

CHAPTER 4.0

Affected Environment

4.1 Regional and Local Setting

LBNL is located in the cities of Berkeley and Oakland in Alameda County on land owned by the University of California. The project site comprises approximately four acres. Of this total, approximately 2.25 acres (the “demolition zone”) would be converted from developed area (i.e., occupied by Building 51) to an undeveloped area for an indeterminate time, until another use for this area is proposed, approved, and initiated. The remaining acreage would be used for parking and staging. The site is located within the City of Berkeley portion of LBNL, in the west-central part of LBNL, and is located adjacent to Lawrence Road (from which vehicles enter and leave the site) and McMillan Road within Berkeley Lab. Laboratory, office, engineering, and computing functions occupy the LBNL buildings immediately adjacent to Building 51. Open space or landscaped areas border the site immediately to the east and north. Surrounding land uses include residential areas to the north of the LBNL property line; LBNL buildings and UC Berkeley athletic fields to the south; LBNL buildings, non-UC Berkeley residences, and UC Berkeley student housing, amphitheater, and classrooms to the west; and additional LBNL buildings and the UC Berkeley Lawrence Hall of Science to the east. Building 51 is approximately 1,100 feet from the nearest residences to the west and north, and about 1,300 to 1,400 feet from the Lawrence Hall of Science to the east.

4.2 Environmental Resources Potentially Affected

4.2.1 Air Quality

The project site is located in the city of Berkeley and is within the boundaries of the San Francisco Bay Area Air Basin (Bay Area). Storm tracks typically stay north of the Bay Area for much of the year. Berkeley’s proximity to the Pacific Ocean also contributes to its moderate climate. The annual temperature at Berkeley Lab averages in the mid 50s (degrees Fahrenheit). Low temperatures during winter months seldom drop below the mid 30s, while the warmest days of the summer infrequently see high temperatures that exceed 80 degrees Fahrenheit. Daily and seasonal oscillations of temperature are small because of the moderating effects of the nearby ocean. In contrast, rainfall generally tends to be confined to the period from early November through late April or early May. On average, Berkeley Lab receives about 30 inches of rainfall annually. The annual total can vary considerably, depending on climatic conditions, such as drought. Winds in the Berkeley area display several characteristic patterns. During the day, especially under fair weather conditions, winds are typically from the west and northwest as air comes in off the Pacific Ocean. At night, cooling of the land generates winds from the east and southeast. Southeast winds typically also precede weather systems passing through the region.

Criteria Air Pollutants

The federal Clean Air Act of 1970 and its amendments established maximum allowable concentration standards for six ambient air pollutants known as “criteria” pollutants: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter (respirable PM₁₀ and fine PM_{2.5}), and lead. Each of these standards was set to meet specific public health and welfare criteria. Individual states were given the option to adopt more stringent state standards for criteria pollutants and to include other pollutants. California has done so through the California Clean Air Act.

The Bay Area Air Quality Management District (BAAQMD) is the regional agency with regulatory authority over stationary sources in the Bay Area, while the California Air Resources Board (CARB) has regulatory authority over mobile sources such as construction equipment, trucks, and automobiles throughout the state. The BAAQMD has the primary responsibility to meet and maintain the state and federal ambient air quality standards in the Bay Area.

Both the federal and state Clean Air Acts require that air basins, or portions thereof, be classified as either “attainment” or “nonattainment” for each criteria air pollutant, based on whether or not the federal and state standards have been achieved. The Bay Area Air Basin is currently designated nonattainment for the state ozone standards and the federal 8-hour ozone standard, though ozone levels measured at monitoring stations in Berkeley and Oakland¹ have not exceeded either standard in recent years. Ozone and ozone precursors such as reactive organic gases (ROG) and nitrogen oxides (NO_x) are the pollutants of greatest concern in the Bay Area. The Bay Area also is designated as nonattainment for the state PM₁₀ standard and the state PM_{2.5} standard. The Bay Area is designated as either attainment or unclassified with respect to all other pollutants.

There have been no exceedances of the state and the federal 1-hour ozone standards in the last five years at the monitoring sites nearest Berkeley Lab. There have been no exceedances of state and federal ambient carbon monoxide standards at the Alice Street station in Oakland in the last five years. Data from the monitoring station in Fremont indicate that there were two days over the state 24-hour PM₁₀ standard in 2000, three in 2001, one in 2002, and none since. The standards for the other criteria pollutants (i.e., nitrogen dioxide [NO₂], sulfur dioxide [SO₂], and lead) are being met in the Bay Area, and the latest pollutant trends suggest that these standards will not be exceeded in the foreseeable future (CARB, 2005b).

Toxic Air Contaminants (Diesel Particulate Matter)

Toxic air contaminants (TACs) are air pollutants that may cause or contribute to an increase in mortality or an increase in serious illness, or may pose a present or potential hazard to human health. The CARB, California’s air quality management agency, recognizes hundreds of substances as toxic air contaminants. CARB identified diesel particulates, referred to as diesel

¹ The BAAQMD operates a regional monitoring network that measures the ambient concentrations of the six criteria pollutants. The station closest to the project site is the Alice Street station in Oakland, approximately six miles south of the project site. This station monitors ozone and carbon monoxide. The nearest station that monitors size-specific particulate matter (PM₁₀ and PM_{2.5}) is located at Chapel Way in Fremont, approximately 30 miles southeast of the project site. The project site is considered typical of urban areas in the East Bay, so PM₁₀ and PM_{2.5} concentrations at the Fremont station provide some indication of likely concentrations at the project site.

particulate matter or DPM, as a TAC in August 1998 (CARB, 2005a). While some other TACs could be expected to be present at the site or could be used in the proposed demolition, the potential hazard from these TACs would be much smaller than the potential hazard from the particulate emissions from diesel-fueled engines of the demolition equipment and haul trucks. For this reason, it is sufficient to consider DPM alone in determining impact.

The central issue of concern with DPM is the risk of chronic health effects associated with long-term exposure to these particulates. To address this risk, CARB developed a risk management guidance document and risk reduction plan to reduce DPM and resultant health risk by 75 percent in 2010 and 85 percent by 2020. Since approval of these documents in September 2000, CARB has adopted a series of rules for stationary and portable diesel engines, solid waste collection vehicles, transport refrigeration units, and idling of diesel vehicles. Additional measures and specific regulations to reduce DPM emissions will be evaluated and developed over the next several years. In addition, in May 2004, the U.S. Environmental Protection Agency (EPA) adopted a comprehensive national program known as the Clean Air Nonroad Diesel Rule to reduce emissions from future nonroad diesel engines by more than 90 percent by integrating engine and fuel controls (EPA, 2004). In parallel with emission standards for heavy-duty diesel engines, EPA introduced sulfur content requirements for highway diesel fuel. The highway vehicle diesel fuel sulfur limit, which was originally 5,000 parts per million (ppm), was first revised to a limit of 500 ppm (low sulfur fuel), and then further reduced to 15 ppm (ultra-low sulfur fuel), beginning, for retail and wholesale consumers, on October 15, 2006. The 15 ppm sulfur limit is required to prevent the malfunction of catalyzed filtration systems that are needed to meet the meet future diesel engine emission standards. These federal limits on sulfur in fuel apply only to fuel for highway vehicles. CARB regulations mandate the same sulfur content for highway diesel fuel as do the EPA regulations, except that the effective date for retail and wholesale consumers is September 1, 2006.

Federal restrictions on sulfur content in diesel fuel for nonroad engines follow a different schedule. The 2004 EPA rule limits the sulfur in nonroad fuels to 500 ppm effective June 1, 2007, and 15 ppm effective June 1, 2010. Subsequent to these federal restrictions for nonroad engines, CARB moved up the dates for compliance with sulfur restrictions and on December 14, 2004, required that nonroad diesel fuel sold in California, except for diesel fuel used for locomotives or marine engines, must meet the same sulfur restrictions as fuel used for highway vehicles. In this case, the sulfur content in fuel for nonroad engines in California must not exceed 15 ppm as of September 1, 2006, rather than EPA date of June 2010.

Sensitive Receptors

Some land uses are known as “sensitive receptor areas” because people there are considered more sensitive to air pollutants than others for reasons that include pre-existing health problems, proximity to emissions source, or duration of exposure to air pollutants. Schools, hospitals, and convalescent homes are considered relatively sensitive to air quality because children, elderly people, and the infirm are more susceptible to respiratory distress and other air quality-related health problems than the general public. Residential areas are also considered sensitive to air quality because people such as children, elderly people, and the infirm (i.e., those most

susceptible to air-quality related health problems) usually stay home for extended periods of time, with associated greater exposure to ambient air quality in residential areas. Recreational uses are also considered sensitive receptors because vigorous exercise associated with recreation places a high demand on the human respiratory system.

Sensitive receptor areas in the vicinity of the project site include residential areas and nearby dormitories associated with the University. The nearest sensitive receptors are the single- and multi-family residences to the southwest and single-family residences to the north of the project site. These areas are generally not downwind of the site, given that the predominant daytime winds are from the west and northwest, and those predominant winds would carry airborne emissions from the project site away from those sensitive receptors.

4.2.2 Biological Resources

LBNL is located on the western slopes of the Oakland-Berkeley Hills, where low- to moderate-density residential neighborhoods are mixed with open space containing a mosaic of vegetation types and wildlife habitats, including oak and mixed evergreen forests, native and non-native grasslands, chaparral, coastal scrub, marsh and wetland communities, and riparian scrubs and forests. The Lab is within a mile of several large tracts of relatively undeveloped open space and preserved land, including Tilden Park and Claremont Canyon Preserve, which are themselves contiguous with undeveloped East Bay Municipal Utility District (EBMUD) watershed lands. The Lab consists of a mix of built and undeveloped spaces, where activities range from industrial-scale operations and construction to minimally invasive vegetation management, often adjacent to one another. The Building 51 site is located in the northern portion of LBNL, an area that is approximately two-thirds developed and one-third open space. The site is thus surrounded by existing buildings and fragmented areas of open space. The site is part of a substantial plateau that was graded (cut and filled) for development into a northeast to southwest sloping hillside.

