA regulates the generation, treatment, and disposal of hazardous waste, and the investigation and remediation of hazardous waste sites. Individual states may apply to U.S. EPA to authorize them to implement their own hazardous waste programs in lieu of RCRA, as long as the state program is at least as stringent as federal RCRA requirements. California has been authorized by U.S. EPA to implement its

own hazardous waste program, with certain exceptions. In California, the DTSC regulates the generation, transportation, treatment, storage, and disposal of hazardous waste, and the investigation and remediation of hazardous waste sites. The California DTSC program incorporates the provisions of both federal and state hazardous waste laws (LBNL 2007).

Hazardous Materials Transportation

The DOT regulates the transportation of hazardous materials between states and foreign countries. DOT regulations govern all means of transportation, except that the U.S. Postal Service regulations govern packages sent by mail. The State of California has adopted DOT regulations for the intrastate movement of hazardous materials. In addition, the State of California regulates the transportation of hazardous waste originating in the state and passing out of the state.

The two state agencies that have primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies are the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans). The CHP enforces hazardous material and hazardous waste labeling and packing regulations to prevent leakage and spills of material in transit and to provide detailed information to cleanup crews in the event of an accident. The CHP conducts regular inspections of licensed transporters to assure regulatory compliance. Caltrans has emergency chemical spill identification teams at as many as 72 locations throughout the state that can respond quickly in the event of a spill (LBNL 2007).

Every hazardous materials package type used by a hazardous materials shipper must undergo tests that imitate some of the possible rigors of travel. While not every package must be put through every test, representative packages for any package design must be able to be dropped, fully loaded, onto a concrete floor with no significant leakage; survive a compression test in a stacked configuration with no significant damage or distortion; demonstrate leakproofness when subjected to internal air and/or liquid pressure; and not have package closure mechanisms adversely affected by vibration.

Occupational Safety

Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. In the State of California, the Division of Occupational Safety and Health Administration (Cal/OSHA) is generally responsible for assuring worker safety in the workplace. However, at DOE facilities such as LBNL, the occupational worker safety program is administered by the DOE pursuant to the authority provided by the Atomic Energy Act over health and safety at its facilities. Beginning in 2007, the DOE began enforcing its own Health and Safety Program

regulation (10 CFR 851), which includes requirements set forth in the OSHA regulations. The DOE enforces OSHA requirements in accordance with a Memorandum of Agreement with OSHA.

OSHA regulations 29 CFR 1910 and 1926 contain requirements concerning the use of hazardous materials in the workplace and during construction that mandate employee safety training, safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, emergency action and fire prevention plan preparation, and a hazard communication program. These regulations also require preparation of emergency action plans (escape and evacuation procedures, rescue and medical duties, alarm systems, and training in emergency evacuation).

Federal OSHA regulations include special provisions for hazard communication to employees in research laboratories, including training in chemical work practices. Specifically, more detailed training and monitoring is required for the use of carcinogens, ethylene oxide, lead, asbestos, and certain other chemicals listed in 29 CFR. Emergency equipment and supplies, such as fire extinguishers, safety showers, and eye washes, must also be provided and maintained in accessible places.

Federal OSHA regulations also include extensive, detailed requirements for worker protection applicable to any activity that could disturb asbestos-containing materials, including maintenance, renovation, and demolition. These regulations are also designed to ensure that people working near the maintenance, renovation, or demolition activity are not exposed to asbestos.

Biosafety Standards

Federal and state laws establish standards for working with biohazardous materials. A hazardous biological material is any potentially harmful biological material (including infectious agents, oncogenic viruses, and recombinant DNA) or any material contaminated with a potentially harmful biological material. The U.S. Public Health Service, the National Institutes of Health (NIH), and the Centers for Disease Control (CDC) and Prevention establish standards for working with biohazardous materials. The CDC and NIH have issued federal guidelines that address biological safety, including containment and handling guidelines to be used in microbiological and biomedical laboratories. These guidelines identify four Biosafety Levels which laboratories are required to comply with, depending on the risk group of the agent used. Biosafety level 1 is for the least hazardous biological agent and Biosafety level 4 is for the most hazardous biological agents. UC LBNL conducts research in compliance with these federal guidelines and in compliance with the California Department of Public Health.

