DOE/EA-1442R

Final Revised Environmental Assessment for The Proposed Construction and Operation of a Biosafety Level 3 Facility at Lawrence Livermore National Laboratory, Livermore, California

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Department of Energy
National Nuclear Security Administration
Livermore Site Office

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FORWARD

The National Nuclear Security Administration (NNSA) of the Department of Energy (DOE) has responsibility for national programs to reduce and counter threats from weapons of mass destruction including nuclear, chemical, and biological weapons (bioweapons). NNSA's bioscience work at Lawrence Livermore National Laboratory (LLNL) in support of these missions requires work with infectious agents, including those historically used for bioweapons. Much of the proposed work must be performed with Biosafety Level 3 (BSL-3) containment and protection. Accordingly, NNSA proposed to construct and operate a BSL-3 facility at LLNL to meet the NNSA mission to "develop, demonstrate and deliver technologies and systems to improve domestic defense capabilities and, ultimately, to save lives in the event of a chemical or biological attack." A Environmental Assessment (EA) and a Finding of No Significant Impact for the proposed BSL-3 facility was issued in December 2002 (BSL-3 EA, DOE/EA-1442), and construction of the facility began.

On September 16, 2003, Tri-Valley CARES filed a lawsuit in the federal district court in San Francisco challenging the adequacy of the EA for the proposed BSL-3 facility. On September 10, 2004, the district court found the EA to be adequate. On November 8, 2004**,** Tri-Valley CARES filed a notice of appeal with the Ninth Circuit Court of Appeals. On October 16, 2006, the appellate court issued a memorandum opinion (D.C No CV-03-03926-SBA). In light of the Ninth Circuit's recent ruling in an unrelated case, the court remanded the matter for DOE to consider whether the threat of potential terrorist activity necessitates the preparation of an environmental impact statement. DOE issued interim guidance on how to address intentional destructive acts in NEPA documents (DOE 2006) as a result of the Ninth Circuit's decision.

In response to this ruling and the guidance, NNSA has revised the 2002 EA to consider the potential impacts of terrorist activity. NNSA has limited the changes to the document in matters not related to the terrorist analysis; however, some updates were necessary. The Appendices to the original EA were not revised. Since this EA, NNSA has issued the *Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SWEIS, DOE/EIS-0348, DOE/EIS-0236-S3, DOE 2005). Background information in this EA has been updated to reflect more current information in the SWEIS if the updated information is pertinent to NNSA's determination of the potential effects of the proposed action on human health or the environment. Also since 2002, the proposed building has been constructed and all facility-related equipment installed. As such, NNSA acknowledges that the impacts related to construction that are discussed in this document have already occurred; these impacts were analyzed in the 2002 EA and considered in issuing the Finding of No Significant Impact (FONSI). Other minor changes have been made if guiding regulations or DOE policies have been updated since 2002. Change bars (a vertical line in the margin next to the text which was changed) indicate significant changes in the document made since the revised draft was made available for public comment in March, 2007.

EXECUTIVE SUMMARY

The National Nuclear Security Administration (NNSA) of the Department of Energy (DOE) has responsibility for national programs to reduce and counter threats from weapons of mass destruction including nuclear, chemical, and biological weapons (bioweapons). NNSA's bioscience work at Lawrence Livermore National Laboratory (LLNL) in support of these missions requires work with infectious agents, including those historically used for bioweapons. The laboratory's pioneering work on biological agent (bioagent) detection and counter-terrorism technologies, and basic research understanding of emerging and re-emerging natural diseases are key elements of the LLNL efforts to support the NNSA mission. As a result, the need to conduct research with infective agents in a secure environment at LLNL and within NNSA is growing rapidly.

DOE does not currently operate any microbiological laboratory facility above Biosafety Level 2 (BSL-2). Much of the proposed work must be performed with Biosafety Level 3 (BSL-3) containment and protection. BSL-3 facilities provide for environmentally safe and physically secure manipulation and storage of infectious microorganisms, many of which are potential bioweapon agents. NNSA's BSL-3 work would require efficient high-quality sample processing, and, for scientific and security reasons, assurance of sample security and integrity. These requirements also necessitate that cross-contamination and degradation of samples be minimized by reducing excessive handling and transportation. Commercial or governmental BSL-3 facilities currently available are often heavily committed to other projects or tailored to work with specific types of microorganisms. In order to more effectively utilize and capitalize on LLNL's existing onsite facilities, expertise, and capabilities, and ensure the necessary quality, integrity, and security of microbiological work, NNSA needs BSL-3 laboratory capability at LLNL.

The Proposed Action and alternatives differ mainly in how the facility would be constructed. In all but the No-Action alternative, the BSL-3 facility would be designed and operated in accordance with guidance for BSL-3 laboratories established by the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH). Physical security would be implemented commensurate with the level of work being performed within the facility. No radiological, high explosives, or propellant material would be used or stored in the proposed BSL-3 facility. The proposed facility would have the unique capability within DOE to perform aerosol studies to include challenges of rodents using infectious agents or biologically derived toxins (biotoxins). Sample shipments would be received only in compliance with all established shipping guidelines and requirements. The samples would be stored in the BSL-3 laboratory within a locked labeled freezer or refrigerator according to the needs of the sample for preservation. Biological wastes would be disposed of in accordance with CDC and NIH guidance, and other applicable federal, state, and local regulations.

The Proposed Action is to assemble on-site an approximately 1,500 ft^2, one-story permanent prefabricated BSL-3 laboratory facility which would have three individual BSL-3 laboratory rooms (one capable of handling rodents), a mechanical room, clothes-change and shower rooms, and small storage space. The building footprint would take less than one-quarter acre. It is estimated that the operational design life of the proposed building would be at least 30 years.

Under the Remodel/Upgrade Alternative, NNSA would create a single BSL-3 laboratory from an existing BSL-2 laboratory at LLNL. This would require substantial building modification and probable disruption of other on-going work in the facility. This alternative has the lowest waste generation during construction and operation since it is only a single laboratory while the other two options consist of three laboratories each. This alternative would be in accordance with NNSA's purpose and need for action. Being only a single BSL-3 laboratory, it would be self-limiting to the amount of research that could be conducted.

The Construct On-Site Alternative would meet NNSA's purpose and need for action. This alternative does not differ significantly from the Proposed Action for operation and decontamination and decommissioning with one exception. The longer time it takes to construct the facility under this alternative affects the duration of noise, dust, and truck traffic and disruption of workers in adjacent buildings. This longer period also means it would be months longer before the facility would be operational.

Under the No Action Alternative, NNSA would not construct or place a BSL-3 facility at LLNL. In this event, NNSA would continue to have its BSL-3 laboratory needs met by using existing or new BSL-3 laboratories located offsite from LLNL. There would continue to be certain NNSA national security mission needs that could not be met in a timely fashion, or that may not be able to be met at all. The No Action Alternative would not meet the NNSA's identified purpose and need for action.