The Building 51 site itself is almost entirely developed, with the exception of two small areas of ornamental landscaping adjacent to the front entrance, although adjacent vegetated areas provide potential habitat for common and special-status wildlife species.² Vegetation types in the vicinity

² The term “special-status species” includes species that are listed and receive specific protection defined in federal endangered species legislation. The term also includes other species that have not been formally listed as threatened or endangered but have been designated as species “of concern,” or as “rare” or “sensitive” on the basis of adopted policies and expertise of federal resource agencies or organizations with acknowledged expertise, including the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (now known as “NOAA Fisheries”). For purposes of this analysis, State of California designations are also included; that is, species identified by the California Department of Fish and Game (CDFG) and the California Native Plant Society. Specifically, the following categories are included: federally listed endangered and threatened species; species proposed for listing as endangered or threatened; candidates for such listing; federally identified species of concern and species of local concern; state-listed endangered and threatened species, and rare (plants only) species; California Species of Special Concern; species designated “special animals” by the state; “fully protected” species (of which there are about 35, most of which are also listed as either endangered or threatened); and raptors (birds of prey), which are specifically protected by Fish & Game Code Section 3503.5, which prohibits the take, possession, or killing of raptors and owls, their nests, and their eggs. The inclusion of birds protected by Fish & Game Code Section 3503.5 is in recognition of the fact that these birds are substantially less common in California than most other birds, having lost much of their habitat to development, and the recognition that the populations of these species are therefore substantially more vulnerable to further loss of habitat and to interference with nesting and breeding than are most other birds. It is noted that a number of raptors and owls are already specifically listed as threatened or endangered by state and federal wildlife authorities.

include annual grassland, coast live oak woodland, California bay woodland, oak-bay woodland, conifer stand, eucalyptus stand, and landscaped areas. Common wildlife observed at the proposed site, as well as in other similarly developed sites during field surveys throughout the LBNL hillside area (ESA, 2005; ESA, 2002a, 2002b, and 2002c; and ESA, 2003a, 2003b) includes species tolerant of human presence such as California mule deer (*Odocoileus hemionus californicus*), fox squirrel (*Sciurus niger*), California towhee (*Pipilo crissalis*), chestnut-backed chickadee (*Poecile rufescens*), and western scrub jay (*Aphelocoma coerulescens*). No special-status plants or wildlife have been identified on the Building 51 project site or elsewhere at LBNL during field surveys (ESA, 2005; ESA, 2002a, 2002b, and 2002c; and ESA, 2003a, 2003b), although nine special-status animal species are judged to have at least a moderate potential to occur, based on habitat conditions. **Table 1** lists these species.³

Of these species, Cooper's hawk, sharp-shinned hawk, red-tailed hawk, American kestrel, great horned owl, and olive-sided flycatcher may all potentially make use of the oak, conifer, or eucalyptus trees in the vicinity of the Building 51 project site for nesting purposes. Bewick's wren may potentially use coast live oaks or landscaped areas adjacent to Building 51 for nesting. Long-eared and fringed myotis may potentially establish maternal roosts in trees with cavities, such as oaks, conifers, and eucalyptus that occur in the project vicinity.

Under Section 9 of the federal Endangered Species Act, a "take" is defined as an act to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect or to attempt to engage in any such conduct." Therefore, for special-status birds, this EA considers direct removal of nesting substrate or the destruction of nests and eggs, as well as indirect impacts such as noise generated by construction, which can result in disturbance of breeding birds, nest abandonment, and mortality of young, as "take" under the regulations protecting special-status species. For special-status bats, destruction of maternal roosts or indirect impacts resulting in maternal roost abandonment are considered as "take."

Generally, the potential for special-status plant species to occur at LBNL is low; none have been observed in past environmental studies prepared for LBNL (LBNL, 1992; LBNL, 1994; LBNL, 1997b; and SAIC, 1994), and none were observed during recent general biological resource surveys (ESA 2002a, 2002b, 2002c and ESA, 2003a, 2002b). The LBNL hill site as a whole has been subject to ongoing disturbance, first in the form of grazing and then in the form of development, for the past 200 years. These types of disturbances, combined with the introduction of highly competitive non-native plant species, have resulted in the extirpation of a number of plant species that were documented in the Berkeley area in the late 1800s and early 1900s. In addition, the suppression of fire in the urbanized hills has resulted in mature stands of scrub and woodland with dense canopy cover and little understory, further reducing the likelihood for herbaceous species to be present. LBNL aggressively manages vegetation on virtually the entire

³ Alameda whipsnake (*Masticophis lateralis euryxanthus*), federally listed as "threatened," has not been sighted at LBNL, although suitable habitat may be present on the Lab site. However, this would most likely be at the eastern corner of the Lab property, contiguous with open space to the north and east. Suitable habitat is not present at or near Building 51. On October 18, 2005, USFWS issued revised designations of Alameda whipsnake critical habitat, which do not include any portion of the project site (Federal Register, Volume 70, Number 200, pp. 60608 et seq.).

**TABLE 1
SPECIAL-STATUS SPECIES POTENTIALLY PRESENT IN PROJECT AREA**

Common Name Scientific Name	Listing Status USFWS/ CDFG	General Habitat	Potential for Species Occurrence within the Project Area	Period of Identification
Birds				
Cooper's hawk <i>Accipiter cooperi</i>	--/CSC	Nests in riparian growths of deciduous trees and live oak woodlands	Moderate potential. Nesting habitat is available adjacent to project site. Observed with kill upslope from Blackberry Canyon gate (ESA, 2003a).	March–July
Sharp-shinned hawk <i>Accipiter striatus</i>	--/CSC	Nests in riparian growths of deciduous trees and live oaks	Moderate potential. Potential nesting habitat is present on the north fork of Strawberry creek, low potential to forage in and around project site.	March–July
Olive-sided flycatcher <i>Contopus cooperi</i>	FSC/--	Inhabits open conifer or mixed woodlands; nests in large coniferous trees	Moderate potential. Suitable perching, foraging and nesting habitat is present adjacent to project site, but species is relatively rare in East Bay Hills.	May–August
Bewick's wren <i>Thryomanes bewickii</i>	FSC/--	Inhabits chaparral, scrub, and landscaped areas; may also be found in riparian and edges of woodland habitats	Moderate potential. Preferred habitat is present throughout LBNL. Species has potential to nest in landscape shrubs and oaks on and adjacent to project site.	Year-round
Great horned owl <i>Bubo virginianus</i>	--/3503.5	Often uses abandoned nests of corvids or squirrels; nests in large oaks, conifers, eucalyptus	Moderate potential. Suitable nesting habitat occurs in eucalyptus and conifer stands adjacent to project site.	Year-round
Red-tailed hawk <i>Buteo jamaicensis</i>	--/3503.5	Usually nests in large trees, often in woodland or riparian deciduous habitats	Moderate potential. Suitable nesting habitat is present in stands of large trees adjacent to site. Observed foraging at LBNL (ESA, 2002a).	Year-round
American kestrel <i>Falco sparverius</i>	--/3503.5	Frequents generally open grasslands, pastures, and fields; primarily a cavity nester	Moderate potential. Observed foraging at LBNL (ESA, 2003b). Potential nesting habitat available in cavities in mature oaks or pines adjacent to project site.	Year-round
Mammals				
Long-eared myotis <i>Myotis evotis</i>	FSC/--	Inhabits woodlands and forests up to approximately 8,200 feet in elevation; roosts in crevices and snags	Moderate potential. Suitable foraging and roosting habitat is present in project area.	March–August
Fringed myotis <i>Myotis thysanodes</i>	FSC/--	Inhabits a variety of woodland habitats, roosts in crevices or caves, and forages over water and open habitats	Moderate potential. Suitable foraging and roosting habitat is present in project area.	March–August

Status codes:

FEDERAL: (U.S. Fish and Wildlife Service [USFWS])
 FSC = Federal species of concern; may be endangered or threatened, but not enough biological information has been gathered to support listing at this time

STATE: (California Department of Fish and Game [CDFG])
 CSC = California Species of Special Concern
 3503.5 = California Fish and Game Code Section 3503.5, Protection for nesting species of Falconiformes (hawks) and Strigiformes (owls)

hill site for fire protection. Through the reintroduction of grazing, as well as fuel reduction by mechanical means, LBNL has converted both coastal scrub habitat and stands of eucalyptus and French broom to grassland in recent years. Although small areas of patchily distributed native grasses remain scattered throughout LBNL, the native herbaceous species observed in these areas are those that are commonly found throughout the Oakland-Berkeley Hills (ESA 2002a, 2002b, 2002c and ESA, 2003a, 2002b). Generally, less common species in the hills tend to be found on serpentine or other ultramafic soils or on thin soils, such as occur in roadcuts, where non-native species do not compete as readily. These types of soils were not observed at LBNL during ESA's field surveys. The Building 51 site itself is fully developed, precluding the establishment of plant cover; the grassy and wooded slopes directly adjacent upslope are not expected to support special-status plants for the reasons outlined above.

There are no wetlands or streams located on the Building 51 project site, and the site is located approximately 500 feet south of the head of the north fork of Strawberry Creek. Therefore, there is no potential for the Proposed Action to affect any streams or other "waters of the United States" that would fall under the jurisdiction of the U.S. Army Corps of Engineers, and this topic will not be discussed in the impacts analysis.