Engineered Nanomaterials Guidelines

Engineered nanomaterials research and development is an emerging field and at the present time, there are no federal or state regulations controlling engineered nanomaterials research. Guidance and information from regulatory agencies available so far is summarized below.

- The U.S. EPA has developed the Nanoscale Materials Stewardship Program (NMSP) to provide a firmer scientific foundation for regulatory decisions by encouraging submission and development of information for nanoscale materials.

- The CDC National Institute for Occupational Safety and Health (NIOSH) has published an informational document on approaches to safe nanotechnology, and that document is used at LBNL.

- The U.S. Food and Drug Administration (FDA) has created the Nanotechnology Interest Group (NTIG) that is designed to facilitate the regulation of the nanotechnology. In addition, the National Nanotechnology Initiative (NNI), which is managed by the National Science and Technology Council, is a federal research and development program established to coordinate multi agency efforts in nanoscale science, engineering, and technology. The NNI acts as a cross-disciplinary network for all sectors that would potentially have an interest in nanotechnology. The three main goals in terms of environmental health and safety research conducted by the NNI are (1) to understand how nanomaterials behave in the environment and within the human body; (2) to develop instrumentation and measuring methods to characterize, test, and monitor nanomaterials; and (3) to conduct research to assess safety of nanomaterials in chemicals, foods, drug, and devices. As further toxicity and epidemiological research is conducted, regulatory standards for environmental health and safety will be established.

UC LBNL staff monitors the development of nanotechnology guidelines from all regulatory agencies to ensure safe and legally compliant research involving engineered nanomaterials.

Emergency Response

The Federal Emergency Planning and Community Right-to-Know Act of 1986 requires detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of to prevent or minimize adverse effects to human health or the environment in the event such materials are accidentally released. California has developed an emergency response plan to coordinate emergency services provided by federal, state, and local government and private agencies.

Responding to hazardous materials incidents is one part of this plan. The plan is administered by the State Office of Emergency Services, which coordinates the responses of other agencies, including the California Environmental Protection Agency, the CHP, the Department of Fish and Game, the San Francisco Bay RWQCB, and Alameda County Fire Department. The on-site fire department at LBNL provides first response capabilities, if needed, for hazardous materials emergencies. The LBNL

Emergency Services Program also conducts an annual Hazardous Materials Screening Process, required by DOE Order 151.1c, which surveys hazards at LBNL for potential operational emergencies.

Hazardous Materials Plans and Policies

UC LBNL has established environment, safety, and health policies and procedures to ensure all work is performed safely and in a manner that strives for the highest protection for the employees, guests, visitors, the public, and the environment. In addition, UC LBNL has developed an Integrated Safety Management System (ISMS) Environmental Management System to implement sound environmental stewardship practices that protect the air, water, land and other resources that could potentially be affected by facility operations. UC LBNL EH&S has the primary responsibility of developing strategies for compliance with local, state, and federal laws and regulations. UC LBNL EH&S has the authority to require abatement of any condition or operation that could endanger people or facilities or result in violations of pertinent federal or state laws or policies concerning health and safety. UC LBNL EH&S develops specific policies and programs in the following areas: industrial hygiene, chemical safety, physical safety, radiation safety, biohazard safety, occupational medicine, hazardous waste management, and environmental protection.

Hazardous Materials Storage, Handling and Disposal

Chemicals and other hazardous materials are stored in aboveground tanks and storage drums at the LBNL hill site. Hazardous, radioactive, and mixed wastes are stored in designated areas in research and support areas throughout the LBNL hill site. From these locations, they are taken to the permitted on-site Hazardous Waste Handling Facility for temporary storage. From this site, the wastes are hauled off for treatment and disposal.