The environmental consequences from site preparation, construction and routine operation would be minor and would not differ greatly between the Proposed Action and alternatives. The potential human health effects of the proposed BSL-3 laboratory would be the same as those demonstrated for similar CDC-registered laboratories that are required to implement the guidelines established mutually by the CDC and NIH. Relevant human health information gathered from LLNL's past experience with BSL-1 and BSL-2 laboratories, from the U.S. Bureau of Labor Statistics, and from anecdotal information in published reports, indicates that while laboratory-acquired or laboratory-associated infections sometimes occur, they should be considered abnormal events due to their infrequency of occurrence (see Appendix B). As such, the potential human health effects from these events are discussed as Abnormal Events and Accidents. No cases of illness would be expected to result from implementing the Proposed Action as a result of an abnormal event or accident.

On September 16, 2003, suit was filed in federal district court challenging the adequacy of the prior version of this EA. The district court ruled that the EA was adequate and plaintiffs appealed to the Ninth Circuit. In October 2006, the appellate court issued its decision. It concluded that while NNSA did take a hard look at identified environmental concerns and that its decision was fully informed and well-considered, the NNSA had not considered whether the threat of potential terrorist activity would necessitate the preparation of an environmental impact statement. The Court therefore remanded the matter to NNSA.

In accordance with the Ninth Circuit's remand, NNSA has reviewed the threat to the facility from terrorists and the potential environmental effects that might derive from various terrorist

acts against the facility. Three terrorist acts were considered: 1) a terrorist attack resulting in facility damage; 2) a theft of pathogenic agent by a terrorist from outside of LLNL; 3) a theft of pathogenic agent by an insider. This review finds that:

1) a successful terrorist attack involving facility damage and loss of containment is not expected to occur due to the extensive layered security programs at the LLNL; in any event, the environmental consequences would be bounded by the effects that would occur during catastrophic events or operational accidents;
2) because pathogenic agents are available in nature and other, less secure locations, operation of the LLNL BSL-3 facility would not make pathogenic agents more readily available to an outside terrorist, or increase the likelihood of an attack by an outside terrorist; and
3) the theft of pathogenic materials by an insider from any bio research facility could have very serious consequences; this scenario is not expected to occur at LLNL due to human reliability programs, security procedures, and management controls at the Facility.

NNSA believes that the probability of a successful terrorist attack on the BSL-3 facility is so uncertain that the possibility of such an event cannot be accurately quantified. The EA concludes that the systems and technologies developed by using the proposed facility would likely reduce the probability and consequence of a bio-terrorist act against the public in general.

Since the original EA and its Finding of No Significant Impact were issued in December 2002, NNSA has issued the *Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SWEIS, DOE/EIS-0348, DOE/EIS-0236-S3, DOE 2005). Background information in this revised Environmental Assessment has been updated to reflect more current information in the SWEIS if the updated information is pertinent to NNSA determination of the potential effects of the proposed action on human health or the environment. Since 2002, the facility has been constructed and equipment has been installed. To date, no work with BSL-3 material has been performed in the building. As such, DOE acknowledges that the impacts related to construction that are discussed in this document have already occurred. Changes have been made in this revised EA to reflect the "as-built" condition of the facility only if those changes are pertinent to the discussion of impacts from planned operations or reasonably-foreseeable accidents. Other minor changes have been made if guiding regulations or DOE policies have been updated since 2002. Appendices A and B to the original EA was not revised. Appendix C was update as necessary to reflect the comments received on the revised version of the EA.

Vertical bars in the margins indicate changes from the Revised Draft EA made in response to public comments or to update information pertinent to the 9th District Court remand.

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ACRONYMS AND ABBREVIATIONS

AAA	American Antiquities Act
AAALAC	Association for Assessment and Accreditation of Laboratory Animal Care
ABSA	American Biological Safety Association
ACGIH	American Conference of Governmental Industrial Hygienists
AFIP	Armed Forces Institute of Pathology
AIDS	Acquired Immune Deficiency Syndrome
ANSI	American National Standards Institute
APHIS	Animal and Plant Inspection Service
BA	Biological Assessment
BASIS	Biological Aerosol Sentry and Information System
BBRP	LLNL Biology and Biotechnology Research Program
BDRP	Biological Defense Research Program
BLS	Bureau of Labor Statistics
BMBL	Biosafety in Microbiological and Biomedical Laboratories
BMI	Battelle Memorial Institute
BMP	Best Management Practice
BRTA	Biological Risk and Threat Assessment
BSC	Biological Safety Cabinet
BSL	Biological Safety Level
BWC	Biological Weapons Convention
CAA	Clean Air Act
CBNP	Chemical and Biological National Security Program
CDC	Centers for Disease Control and Prevention
CDF	California Department of Finance
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
CRDEC	Chemical Research Development and Engineering Command
D&D	Decontamination and Decommissioning
DA	Department of the Army
dB	decibel (a measure of noise level)
dBA	A-weighted decibel
DBT	Design Basis Threat
DHS	California Department of Health Services
DNA	Deoxyribonucleic Acid
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOP	Dioctyl phthalate
DOT	U.S. Department of Transportation
DPG	Dugway Proving Ground
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EIS/EIR	Environmental Impact Statement/Environmental Impact Report

EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GSA	General Services Administration
HAP	Hazardous Air Pollutant
HEPA	High Efficiency Particulate Air-Purifying
HHS	US Department of Health and Human Services
HID	Human Infective Dose
HID_{50}	Human Infective Dose - 50 percent
HMIS	Hazardous Material Information System
HRSA	HHS, Health Resources and Services Administration
HVAC	Heating, ventilation, and air conditioning
IACUC	LLNL Institutional Animal Care and Use Committee
IATA	International Air Transport Association
IBC	Institutional Biosafety Committee
ID_{50}	Infective Dose - 50 percent
ISMS	Integrated Safety Management System
JH	Johns Hopkins
kW	Kilowatt
LAA	Laboratory Animal Allergy
LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LBOC	LLNL Biosafety Operations Committee
LD_{50}	Lethal dose at 50 percent mortality
LLNL	Lawrence Livermore National Laboratory
LR/SAT	Laboratory Registration/Select Agent Transfer
LWRP	Livermore Water Reclamation Plant
MCE	Maximum Credible Event
MMWR	Morbidity and Mortality Weekly Report
NAAQS	National Ambient Air Quality Standards
NAI	Nonproliferation, Arms Control, and International Security
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NIH	National Institutes of Health
NNSA	National Nuclear Security Administration
NSC	National Safety Council
ORPS	Occurrence Report Processing System
OSHA	Occupational Safety and Health Administration
PEIS	Programmatic Environmental Impact Statement
PM	Particulate Matter
PPE	Personal Protective Equipment

RCRA	Resource Conservation and Recovery Act
RDT&E	Research Development Testing and Evaluation
RG	Risk Group
RO	Responsible Official
RNA	Ribonucleic Acid
SA	Supplement Analysis
	Select Agents
SAHRP	Select Agent Human Reliability Program
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratory, California
SNL/NM	Sandia National Laboratory, New Mexico
SOP	Standard Operating Procedure
SSH	Suppression Subtractive Hybridization
SWEIS	Site-wide Environmental Impact Statement
SWPP	Storm Water Pollution Prevention
TLV	Threshold Limit Value
UC	University of California
USAMRIID	United States Army Medical Research Institute for Infectious Diseases
USC	United States Code
USDA	United States Department of Agriculture
USDHS	United States Department of Homeland Security
USFWS	United States Fish and Wildlife Service
USPS	United States Postal Service
VEE	Venezuelan Equine Encephalomyelitis
WMD	Weapons of Mass Destruction
WHO	World Health Organization