4.2.3 Cultural Resources

The entire lab property, including the project site, was surveyed in 2000 for the presence of potential archaeological and historical resources. No indications of historic or prehistoric archaeological resources eligible for listing on the National Register of Historic Places were encountered (Kielusiak, 2000). The Northwest Information Center has indicated there is a "low potential for Native American sites in the project area" and thus "a low possibility of identifying Native American or historic-period archaeological deposits in the project area" (Northwest Information Center, 2003). Native American archaeological sites in this portion of Alameda County tend to be situated on terraces along ridgetops, midslope terraces, alluvial flats, and near sources of water. As the project site is not located on these types of terrain and it is not adjacent to Strawberry Creek, historically the primary natural source of water in the area, there is a low potential for Native American sites to exist at the project site.

In terms of historic buildings, field surveys and historic research is being conducted at LBNL by a team of licensed cultural resource professionals to evaluate the potential for historically important buildings or structures. In coordination with LBNL, DOE, and the State Office of Historic Preservation (SHPO), this team is systematically investigating and reporting on all previously unsurveyed buildings and structures at the Lab. Upon completion, these reports will be submitted to SHPO for review and concurrence.

One historic resource eligible for listing in the National Register of Historic Places (NRHP) has been identified on the project site: Building 51 and the Bevatron equipment within it. Construction of Building 51 began in 1949, and the building was occupied in 1950. When the Bevatron began operating in 1954, it was the world's largest and highest energy accelerator, designed for the study of high-energy nuclear processes of cosmic energy range. Four Nobel Prizes were awarded for discoveries in the field of physics that were made at the Bevatron.

Additions and structural changes to Building 51 and modifications to the Bevatron continued until the facility was closed by the DOE in 1993.

The State Office of Historic Preservation assigned Building 51 a rating of “2S2,” which is defined as an “individual property determined eligible for the NRHP by consensus through Section 106 process. Listed in the California Register” (CSOHP, 2003; CSOHP, 2004).⁴ As such, both the structure of Building 51 and the Bevatron accelerator equipment within it form a single historic resource, since Building 51 was purposefully designed and built to house the Bevatron.

In accordance with Section 106 of the National Historic Preservation Act (NHPA), LBNL has consulted with the SHPO and the Advisory Council on Historic Preservation (ACHP) regarding effects of the demolition of Building 51 and the Bevatron equipment within it, which are discussed in Section 5.1.3, Cultural Resources.

4.2.4 Geology and Soils

The project site is situated on the western slopes of the Oakland-Berkeley Hills, which are raised uplands of the Diablo Range located between the Hayward Fault on the west and the northern Calaveras Fault Zone to the east. Building 51 is underlain by what geologic mapping identifies as sandstone, siltstone, and mudstone bedrock of the Great Valley Complex (Graymer, 2000). Geologic mapping is consistent with bedrock observed in road-cut exposures along Cyclotron Road which consist mostly of sandstone, with some interbedded mudstone (Fugro West, Inc., 2002a, 2002b, and 2002c).

The steep sloping hillsides of the Oakland-Berkeley Hills characterize the general topography throughout the majority of the LBNL site. Building 51 is constructed on a series of graded level areas adjacent to vegetated natural or manmade slopes, some of which reach a steepness of up to 100 percent. Given the degree of grading on the LBNL site, many of the slopes are supported by retaining structures or have otherwise been engineered for stability. Level, graded areas are connected by sloping roads and pedestrian walkways. The Building 51 site is located on one of the larger graded, near-level areas on the LBNL site with elevations varying between approximately 720 and 760 feet above mean sea level. The northeast side of the project site is bound by an upsloped area with average gradients approaching 60 percent while to the west of Building 51, past the parking lot across Lawrence Road, the hillside slopes downward, in places at slopes approaching 100 percent (USGS, 1980).

The U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) (formerly known as the Soil Conservation Service) has characterized the majority of Building 51 site soils as Maymen loam, 30- to 75-percent slopes. Maymen loam is a shallow, moderately permeable soil that exhibits rapid to very rapid runoff and has a high to very high erosion hazard (USDA, 1981).

⁴ Section 106 of the National Historic Preservation Act is a consultation process which requires federal agencies to consult with the Advisory Council on Historic Preservation on federal actions which may affect a building or structure listed in, or eligible for listing in, the National Register of Historic Places.

The San Francisco Bay Area contains both active and potentially active faults and is considered a region of high seismic activity.⁵ The USGS Working Group on California Earthquake Probabilities has evaluated the probability of one or more earthquakes of Richter magnitude 6.7 or higher occurring in the San Francisco Bay Area within the next 30 years. The result of the evaluation indicated a 62-percent likelihood that such an earthquake event will occur in the Bay Area between 2003 and 2032 (USGS, 2003).

Ground movement during an earthquake can vary depending on the overall magnitude, distance to the fault, focus of earthquake energy, and type of geologic material. The composition of underlying soils, even those relatively distant from faults, can intensify ground shaking. The Modified Mercalli (MM) intensity scale is commonly used to describe earthquake intensity and its effects on people or buildings due to ground shaking. The MM values for intensity range from I (earthquake not felt) to XII (damage nearly total); intensities ranging from IV to X could cause moderate to significant structural damage (CGS, 2002).⁶ At LBNL, maximum ground shaking intensity resulting from an earthquake generated on the Hayward Fault, discussed below, is anticipated to be very violent with a Mercalli Intensity of X (ABAG, 2003).

The project site is immediately adjacent to the Hayward Fault Zone and approximately 19 miles northeast of the active San Andreas Fault Zone. Other principal faults capable of producing significant ground shaking at the project site are the San Gregorio-Hosgri, Calaveras, Concord–Green Valley, Marsh Creek–Greenville, and Rodgers Creek faults. The USGS Working Group on California Earthquake Probabilities estimates that there is a 27-percent chance that the Hayward–Rodgers Creek Fault System will experience an earthquake of M 6.7 or greater in the next 30 years (USGS, 2003). Two active traces of the Hayward Fault are close to but not within the project site; the nearest (“Main Trace”) is approximately 1,000 feet downslope, southwest of the project site, while the West Trace is located an additional 100 to 150 feet west (CGS, 1982). The USGS Working Group on California Earthquake Probabilities recently estimated that there is a 21-percent chance of the San Andreas Fault experiencing an earthquake of M 6.7 or greater in the next 30 years (USGS, 2003).

4.2.5 Hazards and Human Health

Hazardous Materials and Waste

Hazardous materials are substances with certain physical and/or chemical properties that could pose a substantial present or future hazard to human health or the environment when improperly handled, disposed of, or otherwise managed. Hazardous materials are grouped into the following

⁵ An “active” fault is defined by the State of California as a fault that has had surface displacement within Holocene time (approximately the last 10,000 years). A “potentially active” fault is defined as a fault that has shown evidence of surface displacement during the Quaternary (last 1.6 million years), unless direct geologic evidence demonstrates inactivity for all of the Holocene or longer. This definition does not, of course, mean that faults lacking evidence of surface displacement are necessarily inactive. “Sufficiently active” is also used to describe a fault if there is some evidence that Holocene displacement occurred on one or more of its segments or branches (Hart, 1997).

⁶ The damage level represents the estimated overall level of damage that will occur for various MM intensity levels. The damage, however, will not be uniform. Some buildings will experience substantially more damage than this overall level, and others will experience substantially less damage. Not all buildings perform identically in an earthquake. The age, material, type, method of construction, size, and shape of a building all affect its performance.

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).⁷ Hazardous materials are commonly used in commercial, agricultural, and industrial applications, as well as in residential areas to a limited extent. A hazardous waste is any hazardous material that is discarded, abandoned, disposed, or is to be recycled. The same criteria that render a material hazardous also make a waste hazardous.⁸

Hazardous Materials Potentially at Building 51

A number of hazardous materials were used or generated at Building 51. Among these are asbestos-containing materials used in the construction of Building 51, polychlorinated biphenyls (PCBs) and mercury used in electrical or research equipment, lead used as shielding during operation of the Bevatron, lead-based paint used in the building, radioactivity in Bevatron components and shielding, and beryllium in Bevatron beamline targets, as well as other chemicals or radioactive materials.

Major examples of hazardous materials that may be encountered in the course of the proposed demolition project are described below, along with the LBNL approach to dealing with these materials. Estimates of the quantities and destinations of the hazardous and non-hazardous materials that would be sent off-site are presented in **Table 5** in Section 5.1.9, Public Utilities Impacts.

Radioactive Materials

While it is known from previous surveys that there is no radioactivity above naturally occurring levels in the outer structure of Building 51,⁹ portions of the Bevatron apparatus, its concrete block shielding, and other items have low levels of radioactivity above naturally occurring levels. All of the radioactive waste that would be generated by the Proposed Action would be classified as low-level radioactive waste, or mixed waste containing low-level radioactive waste, as discussed below. Three main types of low-level radioactive waste would be sent off-site as a result of the Proposed Action:

- **Volume contamination.** Some concrete shielding blocks and concrete foundation, metal Bevatron components, and miscellaneous items (e.g., some tools) have volume contamination from induced radioactivity. For many years, the Bevatron accelerator beams produced thermal neutrons as a byproduct of normal operations for research experiments. These neutrons had the ability to penetrate into solid items to varying depths depending on the properties of the material. This process has resulted in low levels of induced radioactivity contained within the matrix of the present-day concrete and metals. This induced radioactivity is securely contained within the matrix of the concrete and metal and cannot be removed or transferred by simple contact with the surface of the concrete.

There is little likelihood of induced activity in the majority of the concrete shielding blocks, as only the blocks closest to the beams produced by the Bevatron were exposed to thermal neutrons. Surveys to date of similar blocks found within the Building 51 complex confirm that most blocks have no detectable induced activity. Those that have induced activity have

⁷ Title 22 of the California Code of Regulations, Division 4.5, Chapter 11, Article 3.

⁸ California Health and Safety Code, Section 25151.