Emergency Response Plan

UC LBNL has developed an emergency response plan that establishes policies, procedures, and an organizational structure for responding to and recovering from a major disaster at the LBNL hill site. The Master Emergency Program Plan (LBNL) utilizes the Standardized Emergency Management System (SEMS) which was mandated in 1996 by the State of California via Government Code 8607(a) and the National Incident Management System (NIMS) which was mandated in 2005 by the federal government via the Homeland Security Presidential Directive 5. These emergency management systems use the California Master Mutual Aid Agreement, existing mutual aid systems, the County Operational Area concept, and inter-agency and multi-jurisdiction coordination in California, which is a state and nationwide standardized approach to incident management using the Incident Command System (ICS). The UC LBNL plan include a hazards analysis and assessment which determine the primary hazards for

the LBNL hill site; a major earthquake along the Hayward fault and a major urban-wildland fire. In view of these primary hazards, the plan incorporates four phases of emergency management, including mitigation, preparedness, response, and recovery. Mitigation includes activities that eliminate or reduce the occurrence or effects of a disaster. For example, to address earthquake hazards, UC LBNL uses both structural and non-structural measures to make buildings and work areas seismically safe, and to address wildland fires, ongoing vegetation management programs are utilized. Preparedness includes planning as to how to respond when an emergency occurs and training employees so that they are prepared to respond to an emergency. For emergency response, UC LBNL relies on local fire and police services and also maintains response equipment on site for use by employees. Recovery includes short-and long-term actions necessary to return all systems to normal or near-normal conditions through comprehensive business continuity planning. UC LBNL's plan includes planned transitions from response to recovery.

Local Plans and Policies

The LBNL hill site is an approximately 200-acre site owned by the Regents of the University of California, where the University conducts research, service, and training work within the University's mission. The LBNL hill site includes research and support structures that are primarily part of a multi-program national laboratory called the Lawrence Berkeley National Laboratory, a federally funded research and development center operated and managed by the University of California under a U.S. Department of Energy (DOE)-UC contract. The University is exempted by the state constitution from compliance with local land use regulations, including general plans and zoning. However, the University seeks to cooperate with local jurisdictions to reduce any physical consequences of potential land use conflicts to the extent feasible. The LBNL hill site is located astride the Berkeley – Oakland city boundary, with a portion of LBNL located in each city. The SERC project site is located within Berkeley city boundary. The following sections summarize objectives and policies from the LBNL 2006 LRDP and LBNL Design Guidelines, the City of Berkeley General Plan, and local ordinances that relate to hazards and hazardous materials.

2006 LRDP Principles and Strategies

The 2006 LRDP proposes four fundamental principles that form the basis for the Plan's development strategies provided for each element of the Plan. The two principles most applicable to concerns regarding hazards and hazardous materials related to new development are to "Preserve and enhance the environmental qualities of the site as a model of resource conservation and environmental stewardship" and to "Build a safe, efficient, and cost-effective scientific infrastructure capable of long-term support of evolving scientific missions."

Development strategies provided by the 2006 LRDP are intended to minimize potential environmental impacts that could result from implementation of the 2006 LRDP. Development strategies set forth in the 2006 LRDP applicable to hazards and hazardous materials include the following:

- Improve efficiency and security of Laboratory access through improvements to existing gates and the creation of new gates.
- Develop all new landscape improvements in accordance with the Laboratory's vegetation management program to minimize the threat of wildland fire damage to facilities and personnel.

LBNL Design Guidelines

LBNL Design Guidelines were developed in parallel with the 2006 LRDP. There are no design guidelines that are specifically relevant to hazards and hazardous materials.

City of Berkeley General Plan

The City of Berkeley General Plan was adopted on April 23, 2002. The following policies are contained in the General Plan pertaining to hazards and hazardous materials:

Policy EM-13: Hazardous Materials Disclosure: Continue to require the disclosure of hazardous materials usage and encourage businesses using such materials to prepare and implement a plan to reduce the use of hazardous materials and the generation of hazardous wastes;

Policy EM-14: Hazardous Materials Regulation: Control and regulate the use, storage, and transportation of toxic, explosive, and other hazardous and extremely hazardous material to prevent unauthorized and accidental discharge;

Policy EM-15: Environmental Investigation: When reviewing applications for new development in areas historically used for industrial uses, require environmental investigation as necessary to ensure that soils, groundwater, and buildings affected by hazardous material releases from prior land uses would not have the potential to affect the environment or the health and safety of future property owners, users, or construction worker.;