EXPONENTIAL NOTATION: Many values in the text and tables of this document are expressed in exponential notation. An exponent is the power to which the expression, or number, is raised. This form of notation is used to conserve space and to focus attention on comparisons of the order of magnitude of the numbers (see examples):

1×10^4	=	10,000
1×10^2	=	100
1×10^0	=	1
1×10^{-2}	=	0.01
1×10^{-4}	=	0.0001

Metric Conversions Used in this Document

Multiply	By	To Obtain
Length		
inch (in.)	2.54	centimeters (cm)
feet (ft)	0.30	meters (m)
yards (yd)	0.91	meters (m)
miles (mi)	1.61	kilometers (km)
Area		
Acres (ac)	0.40	hectares (ha)
square feet (ft^2)	0.09	square meters (m^2)
square yards (yd^2)	0.84	square meters (m^2)
square miles (mi^2)	2.59	square kilometers (km^2)
Volume		
Gallons (gal.)	3.79	liters (L)
cubic feet (ft^3)	0.03	cubic meters (m^3)
cubic yards (yd^3)	0.76	cubic meters (m^3)
Weight		
Ounces (oz)	29.57	milliliters (ml)
pounds (lb)	0.45	kilograms (kg)
short ton (ton)	0.91	metric ton (t)

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1.0 PURPOSE AND NEED

1.1 INTRODUCTION

The *National Environmental Policy Act of 1969* (NEPA) requires Federal agency officials to consider the environmental consequences of their proposed actions before decisions are made. In complying with NEPA, the United States (U.S.) Department of Energy (DOE), National Nuclear Security Administration (NNSA[1]) follows the Council on Environmental Quality (CEQ) regulations (40 *Code of Federal Regulations* [CFR] 1500-1508) and DOE's own NEPA implementing procedures (10 CFR 1021). The purpose of an environmental assessment (EA) is to provide Federal decision-makers with sufficient evidence and analysis to determine whether to prepare an Environmental Impact Statement (EIS) or issue a Finding of No Significant Impact (FONSI). This EA has been prepared to assess environmental consequences resulting from the construction and operation of a Biosafety Level 3 (BSL-3) laboratory[2] facility within the boundaries of the Lawrence Livermore National Laboratory (LLNL), Livermore, CA (Figure 1-1). LLNL is one of the national security laboratories under the authority of the Under Secretary for Nuclear Security of the NNSA who serves as the Administrator for Nuclear Security and Head of the NNSA (50 USC Chapter 41, § 2402(b)).

The objectives of this EA are to (1) describe the underlying purpose and need for NNSA action; (2) describe the Proposed Action and identify and describe any reasonable alternatives that satisfy the purpose and need for NNSA action; (3) describe baseline environmental conditions at LLNL; (4) analyze the potential indirect, direct, and cumulative impacts to the existing environment from implementation of the Proposed Action and other reasonable alternatives; and (5) compare the impacts of the Proposed Action with the No Action Alternative and other reasonable alternatives. For the purposes of compliance with NEPA, reasonable alternatives are identified as being those that meet NNSA's purpose and need for action by virtue of timeliness, appropriate technology, and applicability to LLNL.

The EA process also provides NNSA with environmental information that can be used in developing mitigative actions, if necessary, to minimize or avoid adverse effects to the quality of the human environment and natural ecosystems should NNSA decide to proceed with implementing the construction and operation of a BSL-3 facility at LLNL. Ultimately, the goal of NEPA and this EA is to aid NNSA officials in making decisions based on an understanding of environmental consequences and taking actions that protect, restore, and enhance the environment.

[1] The NNSA is a separately organized agency within DOE established by Congress in 2000 under Title 50 United States Code Chapter 41, Subchapter I, Section 2401.

[2] A biosafety level or BSL is assigned to an agent based upon the activities typically associated with the growth and manipulation of the quantities and concentrations of infectious agents required to accomplish identification or typing as determined by the Centers for Disease Control (CDC) and National Institutes of Health (NIH). Additional information about the various BSL assignments is provided in later sections and within Appendix A of this EA.

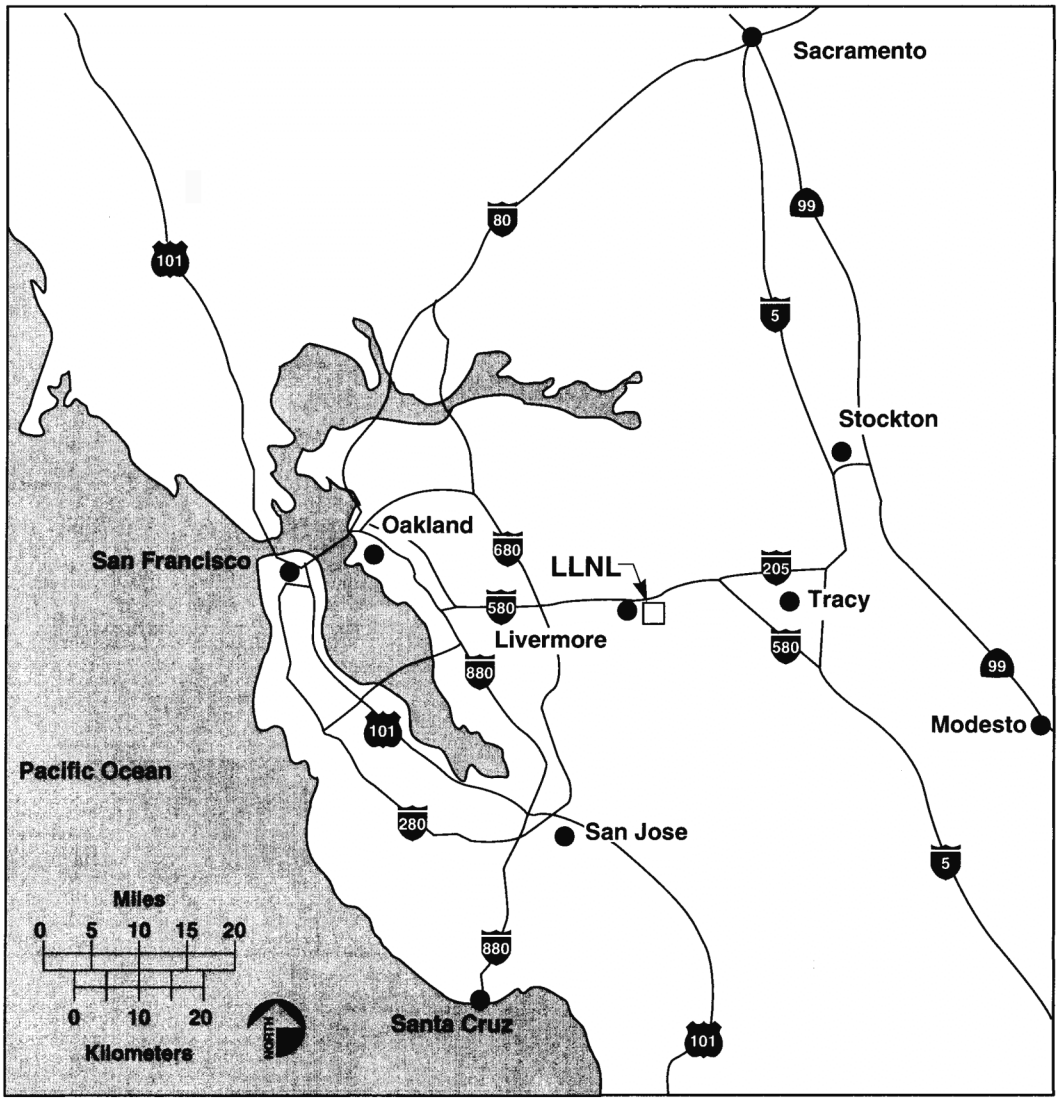


Figure 1-1. Location of Lawrence Livermore National Laboratory (LLNL)