⁹ *Protocol for Survey and Release of Bevatron Materials* (June 30, 2005).

low levels of such activity. This low-level induced activity is of a magnitude similar to the natural radioactivity within the concrete, which typically ranges from 15 to 30 picocuries¹⁰ per gram (pCi/g) total activity. This background radioactivity originates from the elements within crushed stone aggregate that is present in all concrete, and comes primarily from the decay of naturally-occurring radioisotopes of potassium, uranium and its decay series, and thorium and its decay series. The induced radioisotopes that are contained within the concrete shielding include cobalt-60, europium-152/154, barium-133, and cesium-137.

In the Bevatron accelerator apparatus itself, the most prevalent material is steel, with a substantial amount of copper and minor amounts of aluminum and other metals. Preliminary surveys indicate that while a greater proportion of the metals may be activated, the range of activity will be similar to that found in the concrete blocks. The primary isotopes in metals are cobalt-60, titanium-44, and iron-55.

- Surface contamination. A far smaller number of items may have surface contamination. Surface radioactivity resulted from the disintegration of radioactive targets that were used in some accelerator experiments. As a result of particle beam collisions with these targets, some interior surfaces of the beam tube were contaminated with low levels of various radioactive materials. It is anticipated that very limited amounts of surface radioactivity, affecting a small volume of materials, would be encountered.
- Uranium. Two types of shielding blocks contain uranium in excess of naturally occurring amounts. As a result of the materials or processes used in their manufacture to increase their density, a small number of blocks may have concentrations of uranium that cause the radioactivity of these blocks to be above background levels.¹¹ A small number of other blocks are composed of solid depleted uranium metal encased in steel.¹²

Materials that LBNL has reason to suspect might contain radioactivity would be characterized¹³ by taking external radiation measurements using appropriate survey instrumentation and/or swipe samples according to DOE-approved protocols. Following characterization, the different categories of radioactive waste discussed above would be handled as follows:

- Volume contamination. DOE requires that waste items that have detectable DOE-added induced radioactivity (i.e., radioactivity above the background level that is added while the materials are at a DOE site or under DOE control) are to be managed as radioactive waste. For this Proposed Action, as set out in the LBNL EH&S Protocol for Survey and Release of Bevatron Materials (June 30, 2005), the DOE Berkeley Site Office has approved methods that can detect radioactivity down to 2 pCi/g of radioactivity above background.¹⁴ The Laboratory anticipates that less than one-third of the shielding blocks, as well as some other items, will have volume contamination. However, it is expected that much of the

¹⁰ A picocurie is a combination of the Curie, a basic unit of measurement of the rate of radioactive decay, and the prefix pico, which modifies that unit to be 1/1,000,000,000,000 of its basic value. A picocurie is equal to 2.2 disintegrations per minute.

¹¹ A typical background concentration of U-238 in concrete is 0.5 - 1 pCi/g; the blocks with the elevated levels are typically 35 to 200 pCi/g.

¹² Depleted uranium blocks have activity levels of approximately 500,000 pCi/g.

¹³ Characterization is the detailed documentation of the waste constituents such that the appropriate treatment, storage, and disposal decisions can be made. Characterization can include, for example, process knowledge, laboratory analysis, or written documentation (log books, formulas, etc.). LBNL's laboratory is accredited by the State of California Environmental Laboratory Accreditation Program for radionuclide analysis.

¹⁴ This level is more conservative than the clearance screening level of 30 pCi/gram that is recommended in the national standard ANSI N13.12 "Surface and Volume Radioactivity Standards for Clearance" (ANSI, 1999). It is also comparable to the concentration of the natural radioactivity found in concrete.

Bevatron apparatus itself will have detectable DOE-added radioactivity above naturally occurring levels.

Two main options exist for the disposition of items with detectable volume contamination. The first is to transfer the items to other DOE facilities for reuse. Other DOE facilities are permitted to receive and reuse such materials, e.g., for their own accelerator operations. At this time, however, no DOE users for Bevatron components or shielding blocks have been found. The second option, and the one expected to apply to all such items generated during the Proposed Action, is disposal as low-level radioactive waste at a DOE-authorized facility for, such as Envirocare in Clive, Utah, a licensed, privately operated facility; or the Nevada Test Site, a DOE facility approximately 65 miles from Las Vegas.

- Surface contamination. Different regulatory thresholds apply for surface contaminated items, varying with the nature and type of contamination involved. These are presented in DOE Order 5400.5. All material with surface contamination above these thresholds would be disposed as low-level radioactive waste at a DOE-authorized facility, as discussed above.
- Uranium. All blocks containing uranium above background levels, and all depleted uranium blocks, would also be sent to a DOE-authorized disposal facility.

It is anticipated that all Bevatron accelerator components would be disposed of at Envirocare. Regarding metals, the Proposed Action would comply with the July 2000 DOE Metals Release Suspension¹⁵ and with an April 2005 agreement between LBNL and the DOE Berkeley Site Office regarding LBNL's implementation of this policy (*Agreement between LBNL and DOE Berkeley Site Office, LBNL Implementation of DOE Metal Release Suspension*; LBNL, 2005d). Applicable provisions include the following:

- Metals from radiation-controlled areas at accelerators where the metals may have become activated by exposure to beams would not be released for unrestricted recycling into commerce. Some areas within Building 51 contain such controlled areas. Metals covered by the suspension policy would be surveyed in accordance with the June 2005 *Protocol for Survey and Release of Bevatron Materials* referenced earlier. If the metal is contaminated, it would be held in a controlled area until disposed as radioactive waste. If there is no detectable activity, it would be disposed of at an appropriate landfill with a written agreement by the landfill that the metals would be prohibited from being recycled into commerce.
- The following are not within the scope of the DOE Metals Release Suspension: the release of property or equipment for reuse for their intended purpose, metals from locations other than former Radiological Areas, the recycle of non-metal materials, and rebar and other embedded metal materials in concrete that are not surface contaminated or volumetrically contaminated due to induced activity. Such metals, including Building 51 structural steel, are subject to unrestricted, "free" release, as long as there is no detectable DOE-added radioactivity above naturally occurring levels. For example, they could be reused, recycled, or sent to a landfill taking non-hazardous solid waste.

¹⁵ The DOE Metals Release Suspension suspended the unrestricted release of metals from Radiological Areas for recycling into commerce. There currently are no such Radiological Areas at Building 51. However, when the Bevatron was in operation, some of these areas did exist, due to the dose produced by Bevatron operations. Metals from former as well as current Radiological Areas are included in LBNL's implementation of this DOE policy.

Items contaminated with both radioactivity and non-radioactive hazardous waste (e.g., any lead shielding with induced radioactivity) would be managed as mixed waste and would be disposed at Envirocare or other authorized disposal facilities.

Asbestos

Asbestos is a naturally occurring fibrous material that was used as a fireproofing and insulating agent in building construction (e.g., in insulation, shingles, ceiling tiles, and floor tiles) before such uses were banned by EPA in the 1970s. The potential risk to human health is from inhalation of airborne asbestos when asbestos-containing materials (ACM) are disturbed during such activities as demolition and renovation. ACM can be divided into two general categories: friable and non-friable. Friable ACM products are those that can be readily crumbled or powdered by hand pressure, and are of more concern than non-friable ACM because of their greater potential for generating airborne fibers. Intact and sealed friable asbestos materials are considered non-friable and do not pose a health risk if they are undisturbed and undamaged. Non-friable ACMs generally possess a strong binder such as cement or vinyl, which stabilizes the asbestos, reducing the likelihood of generating airborne asbestos dust. However, actions such as sanding, grinding, cutting or drilling of non-friable asbestos can result in the release of asbestos fibers.

The exterior siding of Building 51 is composed of transite, a material typically containing approximately 20 percent non-friable chrysotile asbestos fibers. Building 51 is also known to contain non-friable ACMs in vinyl asbestos floor tiles, roofing felt, and insulation. In addition, due to the age of the building, friable asbestos might be encountered.

Federal regulations governing asbestos include EPA's National Emission Standard for Hazardous Air Pollutants, the Asbestos Hazard Emergency Response Act, and Occupational Health and Safety Administration's (OSHA) Asbestos Standard for the Construction Industry. On the state level, several laws mirror or exceed the federal requirements. Similar to federal laws, state laws and regulations also pertain to building materials containing asbestos. These regulations prohibit emissions of asbestos from asbestos-related manufacturing, demolition, or construction activities; require medical examinations and monitoring of employees engaged in activities that could disturb asbestos; specify precautions and safe work practices that must be followed to minimize the potential for release of asbestos fibers; and require notice to regulatory agencies prior to beginning renovation or demolition that could disturb asbestos.

Section 19827.5 of the California Health and Safety Code, adopted January 1, 1991, requires that local agencies not issue demolition or alteration permits until an applicant has demonstrated compliance with notification requirements under applicable federal regulations regarding hazardous air pollutants, including asbestos. The California legislature has vested the BAAQMD with authority to regulate airborne pollutants, including asbestos, through both inspection and enforcement responsibilities. The BAAQMD is to be notified ten days in advance of any proposed demolition or abatement work.

LBNL has a comprehensive Asbestos Management Program to manage the presence of asbestos materials at the Laboratory. Prior to undertaking demolition activities, a screening survey is

required to identify ACMs, along with sampling to assess and quantify ACMs for removal. Removal of ACMs would be conducted by a licensed and certified asbestos abatement contractor who would remove ACMs in accordance with the LBNL Asbestos Management Program. The ACM abatement would be conducted under the oversight of Lab personnel and subject to inspection by the BAAQMD. All of the abatement work must meet the requirements of OSHA, EPA, and BAAQMD regulations.

PCBs

Polychlorinated biphenyls (PCBs) are synthetic organic oils that formerly were used in many types of electrical equipment, including transformers and capacitors, primarily as electrical insulators. In 1979, the EPA banned the use of PCBs in most new electrical equipment and began a program to phase out certain existing PCB-containing equipment.