Policy EM-16: Risk Reduction: Work with owners of vulnerable structures with significant quantities of hazardous materials to mitigate potential risks;

Policy EM-17: Warning Systems: Establish a way to warn residents of a release of toxic material or other health hazard, such as sirens and/or radio broadcasts;

Policy EM-31: Landscaping: Encourage drought-resistant, rodent-resistant, and fire-resistant plants to reduce water use, prevent erosion of soils, improve habitat, lessen fire danger, and minimize degradation of resources; and

Policy S-23: Property Maintenance: Reduce fire hazard risks in existing developed areas by ensuring that private property is maintained to minimize vulnerability to fire hazards.

City of Berkeley Manufactured Nanoparticle Disclosure Ordinance

In 2006, the City of Berkeley approved a change to the Hazardous Materials and Wastes Management portion of its Municipal Code. The amendment adds to facilities subject to reporting requirements those facilities "that manufacture or use manufactured nanoparticles," and requires such facilities to disclose "current toxicology of the materials reported, to the extent known, and how the facility will safely handle, monitor, contain, dispose, track inventory, prevent releases, and mitigate such materials."

4.5.4 IMPACTS AND MITIGATION MEASURES

Significance Criteria

The impact of the proposed project related to hazards and hazardous materials would be considered significant if it would exceed the following Standards of Significance, in accordance with Appendix G of the *State CEQA Guidelines* and the UC CEQA Handbook:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school;
- Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, result in a safety hazard for people residing or working in the project area;

- For a project within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the project area;
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or
- Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

Issues Not Discussed Further

The SERC project Initial Study determined that compliance with federal, state, and local rules and regulations and **LRDP EIR Mitigation Measures HAZ-3a** through **HAZ-3f**, which are included in the proposed project, would reduce potential impacts to nearby schools associated with the handling of hazardous materials and wastes to a less than significant level during the construction and operation of the SERC facility. Furthermore, as explained above, any on-site soil and/or groundwater contamination would be remediated as part of the approved Old Town Demolition and Environmental Restoration project.[2] Therefore exposure to soil and groundwater contamination are not a concern for the project. The Initial Study also determined that implementation of the project would not expose people on the project site to any safety hazards related to public airports or private airstrips because the project site is more than 11 miles northeast of the Oakland Metropolitan Airport, and is also not located within the vicinity of a private airstrip. These issues are not discussed further in this section.

Mitigation Measures included in the Proposed Project

The following mitigation measures, adopted as part of the 2006 LRDP, are required by the 2006 LRDP for the proposed project and are thus included as part of the proposed project. The analysis presented below assumes that the proposed project will implement these measures; the level of impact reflects project outcomes with all applicable LRDP mitigation measures in place.

LRDP EIR MM HAZ-3a: LBNL shall continue to prepare an annual self-assessment summary report and a Site Environmental Report that summarize environment, health, and safety program performance and identify any areas where LBNL is not in compliance with environmental laws and regulations governing

[2] If additional on-site soil contamination is detected during excavation for the SERC building, remediation would be conducted as part of the SERC project.

hazardous materials, and worker safety, emergency response, and environmental protection.

LRDP EIR MM HAZ-3b: Prior to shipping hazardous materials to a hazardous waste treatment, storage, or disposal facility, LBNL shall confirm that the facility is licensed to receive the type of waste LBNL is proposing to ship.

LRDP EIR MM HAZ-3c: LBNL shall require hazardous waste haulers to provide evidence that they are appropriately licensed to transport the type of wastes being shipped from LBNL.

LRDP EIR MM HAZ-3d: LBNL shall continue its waste minimization programs and strive to identify new and innovative methods to minimize hazardous waste generated by LBNL activities.

LRDP EIR MM HAZ-3e: In addition to implementing the numerous employee communication and training requirements included in regulatory programs, LBNL shall undertake the following additional measures as ongoing reminders to workers of health and safety requirements:

- Continue to post phone numbers of LBNL EH&S subject matter experts on the EH&S website.
- Continue to post Emergency Response and Evacuation Plans in all LBNL buildings.
- Continue to post sinks, in areas where hazardous materials are handled, with signs reminding users that hazardous materials and wastes cannot be poured down the drain.
- Continue to post dumpsters and central trash collection areas where hazardous materials are handled with signs reminding users that hazardous wastes cannot be disposed of as trash.