1.2 BACKGROUND

The LLNL Livermore site lies just outside the boundary of Livermore, California. It occupies a total area of approximately 1.3 sq miles (821 acres), and is about 40 miles east of San Francisco at the southeast end of the Livermore Valley in southern Alameda County, California. The City of Livermore's central business district is located about 3 miles to the west. Figure 1-1 and Figure 1-2 show the regional location of the LLNL Livermore site and its location with respect to the City of Livermore. Lawrence Livermore National Laboratory (LLNL) is a U.S. Department of Energy national laboratory operated by the University of California (UC). Since the publication of this EA, a new M&O contractor for LLNL has been selected, Lawrence Livermore National Security, LLC (LLNS). LLNL was founded in September 1952 as a second nuclear weapons design laboratory to promote innovation in the design of our nation's nuclear stockpile through creative science and engineering. LLNL has also become one of the world's premier scientific centers, where cutting-edge science and engineering in the interest of national security

is used to break new ground in other areas of national importance, including energy,

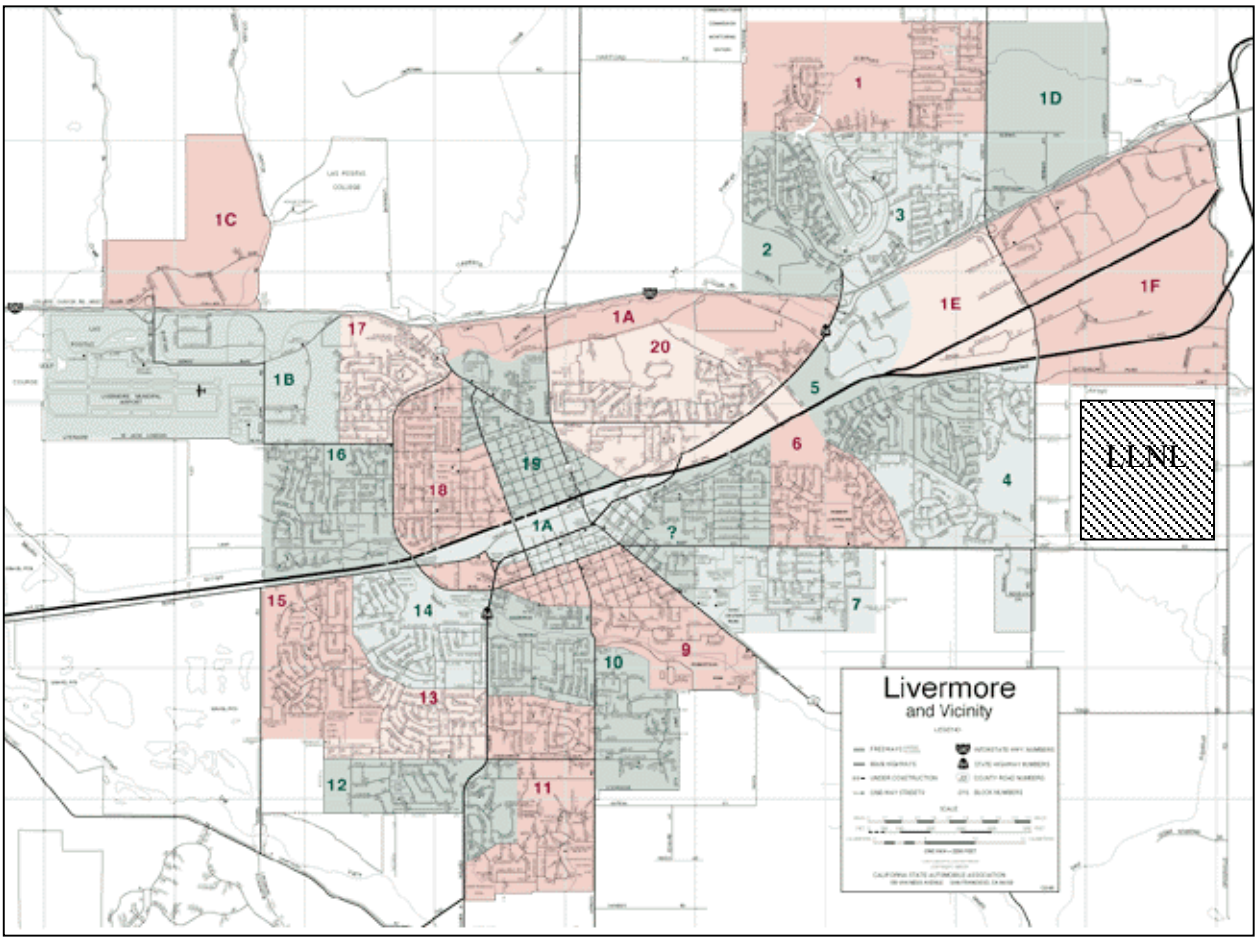


Figure 1-2. Location of LLNL with respect to the City of Livermore, CA

biomedicine, and environmental science.

Current NNSA mission-support work at LLNL includes research and development work performed for a variety of programs within the NNSA, other DOE programs, as well as cost-reimbursable work that is identified as "work for others." This designation, "work for others," encompasses non-DOE sponsored work performed in support of other Federal agencies, universities, institutions, and commercial firms, which is compatible with the NNSA mission work conducted at LLNL and which cannot reasonably be performed by the private sector. Within DOE, the NNSA mission is "(1) To enhance United States national security through the military application of nuclear energy; (2) To maintain and enhance the safety, reliability, and performance of the United States nuclear weapons stockpile, including the ability to design, produce, and test, in order to meet national security requirements; (3) To provide the United States Navy with safe, militarily effective nuclear propulsion plants and to ensure the safe and reliable operation of those plants; (4) To promote international nuclear safety and nonproliferation; (5) To reduce global danger from weapons of mass destruction (WMD); and (6) To support United States leadership in science and technology" (50 USC Chapter 41, § 2401(b)). Work

conducted at LLNL provides support to these NNSA missions, with a special focus on national security.

NNSA has the responsibility for national programs to reduce and counter threats from weapons of mass destruction (nuclear, biological, and chemical weapons). Activities conducted in this area include assisting with control of nuclear materials in states of the former Soviet Union, developing technologies for verification of the Comprehensive Test Ban Treaty (September 1996), countering nuclear smuggling, safeguarding nuclear materials and weapons, and countering threats involving chemical and biological agents.

The DOE Chemical and Biological National Security Program (CBNP) was initiated in fiscal year (FY) 1997 to engage the DOE and its laboratories more fully in the development and demonstration of new technologies and systems to improve U.S. domestic preparedness and response capabilities to chemical and biological attacks. The CBNP is a needs-driven program focused on addressing the highest priority area to counter chemical and biological threats against the people and economy of the United States of America as well as the threat against democracy and freedom. The CBNP was established in response to the *Defense Against Weapons of Mass Destruction Act* passed by Congress in 1996 (50 USC § 2301).