All transformers and capacitors known to contain PCBs have already been removed from Building 51 and properly disposed. The only remaining equipment that may contain PCBs are light ballasts. PCBs were found in soil and groundwater samples taken from under the foundation of the building. Soil cleanup measures were completed such that the PCB contaminants have been reduced to levels considered "protective of human health and the environment" under EPA risk assessment guidelines. Some groundwater contamination remains and continues to be remediated by LBNL under a program that is separate from this Proposed Action.

The use and management of PCBs in electrical equipment is regulated pursuant to the Toxic Substances Control Act (TSCA) and its implementing regulations. These regulations generally require labeling and periodic inspection of certain types of PCB equipment and set forth detailed procedures to be followed for disposal of these items and for responding to PCB spills. The TSCA regulations are administered by the EPA. Materials or equipment containing PCBs not regulated as hazardous under TSCA regulations may still be regulated as hazardous waste under Title 22 of the California Code of Regulations, depending on the concentration. PUB-3000, Berkeley Lab's Health and Safety Manual, contains LBNL EH&S Division policies and procedures for the handling of PCBs (LBNL, 2005c).

Lead

Lead-based paint was common until 1978, when the Consumer Product Safety Commission banned the use of paint containing lead at levels of over 600 parts per million for residential and toy purposes.¹⁶ Some painted surfaces at Building 51, such as structural steel, drywall, ceilings, and exterior surfaces, could contain lead-based paint. In addition, lead dust contaminates some of the interior surfaces of Building 51. Sources of this dust include the operation of internal combustion engines using leaded gasoline and the handling of solid forms (blocks, sheets, bricks) of lead, which were used as radiation shielding during operation of the Bevatron. LBNL has a Lead Compliance Program that covers all facets of lead handling from the use of lead in experiments to disposal of lead-containing materials. In accordance with this program, lead-

¹⁶ Lead in industrial-use paints is still permitted. However, most manufacturers have substantially reduced the amount of lead in such paints.

contaminated surfaces would be vacuumed using HEPA-filter-equipped¹⁷ vacuums to remove surface deposits. Any such lead control measures would also be effective in controlling surface contamination by any other hazardous materials that may be present.

Mercury

Mercury was present in klystron tubes that were used for high energy physics research associated with the accelerator at Building 51, and some electrical switches, diffusion pumps, and gauges still at the facility may contain mercury. A mercury spill on the concrete floor of the facility was detected and cleaned up in the late 1990s. Similarly, mercury was found in plumbing and floors in another section of the building and cleaned up around this same time. It is possible that other mercury contamination may be discovered during the Proposed Action, e.g., in a location near the Motor Generator Room where components containing mercury were stored and handled. Mercury would be handled in accordance with PUB-3000 (LBNL, 2005c).

Beryllium

Small amounts of solid beryllium have been found inside portions of the shielded area within Building 51. Dust containing beryllium also was found in shelves where the solid beryllium was stored. In addition, beryllium may be present in beamline target areas inside the Bevatron. Beryllium found to date has been cleaned up in accordance with regulatory standards. If additional beryllium is found, contractors meeting DOE requirements (10 CFR 850) for beryllium cleanup operations would be engaged. All work would be performed in accordance with the LBNL *Integrated Worker Health and Safety Program for Beryllium Activities at the Berkeley Laboratory* (LBNL, 2000).

Chromium

The wooden and plastic parts of the cooling tower contain low concentrations of chromium, which was used in water treatment chemicals. Handling and disposal of the cooling tower would be performed in accordance with PUB-3000 (LBNL, 2005c).

Crystalline Silica Dust

The concrete slab and foundation that would be demolished contain crystalline silica.¹⁸ Silica is a hazardous substance when it is inhaled, and the airborne dust particles that are formed when the concrete is broken, crushed, or sawn pose potential risks. The potential risks are to workers performing demolition activities or other activities adjacent to the demolition.

LBNL would require contractors to meet the Threshold Limit Values (TLVs) for crystalline silica in air set by the American Congress of Governmental Industrial Hygienists. Dust control measures, such as the use of water/fogger sprays, HEPA-filtered equipment, or other engineering controls,

¹⁷ HEPA filters are high-efficiency filters that remove at least 99.97 percent of all particles that are greater than 0.3 microns in size.

¹⁸ There are no plans to demolish the concrete shielding blocks; these would be removed intact.

would be implemented at the point of dust generation. If these controls cannot keep worker exposures below TLVs, workers would use respirators to limit their exposure to silica dust.

The levels of silica dust at neighboring buildings or off-site locations would be at non-hazardous levels in large part due to dust control measures. For any crystalline silica that would be released, dilution and dispersion would ensure that ambient dust levels at these locations would remain well below BAAQMD levels of concern.

Subsurface Contamination

The proposed site is not listed on the state Department of Toxic Substances Control (DTSC) Hazardous Waste and Substances Sites List, also known as the Cortese List. However, subsurface investigations have been conducted by Berkeley Lab in the vicinity of Building 51 since the early 1990's, and it is known that a portion of the demolition zone (the Building 51 footprint) is underlain by the edges of two groundwater plumes -- the Building 51/64 and the Building 51L Groundwater Solvent Plumes -- containing volatile organic compounds (VOCs).¹⁹ These are shown in **Figures 5** and **6**.²⁰

The Building 51/64 Groundwater Solvent Plume extends westward from the southeast corner of Building 64. The principal plume constituents are halogenated VOCs that were used as cleaning solvents, including 1,1,1-trichloroethane, trichloroethene (TCE), tetrachloroethene (PCE), and their associated degradation products (e.g., 1,1-dichloroethene (DCE), 1,1-dichloroethane, cis-1,2-DCE, and vinyl chloride). The Building 51L Groundwater Solvent Plume is centered near the southwest corner of the former Building 51L. The principal plume constituents are halogenated VOCs that were used as cleaning solvents, including TCE, PCE, and associated degradation products (e.g., cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride).

In addition, PCBs were detected in groundwater samples collected beneath the Building 51 foundation. Soils underneath portions of the site were contaminated by VOCs, petroleum hydrocarbons, PCBs, and mercury.

Remediation (i.e., cleanup) of the above contamination has proceeded as follows:

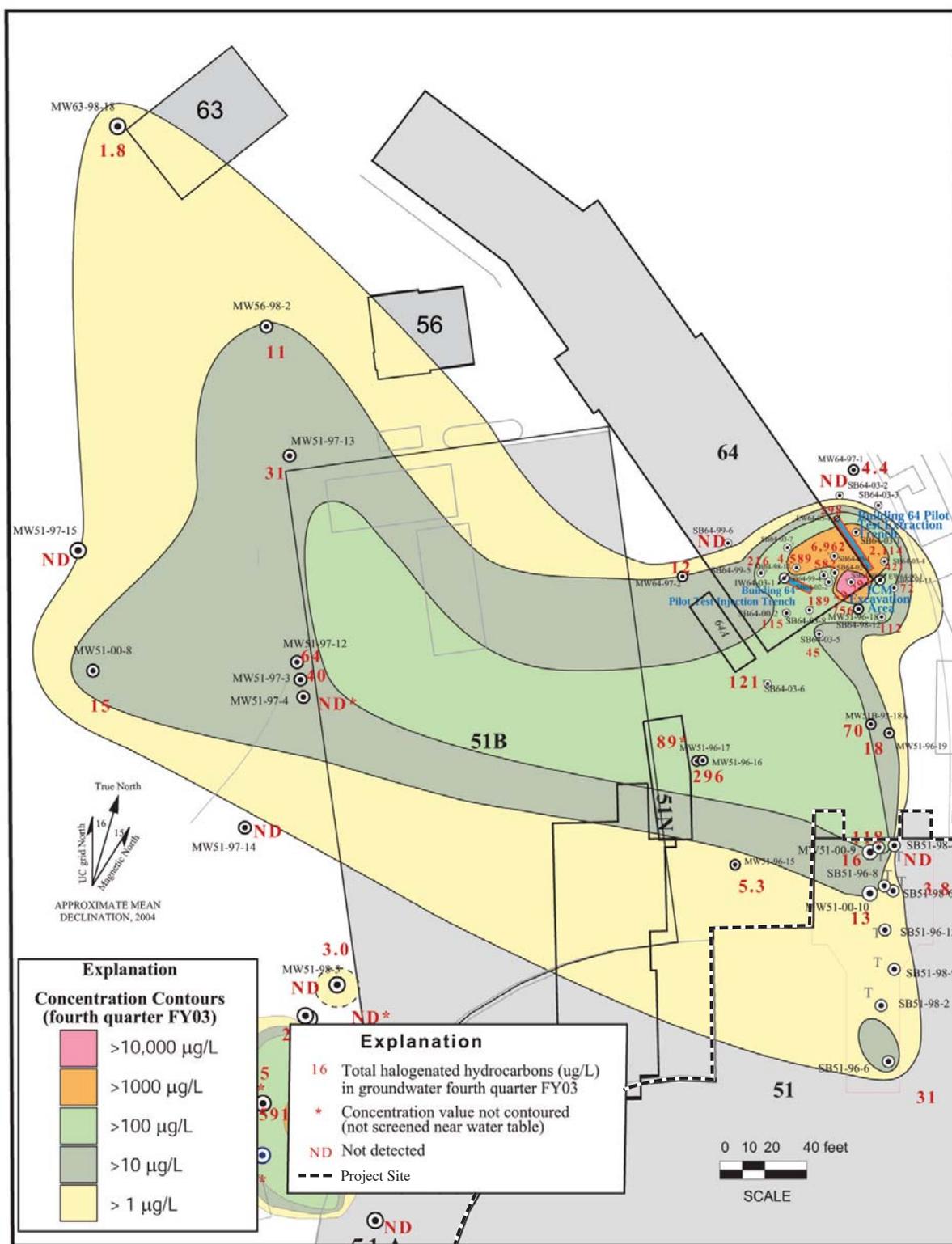
General (LBNL-Wide)

- Berkeley Lab's Hazardous Waste Handling Facility (HWHF) operates under a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit. Under RCRA, LBNL is required to undertake corrective action for all historical releases of hazardous wastes, including hazardous constituents from any Solid Waste Management Unit (SWMU).²¹ (Corrective action refers to the activities related to the investigation, characterization, and cleanup of releases of hazardous waste or

¹⁹ Groundwater at the site varies from 10 to 90 feet below ground surface. Groundwater samples are analyzed at LBNL's own state-certified laboratory, while soil samples are sent to off-site state-certified laboratories.