LRDP EIR MM HAZ-3f: LBNL shall update its emergency preparedness and response program on an annual basis and shall provide copies of this program to local emergency response agencies and to members of the public upon request.

Project Impacts and Mitigation Measures

SERC Impact HAZ-1: **Implementation of the proposed project would increase the routine use, transport and storage of hazardous materials and other scientific materials at the LBNL hill site but would not create a significant hazard to the public or the environment under routine or reasonably foreseeable upset and accident conditions. (*Less than Significant*)**

The proposed project involves the construction and operation of new laboratories which would increase the total amount of hazardous materials and scientific materials transported to, stored, and used at LBNL. Impacts of the proposed project from the transport, use, storage, and disposal of hazardous materials, wastes and scientific materials are discussed below, organized in terms of impacts from routine operations and impacts from accidental releases.

Impact from Routine Operations

Research that would be conducted in the proposed facility would involve a wide variety of research materials, including hazardous chemicals, non-hazardous organic and inorganic materials, and nano-scale materials. Other hazardous materials on site would include an on-site bulk liquid nitrogen storage tank generator and a diesel tank to store fuel for the emergency generator. Non-chemical processes would be used to control scale deposits in the cooling towers.

Similar to all research laboratories at the LBNL hill site, the SERC project would include the following four types of controls to reduce the potential for worker exposure, public exposure, and release of hazardous and other scientific materials to the environment: (1) engineered controls; (2) administrative controls; (3) use of personal protective equipment (PPE); and (4) training.

All lab areas would be appropriately designed and constructed for the types of materials that would be handled in each laboratory. All wet chemistry laboratories would be fitted with fume hoods and biosafety cabinets which are designed to reduce worker exposure to hazardous chemicals. An appropriate number of air changes would be implemented for worker safety. All lab facilities would maintain negative pressure which would control the release of any airborne materials to non-lab areas via doors and other openings. All flooring in the labs would be designed to be chemical resistant.

Administrative controls that would be implemented by UC LBNL consistent with its current practices at similar laboratories include but are not limited to the development and implementation of a chemical hygiene plan and good housekeeping practices in areas where chemicals or other scientific materials are

handled. The latter include maintaining all surfaces free of chemicals and scientific materials; using appropriate cleaning methods and materials; disposing used cleaning materials and wastes appropriately; transferring all materials in closed, labeled containers; posting signs indicating level and type of hazards; and labeling all storage containers. All lab personnel would be required to wear PPE appropriate for the type of materials they are handling. In addition, training would be provided to all personnel who work with these materials and those who enter these spaces.

All employees that would operate lasers in the laser spectroscopy lab would be required to complete laser safety training provided by EH&S and to receive on-the-job training from their Principal Investigator or supervisor.

All hazardous wastes generated at the SERC facility would be handled in compliance with federal and state laws. Nanomaterial wastes would also be handled in accordance with federal and state hazardous waste laws. As discussed above, UC LBNL stores, treats, and prepares for disposal hazardous, radioactive, and mixed wastes at its Hazardous Waste Handing Facility. Hazardous waste generated at the SERC facility would be sent off site for treatment and disposal in accordance with UC LBNL's waste management program.

In summary, consistent with **LRDP EIR Mitigation Measures HAZ-3a** through **HAZ-3f**, UC LBNL would implement the same health and safety plans, programs, practices, and procedures related to the use, storage, disposal, or transportation of hazardous materials and wastes at the SERC project that are implemented at other UC LBNL laboratories with similar types of research activities. Furthermore, it would implement the ISMS which focuses on the effective communication of health, safety, and environmental requirements to all members of the LBNL hill site community and LBNL contractors. All of these programs would ensure that the project's impact from hazardous materials use during routine operations is less than significant.