DOE and the national security laboratories have a long history of supporting nonproliferation and national security policy. As part of its primary nuclear science and technology mission, DOE has developed extensive capabilities in chemistry, biology, materials and engineering science, computations, and systems engineering at these laboratories. These capabilities, in areas such as genomic sequencing, development of new deoxyribonucleic acid (DNA[3])-based diagnostics, advanced modeling and simulation, and microfabrication technologies, as well as the joining of these capabilities with expertise in nonproliferation and national security, form the basis of NNSA's role in combating the chemical and biological threat. In addition to the chemical and biological nonproliferation activities supported by this program, the national security laboratories conduct work in chemical and biological defense research for other government agencies.

Since this EA was originally published, some of DOE's missions relating to biological security have been transferred to the Department of Homeland Security (DHS). However, DOE and LLNL continue to support this critical mission by performing work for the DHS on a "work for others" basis. The Homeland Security Act of 2002 authorizes DHS to access the capabilities of DOE's laboratories and other sites to further DHS mission objectives. In this revised document, references to DOE or NNSA missions should be understood to include work conducted on behalf of DHS in support of their mission objectives.

LLNL has been assigned research and development activities in support of these NNSA responsibilities. The LLNL Biology and Biotechnology Research Program (BBRP) (now part of the Chemistry, Materials, Earth, and Life Sciences Directorate) has been assigned the primary responsibility for conducting work related to biological science research including work with national health security issues and emerging diseases. Program objectives include understanding genetic and biochemical causes of disease, countering biological terrorism, bioengineering

[3] DNA is the polymeric deoxyribonucleic acid that determines the hereditary information in cells.

research, and developing and applying computational biology capabilities. Most of the on-site work is conducted in the Building 360 Complex area (Figure 1-3). Current research performed at this complex includes structural, molecular, and cellular biology, biophysics, biochemistry, and genetics research.

The BBRP work in the biosciences arena at LLNL has been ongoing for more than 40 years, and is conducted according to the accepted national standards for biosafety level (BSL)-1 and -2 work that have been developed by the U.S. Department of Health and Human Services, Public Health Service, through their subsidiary organizations, the CDC and the NIH. Details regarding BSLs -1, -2, and -3 and specific information and requirements for work in microbiological laboratories are provided in Appendix A of this EA. In addition, prior to commencement of any

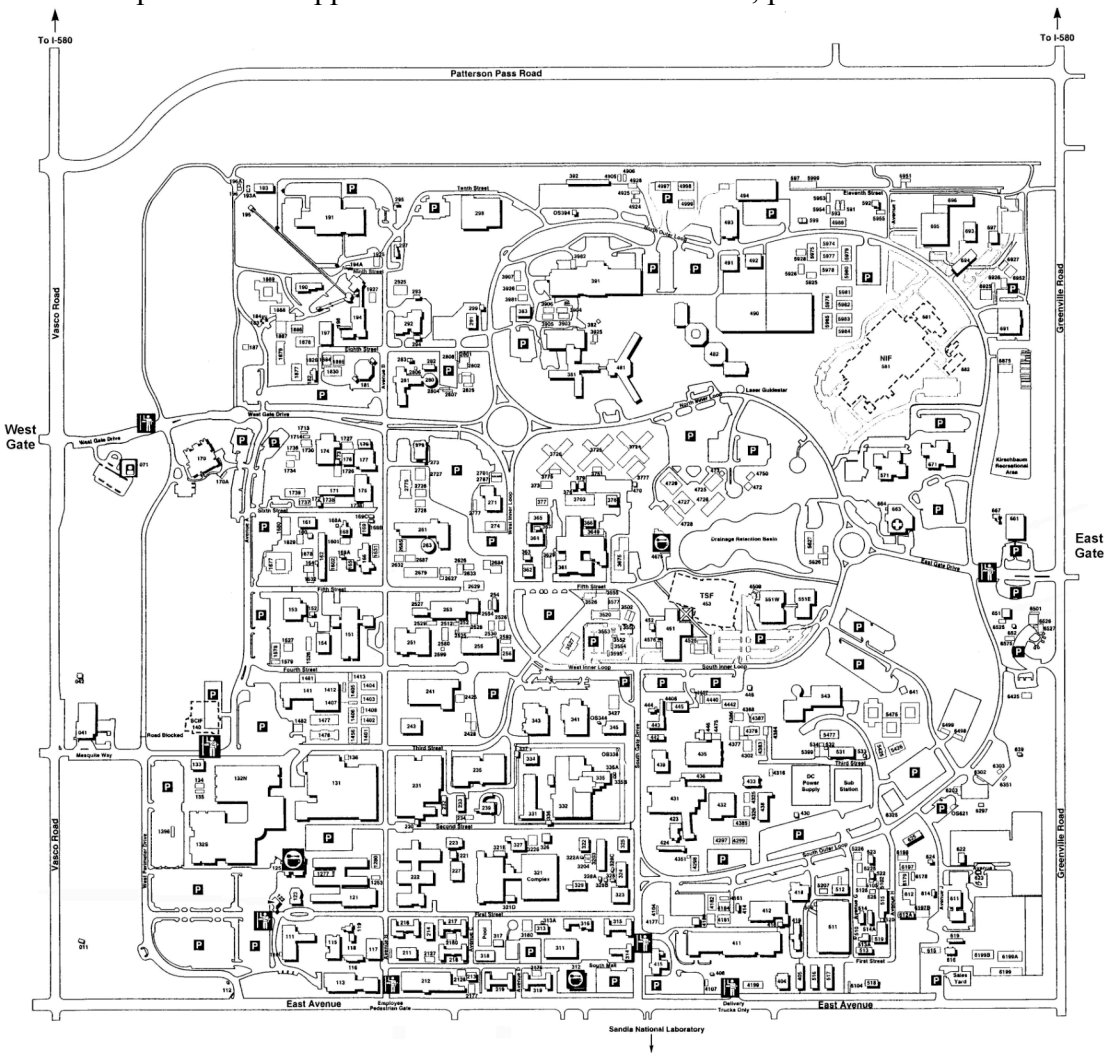


Figure 1-3. Map of LLNL showing the location of the Building 360 Complex Area (within the dashed line)

LLNL experiments involving biological agents[4], work is reviewed and must be approved by the LLNL Laboratory Biosafety Operation Committee (LBOC). Certain projects must also be

[4] Biological agents or bioagents are organisms or the product of organisms that present a health risk to humans. These can be bacterial, fungal, parasitic, rickettsial, or viral agents, or prions.

reviewed and approved by the LLNL Institutional Biosafety Committee (IBC), which is made up of LLNL staff members, UC and community health care providers, a DOE Federal member, and at least two members of the public. The IBC typically meets in the Building 361 Complex several times per year, depending on demand. In general, BSL-2 facilities are used for working with a broad spectrum of biological agents (or bioagents) or biological toxins[5] commonly present in the community and may be associated with human disease of moderate severity. Facilities using CDC and NIH standards have demonstrated safe and secure working conditions with infectious agents. According to these standards for BSL-2 (CDC 1999) laboratories, the primary hazards to personnel working with agents at this level relate to accidental exposures through skin punctures or contact with mucous membranes, or ingestion. The organisms routinely manipulated at BSL-2 are not known to be transmissible, person-to-person by the airborne pathway. Examples of diseases include Hepatitis, measles, and salmonellae. Limited access, separated from public areas with posted BSL-2 biohazard signs, waste decontamination facilities, together with standard and special microbiological practices, are required for these laboratories. Common examples of BSL-2 facilities are those located in hospitals, medical schools, veterinary schools, biology research institutions, and dental offices.