²⁰ These figures show partial footprints of Building 51. For orientation purposes, see **Figure 2** in Chapter 3.0 (Project Description). It should also be noted that **Figures 5** and **6** include the former outlines of Building 51B and Building 51L, structures that were removed from LBNL in 2004.

²¹ "Solid Waste Management Unit" means any unit at a hazardous waste facility from which hazardous constituents might migrate, irrespective of whether the units were intended for the management of wastes.

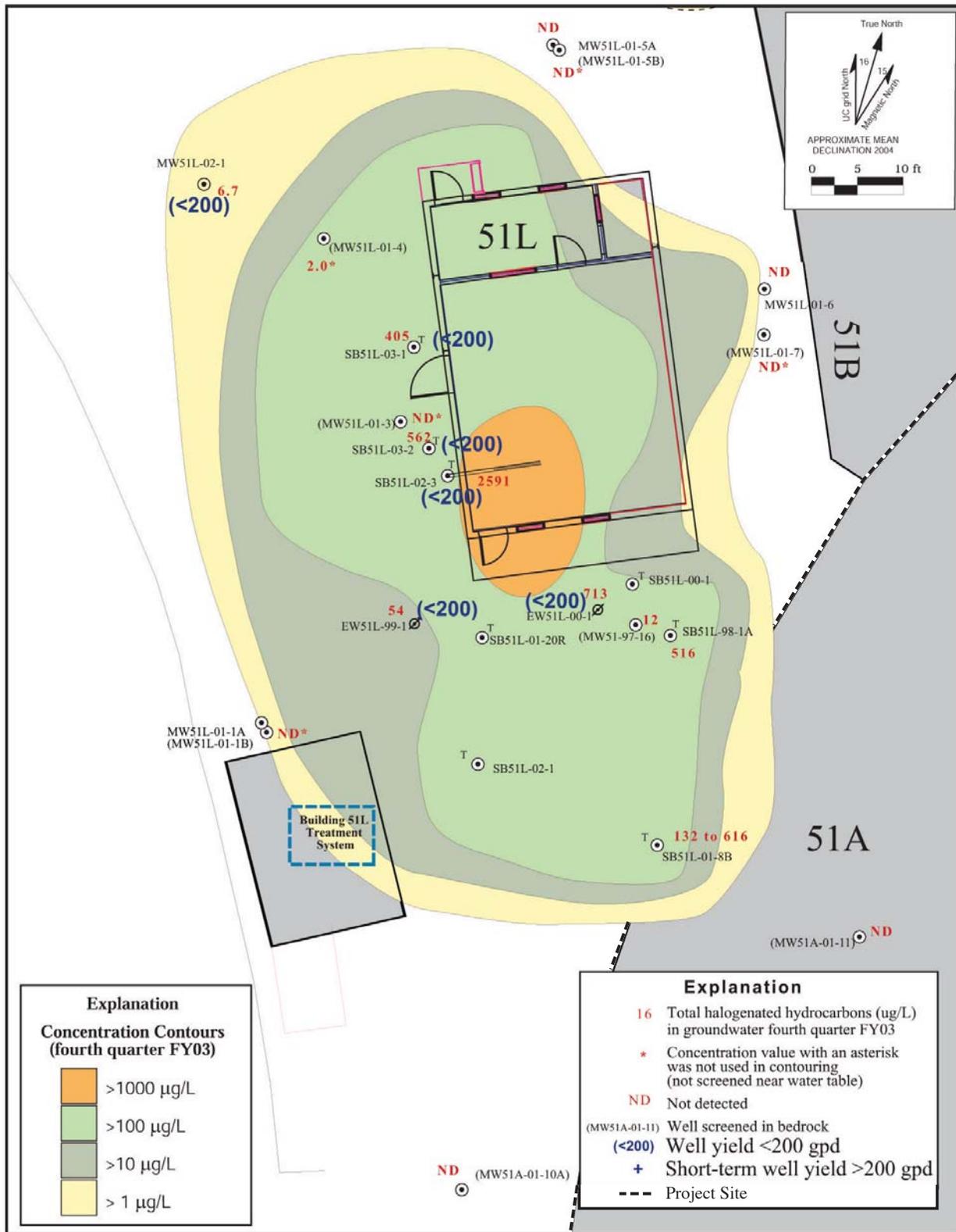


SOURCE: LBNL (2005)

Demolition of Building 51 and the Bevatron / 204442 ■

Figure 5

Total Halogenated Hydrocarbons in Groundwater,
 Building 51/64 Groundwater Solvent Plume



SOURCE: LBNL (2005)

Demolition of Building 51 and the Bevatron / 204442 ■

Figure 6
 Total Halogenated Hydrocarbons in Groundwater in the Fill, and Estimated Well Fields, Building 51L Groundwater Solvent Plume

hazardous constituents under RCRA.) Therefore, the permit requires that Berkeley Lab investigate and address historic releases of hazardous waste and hazardous constituents that may have occurred both at the HWHF and at SWMUs throughout the Berkeley Lab site. The DTSC is the regulatory agency responsible for enforcing the provisions of Berkeley Lab's Hazardous Waste Facility Permit, including the activities required under the RCRA Corrective Action Plan (RCRA CAP) process. DTSC consults with such other agencies as the San Francisco Bay Regional Water Quality Control Board, DOE, and the City of Berkeley Toxics Management Division.

The RCRA CAP Process has several primary components:

- RCRA Facility Assessment (completed in 1992);
- RCRA Facility Investigation (completed in 2000);
- Interim Corrective Measures (ICMs; ongoing);
- Corrective Measures Study (CMS, completed in 2005; see below) and Corrective Measures Implementation (CMI; ongoing).

Berkeley Lab currently is in the CMI phase of the RCRA CAP process. In February 2005, a revised CMS Report was submitted by the Laboratory to DTSC (LBNL, 2005f). NEPA documentation is contained in Chapter 7 of this document. The purpose of the CMS Report was to recommend appropriate remedies that can eliminate or reduce potential risks to human health from chemicals of concern in soil and groundwater and that can protect groundwater and surface water quality. The components of the RCRA CAP process are described in detail in the CMS Report, and the reader is referred to that document for information beyond that provided in this EA.

A CEQA Initial Study/Negative Declaration was prepared for the CMS Report (DTSC, 2005). DTSC solicited public comments on the CMS Report and the Initial Study/Negative Declaration from April 25 through June 8, 2005, and held a public hearing on May 26, 2005. DTSC approved the CMS Report and final Remedy Selection, effective October 2005. DOE issued a NEPA Environmental Assessment/Corrective Measures Study Report in September 2005 (DOE, 2005). The EA has the same content as the CMS Report, but also includes a Finding of No Significant Impact under NEPA, and responses to comments by DTSC and DOE.

The IS/ND is available on the DTSC website at http://www.dtsc.ca.gov/HazardousWaste/Projects/upload/LBNL_CEQA_Initial-Study1.pdf. The approved CMS Report and the DOE EA/CMS Report are available on the Lab's Environmental Restoration Program website at <http://www.lbl.gov/ehs/erp/html/documents>. These documents also are available at the downtown Berkeley Public Library.

Corrective Action at Units Relevant to Building 51

The RCRA CAP process identified two SWMUs at Building 51. While corrective action measures have addressed and will continue to address subsurface contamination in the vicinity of Building 51, the RCRA CAP is a preexisting activity that is independent of the proposed Building 51 and Bevatron demolition project. The RCRA CAP would take place whether or not

the Proposed Action proceeds. At the same time, the Proposed Action would be configured such that it would not interfere with the successful continuation of the RCRA CAP.

As part of interim corrective measures, cleanup activities have already been conducted in many areas of the Lab, including two soil units at Building 51, the Motor Generator Room and Vacuum Pump Room. The main contaminants of concern were PCBs, waste oil, and vacuum pump oil. After soils were excavated, contaminants were reduced to levels considered "protective of human health and the environment" under EPA risk assessment guidelines.

To remediate the Building 51/64 Groundwater Solvent Plume, contaminated source area soils located at the southeast corner of Building 64 were excavated as an ICM in August 2000 and a groundwater extraction system was installed in the backfilled excavation. In addition, an in situ soil flushing pilot test is being conducted in the source area to prevent further migration of contaminants in groundwater. To divert discharges away from the North Fork of Strawberry Creek, an ICM was also implemented that routes water from the Building 51 subdrain system to a groundwater treatment system using granular activated carbon. The treated groundwater is then discharged to the sanitary sewer under an EBMUD wastewater discharge permit.

As a result of these measures, the remaining soil contaminant concentrations in the source area are below cleanup standards, and groundwater contaminants have generally shown gradual long-term declines over most of the plume area. The CMS Report recommends that the following further corrective actions be undertaken in the CMI phase: continued in situ soil flushing combined with groundwater capture in the plume source area, monitored natural attenuation for the downgradient portion of the plume, and continued surface water (subdrain effluent) capture and treatment until groundwater discharge to surface water is shown to be below detectable levels.

To remediate the Building 51L Groundwater Solvent Plume, the groundwater level has been lowered, using pumping from two extraction wells, to stop any discharge of contaminated groundwater to surface water. The treated groundwater is then discharged to the sanitary sewer under EBMUD permit.