Impact Related to Accidental Releases

The potential for an off-site impact under upset conditions relates mainly to any releases of incoming hazardous materials while in transit to the site or from the release of hazardous waste as it is hauled off site for disposal or reuse. However, similar to existing conditions all incoming hazardous materials would be transported generally in small quantities and in compliance with DOT requirements; therefore the potential for an accidental release would be minimized. Similar to other laboratory facilities managed by UC LBNL and in compliance with **LRDP EIR Mitigation Measure HAZ-3d**, the SERC project would also minimize generation of hazardous wastes. Furthermore, off-haul of hazardous wastes from the project site would comply with **LRDP EIR Mitigation Measures HAZ-3b** and **HAZ-3c**. As a result, the

potential for a substantial impact under upset conditions would be minimized and the impact would be less than significant.

Due to the types of wet and dry laboratories included in the proposed project, the volume of hazardous chemicals and scientific materials present on site at any one point in time would be small. All hazardous materials would be stored in closed, labeled and secured storage containers. Signs indicating level and type of hazards would be posted. In addition, the potential for an accidental release of hazardous materials, including other scientific materials, from the project site as a result of a major earthquake on the regional fault system would be minimized by both the design of the proposed building and by the anchoring, bracing, and securing of all non-structural building elements.

- Similar to all new buildings at LBNL, the proposed SERC facility would be designed to comply with the requirements of the current California Building Code, the University of California Seismic Safety Policy, and "Lateral Force Design Criteria" of LBNL Design Management Procedures, including lateral force anchorage provisions. Furthermore, the structural design of the proposed building would be reviewed by the UC Berkeley Seismic Review Committee which consists of leading world experts on seismic design.

- The project would also comply with LBNL Construction Standards and Design Requirements for the design of mechanical systems and plumbing, including supports, vibration isolators, tie-downs, and seismic bracing for equipment and piping in the laboratories. Specialized safety measures would be applied to mechanical systems serving areas containing toxic chemicals. The mechanical design of the proposed project would be reviewed by the LBNL Mechanical Safety Subcommittee prior to release of construction documents for construction.

- The LBNL Construction Standards and Design Requirements also include guidelines for non-structural elements, including: anchoring of all free-standing equipment; restraints on shelves to keep items from falling (for chemicals and in other laboratory areas, the restraint must extend at least 1.5 inches above the shelf); use of mechanical latches on cabinet doors; restraint of compressed gas cylinders using approved brackets; and flexible utility connections for fume hoods and other equipment to minimize the potential for breakage. This equipment is secured to contain any possible releases and materials are stored at all times when not in use under seismically controlled conditions to minimize releases from a seismic event.

The impact related to hazardous materials use, transport, and storage under normal operations and upset conditions would therefore be less than significant.

Mitigation Measure: No project-level mitigation measure is required.

SERC Impact HAZ-2: The proposed project would not be located on a site that is included on a list of hazardous materials site or result in a significant hazard to the public or the environment by disturbing groundwater remediation activities. (*Less than Significant*)

As described in **subsection 4.6.2**, the Building 25A area is contaminated with volatile organic compounds (VOCs). The Building 25A groundwater lobe extends both southwards and westwards from Building 25A. The RCRA cleanup of the LBNL hill site, including the cleanup of the contaminated groundwater at the SERC project site, is currently under active oversight by DTSC. As LBNL is in compliance with the DTSC corrective action program, it is not included the list of hazardous materials sites compiled pursuant to Government Code Section 65962 (Cortese list). As the proposed project would not be located on a site that is included on the Cortese list, it would not result in a significant hazard to the public or environment.

The project as proposed would not create a significant hazard to the public or the environment by disturbing or redirecting the on-site contamination, or adversely impact the ongoing remediation. In order to construct the building foundation and a partial basement, the proposed building excavation would range from about 10 to 20 feet bgs. The excavation activities are expected to encounter groundwater and it is considered likely that some of the groundwater encountered would be contaminated. Any groundwater that results from dewatering during excavation would be tested, treated if necessary, and appropriately disposed of via one of several options, including but not limited to discharge to the sanitary sewer system, off-haul, or reinjection into the ground at the project site as part of the installed remediation system.