According to their standard for BSL-3 (CDC 1999), the primary hazards to personnel working with agents at this level relate to accidental injections, ingestion, and exposure through airborne pathway. In BSL-3, more emphasis is placed on primary and secondary barriers to protect personnel in contiguous areas, the community, and the environment from exposure to potentially infectious aerosols. There are currently over 1350 BSL-3 laboratory facilities in the United States at various non-DOE sites (GAO 2007). BSL-3 laboratory facilities are specifically designed and engineered for work with bioagents with the potential for aerosol transmission that may cause serious or potentially lethal disease by inhalation if left untreated (such as the bacteria responsible for causing tuberculosis in humans). Examples of common BSL-3 facilities include hospital surgical suites, clinical, diagnostic, and teaching laboratories associated with medical or veterinary schools, and university research and development laboratories. Requirements of operating a BSL-3 facility (CDC 1999) are detailed in Appendix A.

Current research and technology development work conducted at LLNL targets both the reduction of the national threat from terrorism using biological weapons and enhances the Nation's public health capabilities. For example, in support of these responsibilities LLNL has developed the Biological Aerosol Sentry and Information System (BASIS) for early detection and rapid response to biological attack, conducts "expression studies" of *Yersinia pestis*, the causative bacterial agent in plague to understand the mechanisms of virulence, and performs "suppression subtractive hybridization" (SSH) to study the fundamental biology of microbes through DNA segmentation and similar-strain comparison. This current research and technology development work is focused on the development of scientific tools to identify and understand the pathogens of medical, environmental, and forensic importance.

The importance of work performed by NNSA laboratories in bioscience research and development in support of the national security WMD nonproliferation mission is increasing. This mission is to develop, demonstrate, and deliver technologies and systems to improve domestic defense capabilities and, ultimately, to save lives in the event of a chemical or

[5] Biological toxins are toxic chemicals of biologic origin and are not self-replicating.

biological attack. The threat presented by terrorists and rogue nations to the American people and our allies, including military personnel, amplifies the need for threat reduction research. Current work at LLNL in bioscience research is limited to BSL-2. Pending and future work in support of the DOE, NNSA, and DHS national security missions requires specialized facilities to safely and securely handle and store infectious organisms beyond that which can be provided by BSL-2. DOE does not currently have under its administrative control within the DOE complex any microbiological laboratory facility capability beyond BSL-2, but BSL-3 facilities are proposed both at LLNL (as outlined in this EA) and at Los Alamos National Laboratory (LANL) (DOE 2002b).

Additional information regarding the DOE and NNSA mission areas of work conducted at LLNL is presented in the *Final Environmental Impact Statement and Environmental Impact Report for Continued Operations of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, August 1992* (DOE/EIS-0157) (DOE 1992), its associated Supplement Analysis (SA) (DOE 1999), and the *Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SWEIS, DOE/EIS-0348, DOE/EIS-0236-S3, DOE 2005).

1.3 PURPOSE AND NEED FOR AGENCY ACTION

DOE conducts bioscience work in support of its biology and biotechnology research programs, work for other agencies, and work in support of CBNP. The NNSA CBNP mission is to "develop, demonstrate and deliver technologies and systems to improve domestic defense capabilities and, ultimately, to save lives in the event of a chemical or biological attack."

In order to meet these mission requirements, it is necessary to expand some existing capabilities to test the understanding and effectiveness of research on infectious agents and biotoxins, particularly those associated with potential bioweapons threats. Efficient execution of the NNSA mission therefore, also requires the capability to handle operations involving small-animal (rodent) challenges of bioagents (and possibly biotoxins) and the ability to produce small amounts of biological material (enzymes, DNA, ribonucleic acid[6] [RNA], etc.) using infectious agents and genetically modified agents under conditions that would require management of the facility at the BSL-3 level.

This capability does not currently reside within DOE/NNSA facilities, but some of the research is carried out for the LLNL Nonproliferation, Arms Control, and International Security (NAI) Directorate primarily by the BBRP using external (private-sector and University) laboratories to conduct the BSL-3 level components of the research. The nature of BSL-3 work requires efficient sample processing, handling of a variety of organisms concurrently, and assurance of sample security and integrity. NNSA's mission requirements for sample integrity necessitates that the chances of cross-contamination and degradation of samples be minimized by reducing excessive handling and transportation. The several key off-site BSL-3 facilities that conduct work for LLNL in support of NNSA, are often heavily committed to other projects or tailored to

[6] Ribonucleic acid or RNA is a generic term for a group of natural polymers present in all living cells directly involved with protein synthesis.

work with microorganisms not of specific interest to NNSA. This has especially become an issue since September 11, 2001. Because of this these laboratories are unlikely to be able to provide the quick response that may be necessary to support the NNSA need.

An on-site BSL-3 facility would provide safe and secure manipulation and storage of infectious microorganisms at a time when these issues are imperative to national security. In order to more effectively utilize and capitalize on existing onsite facilities and capabilities at LLNL, including informatics and DNA sequencing capability, and to ensure the quality, timeliness, integrity and security of microbiological work, NNSA needs BSL-3 laboratory capability within the boundaries of this national laboratory.

1.4 PUBLIC INVOLVEMENT

The Draft EA was originally made available for public comment from July 24 through August 23, 2002. The comment period was extended through September 7, 2002.

The revised document was made available for a 30 day comment period beginning April 11 and ending May 11, 2007. No comments received were excluded from the record. All comments were accepted even if they were received after the 30 day period.

1.5 COMMENT SUMMARIES AND NNSA RESPONSES

The full text of the comments received by NNSA on the Revised Draft EA by stakeholders and members of the public are included in Appendix C-2 of this EA. Where comments were duplicated, as in the presentation of form-type letters, only one is shown in its entirety. Many of the topics generated from public responses are of broad interest or concern and were categorized into twelve general issues which comprise the twelve sections in Appendix C-1. Comments and concerns voiced by the commentors were addressed through changes made to the document text to the extent practicable. Some commenters raised issues that are not pertinent to the NEPA review. These were also addressed to the extent practicable. The following general issues are discussed in the appendix:

1. NEPA Compliance: Documentation/Review Level
2. Safety of Laboratory Operations
3. Defensive vs. Offensive-oriented Research
4. Compliance with the Biological Weapons Convention
5. Public Health and Safety, and Worker Safety Issues
6. Accident Analysis
7. Threat of Terrorist Attack/Sabotage
8. Transportation Safety
9. Purpose and Need
10. Adequacy of Alternatives Analysis
11. Waste Disposal
12. Timeline for the BSL-3 Facility
13. Oversight
14. Public Comment Period and Public Hearings

Appendix C includes only those comments received on the Revised EA. Comments previously received on the original document have been left out to reduce the length of the appendix. The original responses from the 2002 EA have been revised or updated where public comments on the Revised Draft EA provided new information pertinent to the proposed action or expressed concerns that were not responded to previously.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Section 2.1 describes the Proposed Action for the EA that would allow NNSA to meet its purpose and need for agency action. Two additional alternatives are presented in Section 2.2 and 2.3, respectively. The No Action Alternative is presented in Section 2.4 as a baseline for comparison with the consequences of implementing the Proposed Action. Alternatives that were considered in this EA but were not analyzed further are discussed in Section 2.5, and related actions are identified in Section 2.6.