The CMS Report recommends that the following further corrective actions be undertaken in the vicinity of the project site in the CMI phase: excavation and off-site disposal of saturated and unsaturated zone soils in the plume source zone, monitored natural attenuation for the remaining plume area, and rerouting or lining of the storm drain to prevent migration of groundwater contaminants to surface water. For more complete descriptions of contamination and corrective action measures in the vicinity of Building 51, the reader is directed to the CMS Report. Once Building 51 is demolished, further investigation for potential soil and groundwater contamination at portions of the site that were previously inaccessible would take place, and appropriate corrective measures would be undertaken as required by DTSC, in consultation with the San Francisco Bay Regional Water Quality Control Board and the City of Berkeley Toxics Management Division.

Fire Hazards

LBNL is located near undeveloped land in the Oakland and Berkeley Hills. Portions of this land are wooded with native canyon stands of oak and California bay or with introduced plantations of eucalyptus or conifers. At the project site, extensive natural vegetation both within and surrounding LBNL creates the greatest potential for fire hazard. The Building 51 site itself is almost entirely developed and devoid of vegetation, with the exception of small landscaped areas. It is surrounded by a mosaic of other existing buildings, paved areas, and fragmented areas of open space.

Fire protection services for the project site are provided by Berkeley Lab through a contract with the Alameda County Fire Department, which maintains an on-site fire station. Fire personnel are also trained in emergency medical services and hazardous materials response. In addition, LBNL maintains an automatic aid agreement with the City of Berkeley to provide support during the summer fire season and in the event of a hillside wildfire.

4.2.6 Hydrology and Water Quality

The Berkeley Lab facility lies within the upper portion of the Strawberry Creek watershed; this upper portion consists of approximately 874 acres of land east of the UC Berkeley campus. The entire Strawberry Creek watershed occupies approximately 1,163 acres and includes other UC properties, public streets of both Oakland and Berkeley, and private property (LBNL, 2005e).

Approximately 35 percent of the LBNL site is covered with impervious surfaces such as buildings, roads, and paved surfaces. Compared to natural ground cover (pervious surfaces), impervious surfaces restrict natural infiltration of surface water and increase stormwater runoff rates and volumes. The remaining 65 percent surface area at the site is pervious surface area consisting of steep hillsides covered with natural grasses and other vegetation to minimize erosion (LBNL 2002).

Building 51 is located within Blackberry Canyon. Situated at an elevation of about 720 feet above mean sea level, the building complex is constructed on a series of graded level areas adjacent to vegetated natural or manmade slopes, some of which reach a steepness of up to 100 percent. A portion of the building has a second story that opens to another level, graded area. The two levels are connected by internal staircases or a sloping roadway. Building 51 is located on the largest graded area of the LBNL site. Surface water flows from the project site and the larger Strawberry Creek watershed are ultimately discharged into San Francisco Bay south of the Berkeley Marina at the terminus of the municipal storm drain system that conveys Strawberry Creek through the city of Berkeley (LBNL, 2005e).

The LBNL site is situated over bedrock, which is covered by a shallow soil surface. The flow and occurrence of groundwater at the LBNL site is controlled by the underlying complex geology, the presence of faults, and fractures in the bedrock (LBNL, 2002). Groundwater flows through the fractures in the bedrock and is therefore slow to recharge. Groundwater flow generally follows the surface topography either west or south toward the City of Berkeley or toward streams (Strawberry Creek and its tributaries).

Groundwater flows beneath Building 51 in a northwest direction through the artificial fill materials and appears to be influenced by the natural topography that underlies the graded cut and fill supporting Building 51 (LBNL, 2005e). Water level elevation mapping of the Bevalac area (between Buildings 51 and 71), which was generated from groundwater data collected in the fourth quarter of 2003 (when groundwater was at a seasonal high), indicates that groundwater depths can range between 15 feet and 50 feet below the ground surface, depending on location (LBNL, 2005e). Groundwater levels are deeper during the summer months or drought periods when the water table is not recharged by precipitation. Based on the water level map, shallower groundwater depths occur along the base of the slope on the east side of Building 51 (depths of 15 feet to 30 feet) and become deeper toward the northwest (depths of 30 feet to 60 feet). Groundwater elevations beneath the central portion of Building 51 are relatively level, reflecting the flat surface topography of the Building 51 site (LBNL, 2005e).

4.2.7 Noise

Transportation sources, such as automobiles, trucks, trains, and aircraft, are the principal sources of noise in the urban environment. Along major transportation corridors, noise levels can reach 80 DNL²², while along arterial streets, noise levels typically range from 65 to 70 DNL. Industrial and commercial equipment and operations also contribute to the ambient noise environment in their vicinities.

The Building 51 project site is located on a large parcel of flat land along Lawrence Road and McMillan Road. The primary sources of noise at the project site are activities from the operation of the adjacent buildings and noise from the LBNL shuttle buses, trucks, and other vehicles.

Some land uses are considered more sensitive to ambient noise levels than others because of the duration of noise exposure as well as the types of activities that typically occur there. People in residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, natural areas, parks and outdoor recreation areas are generally more sensitive to noise than are people at commercial and industrial establishments. Housing, outdoor recreation, and similar land uses are therefore considered “sensitive receptor areas” for noise.

Figure 7 shows the position of Building 51 in relation to other LBNL buildings as well as the nearest sensitive-receptor areas to the north, east, and west; there are no nearby sensitive receptor areas to the south. The noise-sensitive land uses are as follows:

- Area 1. This area to the west consists of the Nyingma Institute (Buddhist facility) and single- and multi-family residences. This area is approximately 1,100 to 1,400 feet west of Building 51 and approximately 160 to 250 feet lower in elevation. As a result of intervening hillside terrain and building structures, there is no direct line-of-sight between any of the residences or the Buddhist facility and Building 51.

²² DNL = day-night average sound level, which is the energy average of the A-weighted sound levels occurring during a 24-hour period, accounting for the greater sensitivity of most people to nighttime noise by weighting noise levels at night (“penalizing” nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted by adding 10 dBA to take into account the greater annoyance of nighttime noises.

- **Area 2.** This area to the north consists of single-family residences along Campus Drive, Olympus Avenue, and Summit Road. The nearest residences are located on Campus Drive approximately 1,100 feet north of Building 51 and are approximately 270 feet higher in elevation. A partial line-of-sight exists between some of these residences and Building 51, although none has a completely unobstructed view due to the intervening terrain and building structure.
- **Area 3.** To the east is the UC Berkeley Lawrence Hall of Science Museum (LHS), which is located approximately 1,300 to 1,400 feet away from Building 51. The LHS rests on a hillside approximately 350 feet higher than Building 51. No line-of-sight exists between Building 51 and the buildings at LHS because LHS is offset from the edge of the hillside. However, a person standing directly in front of the 3.5-foot-tall boundary wall at the edge of the hillside where the LHS property faces Building 51 would have a partial line-of-sight. This wall is at the boundary of the LHS outdoor area where children often play on the outdoor fixtures. The play fixtures themselves do not have a line-of-sight to Building 51.

As shown in **Figure 7**, the average existing noise levels were measured at six sites in the three areas described above. **Table 2** lists the measured background noise levels.

**TABLE 2
AVERAGE EXISTING BACKGROUND NOISE LEVELS AT SENSITIVE RECEPTOR LOCATIONS**

Measurement Location (see Figure 7)	Average Existing Background Noise Level (dBA)	Noise Sources
Site 1	54	Distant roadway noise
Site 2	46	
Site 3	44	
Area 2		
Site 4	54	Intermittent distant construction noise
Site 5	52	
Area 3		
Site 6 (at wall)	54	Distant construction noise and children playing on Lawrence Hall of Science outdoor fixtures
Site 6 (15 ft. from wall)	53	

SOURCE: Parsons (2003)

Noise measurements taken in connection with the ongoing preparation of the LBNL LRDP EIR indicate that hourly average noise levels at locations measured nearest Building 51 range between 52 and 66 decibels (dBA, Leq²³). Maximum noise levels measured were between 61 and 83 dBA, with the second highest reading (74 dBA) at Building 71, near the top of the McMillan Road grade. These levels likely were the result of shuttle bus traffic on the hill.²⁴

²³ Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements; Leq represents the constant sound level which would contain the same acoustic energy as the varying sound level.

²⁴ All noise readings were based on 15-minute measurements.

A less frequent but regular noise source is a nearby 2-megawatt diesel emergency power generator, located approximately 200 feet northwest of Building 51 and abutting the tree line. This generator is tested monthly for a minimum of four hours, and it creates noise of up to 85 dB at a distance of 50 feet. In addition, regular vegetation management is performed in and around the area of trees under analysis. This management includes use of equipment such as weed-whackers, leaf blowers, chippers, and chain saws.

4.2.8 Public Services

LBNL secures firefighting services through a contract with the Alameda County Fire Department, which staffs a fire station located on the LBNL grounds. This station, which is Alameda County Station No. 19, is located at LBNL Building 48. Station 19 is staffed with four persons 24 hours a day, every day of the year: two firefighters, one engineer, and one officer. Three of these personnel are required to be trained in hazardous materials response, and one is a paramedic. Equipment at Station 19 includes one fire engine, one reserve fire engine, a hazardous materials vehicle, and a light-duty four-wheel drive “brush patrol unit” that can be used for wildland fires.

An Emergency Operations Center has been established at LBNL’s Station 19, which is equipped with fault-tolerant telecommunications. LBNL’s Fire, Medical, Protective Services, Plant Engineering, Maintenance, and Environmental Health and Safety personnel are trained and equipped to respond to local emergencies. Each building, including Building 51, has an Emergency Team headed by the building manager.

Police services at LBNL are provided through a contract with the UC Berkeley Police Department (UCPD). UCPD handles all patrol, investigation, and related law enforcement duties for UC Berkeley and associated University-owned properties. UCPD operates 24 hours a day, seven days a week, coordinating closely with the City of Berkeley Police Department. UCPD includes 77 police officers, 45 full-time non-sworn personnel, and 60 student employees. Located at 1 Sproul Hall on the UC Berkeley campus, UCPD has primary law enforcement jurisdiction on the campus of the University of California and associated University properties, including LBNL (UCPD, 2005).