Once constructed, some of the basement area is expected to be slightly below the water table. As described in **Section 3.0, Project Description**, a wall backdrainage and an under-drainage system would be installed to avoid build up of hydrostatic pressure. Any collected groundwater would be tested and treated as necessary and then disposed of appropriately.

The proposed project includes the modification/relocation of some portions of the existing Building 25A *in-situ* soil flushing groundwater remediation system. The modifications would be accommodated on the project site or in the immediately adjacent area and would be designed to maintain or enhance the effectiveness of the currently installed system. All modifications would require DTSC approval prior to implementation. Since the modified/relocated system would maintain or enhance the effectiveness of the current groundwater remediation system at Building 25A, the impact of the project on the existing groundwater remediation activities would be less than significant.

Mitigation Measure: No project-level mitigation measure is required.

SERC Impact HAZ-3: **The proposed project would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. (*Less than Significant*)**

The proposed project would not construct any facilities that would interfere with the implementation of the UC LBNL MEPP. The proposed building has been designed with adequate access for emergency vehicles which are expected to access the site via McMillan Road and the existing service road along the west side of the project site (Medical Road). Under the proposed project, Medical Road would be modified to meet current fire code requirements. The proposed project would not interfere with access to any LBNL hill site gates and all routes would continue to be available to UC LBNL employees for evacuation.

In compliance with 2006 LRDP EIR Mitigation Measure GEO-1, a draft evacuation plan would be prepared for the SERC project in order to identify ingress and egress routes for emergency vehicles and facility employees. Under the 2006 LRDP, UC LBNL's emergency response procedures would not allow uncontrolled vehicle evacuation of the site if conditions did not warrant it. During or after a catastrophic event, the LBNL's perimeter gates would be controlled. For example, the gates would be closed to all vehicles except for emergency vehicles. If evacuation by vehicle is determined by the UC LBNL Emergency Operations Center or emergency official to be safe in a particular emergency, traffic control would be provided on Centennial Drive and Cyclotron Road by UC LBNL and UC Berkeley to ensure orderly evacuation of all vehicles and individuals in the area. In a regional emergency where exigent circumstances do not exist, any decision to evacuate would be coordinated with UC Berkeley and the City of Berkeley, and with Alameda County and the City of Oakland if necessary.

In the event that evacuation of the SERC site is not advised by UC LBNL officials, LBNL has resources on site that can be used by the on-site population to shelter-in-place for approximately three days. These resources include internal water supply, stocked food supply, medical facilities and staff, fire station and emergency response staff, emergency generators and fuel supply, security staff, communications and EMS system, and on-site construction crews and craftspeople. The on-site resources would be adequate to serve the increased population to include SERC staff if required. There would be no impact related to the LBNL emergency response plan or evacuation plan.

Mitigation Measure: No project-level mitigation measure is required.

SERC Impact HAZ-4: **The proposed project would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. (*Less than Significant*)**

The LBNL hill site is located in the Oakland-Berkeley Hills in an area that is prone to wildland fires. As discussed in **Section 3.0, Project Description**, the proposed building is being located in the central portion of the LBNL hill site on a previously developed site, adjacent to existing buildings in order to foster collaboration and interaction. The potential for exposure to wildland fires at this location is relatively low as the project site is in a highly developed area and at a distance from the surrounding open space areas. The siting of the building in this manner also minimizes the intrusion of new facilities into undeveloped wildland areas and thus minimizes the potential for human activities to cause wildland fires.

The SERC project would bring approximately 50 additional persons to the LBNL hill site during normal business hours on weekdays (the remainder of the facility population would be staff relocating to the new building from other LBNL facilities). Although both the proposed building and the new population associated with the new building could be exposed to the risk from wildland fires, a significant impact related to risk of loss, injury or death involving wildland fire is not expected because:

- The building would be designed and constructed in conformance with Title 24, California Code of Regulations, the requirements for Group B research laboratory occupancies as defined by the California Building Code, Type I-B Fire Resistive Construction for the laboratory building, and with applicable fire code safety requirements. The fire protection system would meet all statutory requirements which apply to the hazardous materials that would be handled in the facility. The building would be fitted with automatic sprinklers. Fire hydrants would be provided to the northeast of the building near the intersection of McMillan Road and Medical Road and also to the northwest of the building along McMillan Road to protect the building against wildland fire threats.