Readers of this revised document should note that since the original Environmental Assessment and its associated Finding of No Significant Impact were issued in December 2002, the facility has been constructed and equipment has been installed. This document has been revised to address the issues regarding terrorist attacks pursuant to the Ninth Circuit Court's remand. NNSA acknowledges that the impacts related to construction that are discussed in this document have already occurred. Changes have been made in this revised EA to reflect the "as-built" condition of the facility only if those changes are pertinent to the discussion of impacts from proposed operations or reasonably-foreseeable accidents.

2.1 PROPOSED ACTION TO CONSTRUCT AND OPERATE A BSL-3 FACILITY AT LLNL

NNSA proposes to construct and operate a BSL-3 facility at LLNL for the purpose of conducting biological research projects involving indigenous or exotic agents which may cause serious or potentially lethal or debilitating effects on humans, plants, and animal hosts, therefore, potentially impacting human health as well as agriculture, food, and other industries. LLNL's existing BSL-2 laboratory capability which cannot be used to perform this work is primarily located in the Building 360 Complex area (see Figure 1-3). As proposed, the BSL-3 facility would be an essential component for future advanced biological sciences research and development performed by LLNL's staff but would not replace the other biological laboratory capabilities at LLNL. The BBRP would continue to support current biological sciences initiatives at LLNL through the existing BSL-2 laboratories. The proposed facility (Figure 2-1) would be a permanent modular unit that would be constructed off-site and assembled on-site near the northwest corner of Building 361. It would have the same life expectancy as a facility constructed on-site.

The construction would be permanent and meet applicable building code, and required structural, seismic, plumbing, electrical, and fire standards. The proposed facility would include three BSL-3 laboratory rooms, one of which would be capable of holding rodents. The building would include clothes-change and shower rooms, a mechanical room, and some storage space, but no office space. When complete, the BSL-3 facility would be about 1,500 ft^2 (135 m^2) in size and would normally be occupied by no more than 6 workers. As currently projected, these staff

members would come from the adjacent Building 360 Complex laboratory facilities (Figure 2-1) with no requirement for permanent relocation. Any additional staffing needed to support BSL-2 work previously done by workers who would be performing BSL-3 work may be made up by hiring locally or regionally, as necessary, to find qualified individuals.

The BSL-3 facility would be designed with a lifetime expectancy of 30 years (minimum) of operation. During the operational life of the building, the performance of routine maintenance actions would be expected. At the end of the facility's useful life, final decontamination and demolition would be performed as needed.

2.1.1 Proposed BSL-3 Facility Location and Construction Measures[7]

The proposed location is in the current parking area and access-drive directly adjacent to (east of) building B-365 and northeast of the intersection of Fifth Street and West Inner Loop (see Figure 2-1). Approximately 20 parking spaces of the paved current parking area would become

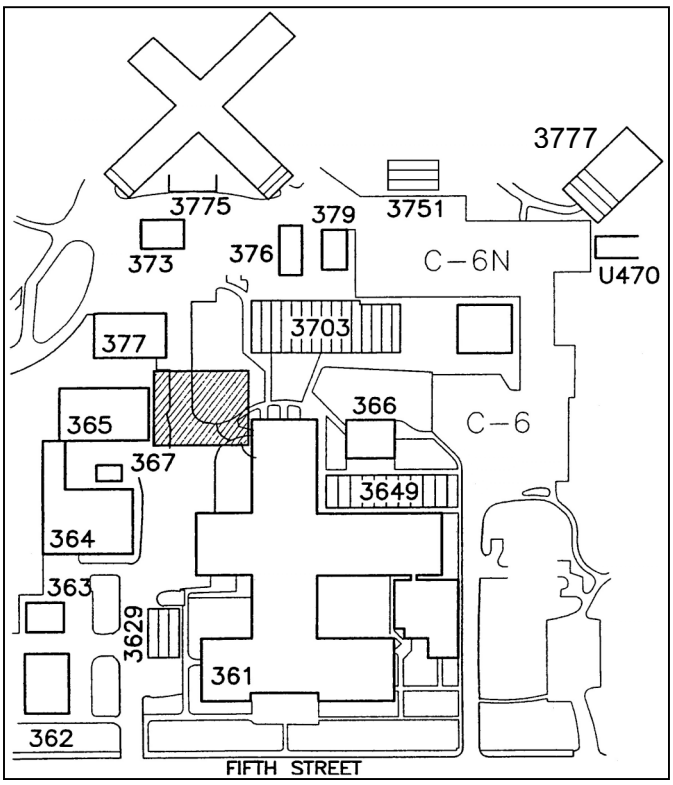


Figure 2-1. Map of the Building 360 Complex Area showing the location of the proposed BSL-3 facility (cross-hatched area)

permanently unavailable for use due to the footprint of the building and it may be necessary to redirect part of the parking access driveway.

[7] As discussed in Section 2.0, construction of the facility has already occurred.

The footprint of the proposed building would be less than one-quarter of an acre. Utilities necessary for construction and operation of the BSL-3 facility would be available within 50 ft (15 m) of the proposed construction site facility. These include potable water, natural gas, steam, sewer, electricity, and telephone service. Some minor trenching (at depths less than about 4 ft [1.3 m]) would be required to bring those utilities to the site.

Construction Measures[8]: As noted above, the project construction site would be at a location that has previously been cleared of buildings or structures and is within existing paved parking areas. No undeveloped (so called "green field") areas would be involved. No construction would be conducted within a floodplain or a wetland. The building would not be constructed over a known geologic fault or vertical displacement of a fault line, nor would it be sited within 50 feet of such a condition. No construction would be conducted within a solid waste management unit.

The BSL-3 facility building would be designed in accordance with guidance for BSL-3 laboratories established by the CDC and NIH (CDC 1999, NIH 2001). The CDC, which is part of the Department of Health and Human Services, provides guidelines for the operation of BSL-3 facilities, registers facilities that will access, use and transfer select agents, and then periodically inspects these facilities during operation. DOE Order O420.1 (DOE 1996b) which addresses natural phenomena hazard mitigation for non-nuclear facilities would be considered in preparing the final design criteria for seismic, wind and flooding events.

Sustainable design features would allow the structure to operate with improved electric and water use efficiency and would incorporate recycled and reclaimed materials into the construction as much as practicable while still meeting the requirements specified by CDC for laboratory interiors. For example, the facility could incorporate building and finish materials and furnishings made of reclaimed and recycled materials, low-flow lavatory fixtures to minimize potable water use, and energy-efficient lighting fixtures and equipment to reduce electric consumption. Where possible, the finished landscaping of the involved construction area would utilize non-potable water, reused and recycled materials, and native plant species.