LBNL also contracts with a private security firm, which is responsible for on-site security needs including Laboratory access, property protection, and traffic control. The on-site security staff at LBNL totals approximately 25 personnel, divided into five to six personnel per shift. Staffing and resources include an on-site manager, two roving patrols 24 hours per day, and gate access attendants 24 hours per day at the Blackberry Gate and fewer hours at the Strawberry and Grizzly Peak gates.

The City of Berkeley Public Works Department maintains public streets within the city limits of Berkeley. Caltrans maintains public highways in the project site vicinity.

4.2.9 Public Utilities

The LBNL Facilities Division collects non-hazardous solid waste from Berkeley Lab buildings. In calendar year (CY) 2004, the Lab generated 191.5 metric tons (about 423,000 pounds) of routine solid sanitary waste, which was disposed by the Richmond Sanitary Service. In addition, it generated 1,087.43 metric tons (about 2,396,000 pounds) of waste that was recycled. As a government-owned facility operated through contract by the University of California, LBNL complies with the waste minimization reporting requirements of DOE, the State of California, the University of California, and Berkeley Lab itself, and has achieved significant reductions in the amount of waste it generates. As of CY 2004, LBNL had reduced the amount of routine solid sanitary waste going to land disposal by almost 80 percent compared with the baseline year set by DOE of CY 1993. The reductions were achieved through waste segregation and recycling efforts and through a composting and mulching program.

4.2.10 Traffic and Circulation

LBNL is located close to two major highways: Interstate 80/580 (I-80/I-580) approximately three miles to the west, and State Route (SR) 24 approximately two miles to the south. Access from the Lab to I-80/I-580 is through the city of Berkeley via east-west arterial streets. Access to SR 24 is via Tunnel Road. The primary local access routes to the Berkeley Lab site are University Avenue-Hearst Avenue, Grizzly Peak Boulevard-Centennial Drive, and Piedmont Avenue-Gayley Road.

Vehicles can enter Berkeley Lab through three gates: Blackberry (main) Gate, Strawberry Gate, or Grizzly Peak Gate. Normally, Blackberry Gate is staffed continuously, Strawberry Gate is staffed for about 13 hours encompassing both the morning and evening commute hours, and Grizzly Peak Gate is staffed during morning commute hours only.

The Laboratory's main vehicle routes are two-way, except for three sections where roadside parking reduces traffic lanes, permitting only one-way travel. Main routes within the boundaries of LBNL include Cyclotron Road and Lawrence Road. Vehicle access to the project site is from Lawrence Road. Cyclotron Road and Lawrence Road each have two lanes, and on-street parking is prohibited. As part of its standard practices, the Laboratory uses or requires subcontractors to use advance warning signs and flaggers to direct traffic as needed to maintain safe and efficient traffic flow during construction projects.

The Berkeley Lab site is served indirectly by Bay Area Rapid Transit (BART) and by Alameda-Contra Costa Transit (AC Transit) bus routes, and directly by two LBNL-operated shuttle service routes.

LBNL operates a free on-site shuttle bus and several shuttle buses that travel off-site. Two of the latter travel around some of the perimeter of the UC Berkeley campus, and one shuttle goes to downtown Berkeley, connecting with the Berkeley BART Station and AC Transit bus lines. A separate off-site shuttle provides express service to and from the Rockridge BART Station at selected commute hours. Off-site shuttle service starts at 6:20 a.m. from the main Laboratory shuttle bus hub located at Building 65 and continues until 6:50 p.m. Buses run every 10 minutes

up to 6:10 p.m. Between the hours of 6:10 p.m. and 6:50 p.m., the shuttle runs at 20-minute intervals. The internal shuttle operates every 10 minutes from 6:40 a.m. until 5:20 p.m.; it then operates at 20-minute intervals until 6:50 p.m. The closest internal shuttle bus stop to the project site is below Building 70, across the street from the entrance to Building 51.

The UC Berkeley 2020 LRDP EIR assessed existing traffic level of service (LOS) conditions during weekday a.m. and p.m. peak traffic hours at the following intersections (UC Berkeley, 2004):

- Hearst Avenue and La Loma Avenue / Gayley Road – signalized
- Hearst Avenue and LeRoy Avenue – side-street stop-sign control
- Hearst Avenue and Euclid Avenue – signalized
- Hearst Avenue and Scenic Avenue – side-street stop-sign control
- Hearst Avenue and LeConte Avenue – side-street stop-sign control
- Hearst Avenue and Spruce Street – signalized
- Hearst Avenue and Oxford Street – signalized
- Hearst Avenue and Shattuck Avenue – signalized
- Oxford Street and Berkeley Way – signalized
- Oxford Street and University Avenue – signalized
- University Avenue and Shattuck Avenue (northbound) – signalized
- University Avenue and Shattuck Avenue (southbound) – signalized
- University Avenue and Milvia Street – signalized
- University Avenue and Martin Luther King, Jr. Way – signalized
- University Avenue and San Pablo Avenue – signalized
- University Avenue and Sixth Street – signalized
- Shattuck Avenue and Bancroft Avenue – signalized
- Shattuck Avenue and Durant Avenue – signalized
- Gayley Road and East Gate – side-street stop-sign control
- Gayley Road and Stadium Rim Way – all-way stop-sign control
- Stadium Rim Way and Centennial Drive – all-way stop-sign control
- Centennial Drive and Grizzly Peak Road – all-way stop-sign control

The LOS concept is a qualitative characterization of traffic conditions associated with varying levels of traffic, based on delay and congestion. Descriptions of conditions range from LOS A (free-flow condition) to LOS F (jammed condition). LOS C or better are generally considered to be satisfactory service levels, while LOS D is minimally acceptable, LOS E is undesirable, and LOS F conditions are unacceptable. The determination of LOS for signalized and all-way stop-sign-controlled intersections is based on the average delay (in seconds per vehicle) for the entire intersection. The LOS for intersections controlled by stop signs on side-street approaches only is presented for the worst movement at the intersection (i.e., the movement with the highest average delay in seconds per vehicle) that is controlled by stop signs.

Traffic counts were conducted at each of the above-cited intersections when UC Berkeley was in session.²⁵ Based on methodologies presented in the 2000 *Highway Capacity Manual*, all of these

²⁵ Peak-period traffic counts were conducted at the study intersections during November and December 2002 for the UC Berkeley LRDP Update analysis.

intersections operate at an acceptable LOS D or better during both the a.m. and p.m. peak hours, except for the signalized intersections of University Avenue / Sixth Street and University Avenue / San Pablo Avenue, which operate at LOS F during both peak hours.²⁶

The Alameda County Congestion Management Agency's 2002 level of service monitoring indicates that the segments of I-80 through Berkeley are congested (LOS E or F) in both directions during morning and afternoon peak commute periods, and frequently during off-peak periods as well (Abrams Associates, 2002). The portion of SR 24 within the Oakland city limits experiences LOS F in the eastbound direction from I-580 to the Caldecott Tunnel during the p.m. peak hour. The only Alameda County Congestion Management Program arterial roadway operating at LOS F within the city of Berkeley is SR 13 (Ashby Avenue).

4.2.11 Visual Quality

LBNL is located on approximately 200 acres in the eastern hills of Berkeley and Oakland. It is surrounded by open space, institutional uses, and residential and neighborhood commercial areas. The project site is located entirely within the City of Berkeley. South and east of the Lab is the University of California, Berkeley campus, characterized by a variety of buildings, open space, student parking areas, and mature landscaping. The stadium and other University buildings are located farther southeast. To the west and north of the Lab are residential neighborhoods and a small commercial area located in the City of Berkeley. The residential neighborhoods are characteristically a mix of single- and multiple-family homes, some small retail uses, and a variety of local, landscaped roadways. Some of the homes closest to the Lab are tucked into the lower reaches of the hillside, while others are situated atop the higher ridges, and therefore have an unimpeded panoramic view of the Lab and its environs. Building 51 is approximately 1,100 feet from the nearest residences to the west and north, and about 1,300 to 1,400 feet from the Lawrence Hall of Science to the east. Farther away and to the northeast of the site are Tilden and Claremont Canyon Regional Parks. These large open space areas are heavily vegetated with eucalyptus, oak, and other herbaceous species, and include numerous paved and unpaved recreational trails, open field areas, and a variety of public amenities.

The project site is approximately four acres, including parking and staging areas. Approximately 2.25 acres of the project site (the "demolition zone") would be converted from developed area (i.e., occupied by Building 51) to an undeveloped area for an indeterminate time, until another use for the site is proposed, approved, and initiated. The site is located adjacent to Lawrence Road and McMillan Road within Berkeley Lab, and is generally flat. As shown in **Figure 8**, an aerial view of Building 51, the project site is surrounded by parking lots, other LBNL research structures, landscaping, and roadways. The character of the immediate area is highly urbanized and developed as an institutional facility. Parks and other open spaces are located beyond the perimeter of LBNL, but do not define the character of the site.

²⁶ The *Highway Capacity Manual* is published by the Transportation Research Board. Characterization of existing levels of service is taken from the *UC Berkeley LRDP Final EIR* (April 2004).

Views of the vicinity of the project site are available from long-, medium-, and short-range distances, although, due to topography, other buildings, and the presence of many large trees, Building 51 is generally not visible from publicly accessible long-range views of LBNL.

The existing sources of light and glare at the project site are generally limited to the interior and exterior lights of Building 51. Other sources of light include interior and exterior lighting associated with adjacent buildings, parking lots, and access roads. All on-site buildings and parking areas are currently equipped with outdoor, downward-directed light fixtures for nighttime lighting and security. In addition, the cars and trucks traveling to and from the site represent sources of glare. The project site is located near internal LBNL roadways such as Cyclotron Road, Alvarez Road, Lawrence Road, and McMillan Road, where street lighting results in light and glare during evening hours.