- In compliance with LBNL's vegetation management program and consistent with 2006 LRDP design strategies, all new landscaping in the areas surrounding the building would be developed to minimize the threat of wildland fire damage to facilities and personnel. The landscaping plan would provide for adequate spacing between trees to avoid interconnecting canopies and would provide for control of accumulation of light medium vegetation (grasses and woody shrubs).

- All new employees would be provided training and information regarding measures to be taken in the event of a fire.

- The fire station on the LBNL hill site is within 500 feet of the project site and is adequately staffed to serve this project along with other existing facilities on the LBNL hill site. As discussed above, the service road along the west side of the project site would be modified to provide adequate space for a standard fire engine to turn into and out of the service road and therefore fire engines would be able to serve the project site.

Therefore, the impact related to exposure to wildland fire risk would be less than significant.

Mitigation Measure: No project-level mitigation measure is required.

4.5.5 CUMULATIVE IMPACTS

As stated in **subsection 4.0.4**, the 2006 LRDP EIR included the evaluation of the environmental impacts from the construction of a large building at the proposed site of the SERC project, in conjunction with the rest of the projected growth at the LBNL hill site, growth at UC Berkeley, and in the nearby communities.

The cumulative impacts related to hazards and hazardous materials are presented on pages IV.F-40 to IV.F-42 of the 2006 LRDP EIR. The cumulative impact from increased exposure to hazards and hazardous materials is adequately addressed under LRDP Impact HAZ-7 in the 2006 LRDP EIR. That impact evaluates the cumulative effect of hazardous materials use at LBNL under the 2006 LRDP, including the proposed project, hazardous materials use at UC Berkeley under the Campus's 2020 LRDP, and increases in hazardous materials use in the East Bay and adjoining areas, and concludes that because of compliance with federal, state and local policies, the cumulative impact would be less than significant.

The 2006 LRDP EIR also discusses the cumulative effect related to a regional catastrophic event under LRDP Impact HAZ-5, and concludes that the Lab's contribution to a regional cumulative impact would be less than significant. There are no changes in circumstances related to hazardous materials and hazards that would alter the conclusions of the 2006 LRDP EIR with respect to cumulative effects related to hazards and hazardous materials. No further evaluation of long term cumulative impacts is considered necessary. The project's construction-phase cumulative impact is described below.

Cumulative Impact HAZ-1: **Construction of multiple projects at the LBNL hill site during the 2010 to 2013 window would not create a significant short-term cumulative impact related to hazardous materials exposure. (*Less than Significant*)**

Hazardous materials concerns that arise during construction typically relate to

- potential exposure of workers and the public to hazardous substances used in the construction process, including but not limited to vehicle fuels and lubricants, solvents, paints, adhesives, and paving media; and/or
- potential exposure of workers and the public to preexisting site contamination as a result of grading or other ground-disturbing activity.

Handling, storage, and transport of hazardous substances is strictly regulated at the state and local levels, and for UC LBNL projects, additional safeguards are provided through compliance with measures included in the 2006 LRDP EIR to ensure that hazardous materials and wastes are stored and handled

during construction in a manner that minimizes public and environmental exposure; and UC LBNL's commitment to continue developing project specifications to ensure that subcontractors meet applicable environmental health and safety regulations. As a result, project-level impacts related to hazardous materials usage are controlled on a project by project basis and are generally not considered likely to cumulate. The same is true for potential exposure to preexisting site contamination through grading or other ground disturbance—under federal and state law, known contamination must be remediated consistent with the proposed site use before construction may begin, and evaluative and corrective requirements in the event previously undocumented contamination is discovered during construction are also prescribed under law. The cumulative impact would therefore be less than significant.

Mitigation Measure: No mitigation measure is required.

4.5.6 REFERENCES

Lawrence Berkeley National Laboratory. 2007. 2006 Long Range Development Plan Final Environmental Impact Report. SCH No. 2000102046. July.

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