Clearing or excavation activities during site construction have the potential to generate dust and encounter previously buried materials. If buried materials or remains of cultural or paleontological significance were encountered during construction, activities would cease until their significance was determined and appropriate subsequent actions taken in accordance with the National Historic Preservation Act (NHPA, 16 USC 470) or the American Antiquities Act (AAA, 16 USC 430). Standard dust suppression methods (such as water spraying) would be used onsite, if needed, to minimize the generation of dust during all phases of construction activities.

All construction work would be planned and managed to ensure that standard worker safety goals would be met. All work would be performed in accordance with good management practices, with regulations promulgated by the Occupational Safety and Health Administration (OSHA, 29 CFR 1910 and 29 CFR 1926), in accordance with various DOE orders involving worker and site safety practices, and in accordance with the LLNL Environment, Health and

[8]As discussed in Section 2.0, construction of the facility has already occurred.

Safety Manual (LLNL 2001c). The construction contractor would be prohibited from using chemicals that generate *Resource Conservation and Recovery Act* (RCRA)-regulated wastes (40 CFR 261). Engineering best management practices (BMPs) would be implemented at the building site chosen, as part of a Storm Water Pollution Prevention (SWPP) Plan executed under a National Pollutant Discharge Elimination System construction permit. These BMPs may include the use of hay bales, plywood, or synthetic sedimentation fences with appropriate supports installed to contain any excavated soil and surface water discharge during construction of the BSL-3 facility. After the facility is constructed, mounds of loose soil would be tested for previous contaminants, removed from the area, and either reused or disposed of appropriately.

During site preparation and construction, noise levels (for short time periods) would be consistent with those expected from the construction of single-story frame non-residential structures using metal studs and cross members. The use of welding equipment, air compressors, riveting tools, and heavy equipment is reported to range from 65 to 125 dBA[9] continuous or intermittent noise. Power-actuated tools (for example, those for setting fasteners into concrete) can go up to 139 dBA of impact-type noise near the point of generation (ACGIH 2000).

Vehicles and heavy machinery (such as front-end loaders, dump trucks, cranes, and cement mixer trucks) would be used onsite during the construction phase. These vehicles would operate primarily during the daylight hours and would be left onsite overnight. If needed, temporary task lighting would be used. Wastes generated by site preparation and construction activities would be expected to be nonhazardous.

Construction of the BSL-3 facility is estimated to start in FY 2003 and take several months to complete. Construction materials would be procured primarily from local California suppliers. Construction workers would be drawn from local communities or would be derived from the current in-house LLNL staff.

2.1.2 BSL-3 Facility Description and Operations

Facility Description: The proposed BSL-3 facility would be a one-story building with about 1,500 ft^2 (135 m^2) of floor space (Figure 2-2) housing three BSL-3 laboratories (one with rodent handling and maintenance capability), showers, sinks, lavatories, and mechanical and electrical equipment areas. The BSL-3 facility would most likely be constructed using concrete footing and stem walls with concrete slab-on-grade floors. Walls would be steel stud framed and the roof construction would consist of metal decking over steel bar joists. The exterior walls would have an application of stucco and the painting of the building would be visually consistent with surrounding structures. The interior surfaces of walls, floors, and ceilings of the BSL-3 laboratory areas would be constructed for easy cleaning and disinfection. The walls would be finished with an easily cleanable material with sealed seams, resistant to chemicals and disinfectants normally used in such laboratories. Floors would be coated and slip-resistant. All penetrations in floors, walls, and ceiling surfaces would be sealed, or capable of being sealed to facilitate disinfection, to aid in maintaining appropriate ventilation system air pressures, and to keep pests out. Laboratory furniture would be capable of supporting anticipated loading and use,

[9] dBA refers to sound level in decibels measured on a sound level meter using the A-weighted scale as established by the American National Standards Institute (ANSI, 1983)

and bench tops would be impervious to water and resistant to moderate heat, chemicals used, and disinfection solutions. Spaces between benches, cabinets, and equipment would be accessible for cleaning with disinfectants.

Each of the three BSL-3 laboratories would have at least one Class II Type A-2 biological safety cabinet[10] (BSCs) (Figure 2-3). Class II BSCs provide their own airflow, have High Efficiency Particulate Air-Purifying (HEPA)[11] filtration internally within the cabinet and would be designed to provide personal, environmental, and test material protection. Exhaust air from the BSCs would exit the room via the thimble-type connection to HEPA filters in the mechanical rooms, then outside the building. With the use of Class 11, Type A-2 BSCs, some room air from outside the BSC may exit directly (through the thimble connection) to the building exhaust system without first going through the BSC. All BSC air and room air would be 100 percent exhausted to the outside through the building heating, ventilation, and air conditioning (HVAC) and HEPA filtration system (air exhausted from BSCs is doubly-filtered). Class II Type A-2 BSCs are designed to operate at a minimum inward flow of a 100 linear ft per min (30.5 linear m per min) at the face opening (CDC 2000b). BSCs would be located away from doors, room supply louvers, and heavily

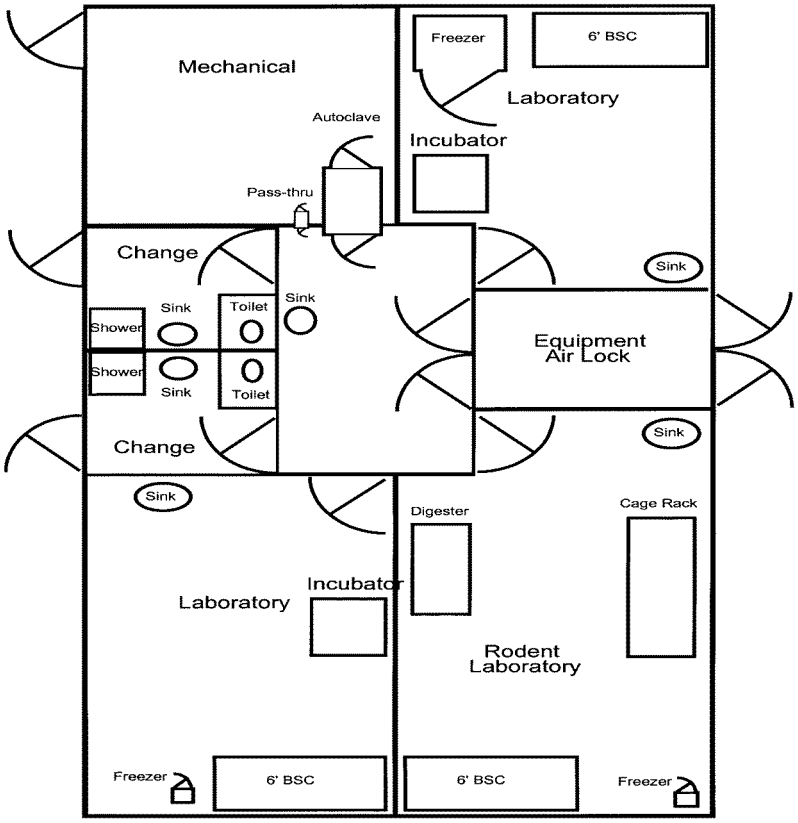


Figure 2-2. Conceptual floor plan for the proposed BSL-3 facility at LLNL (not to scale) (The As-Built facility does not significantly vary from this drawing.)

[10] A BSC (biosa :ing safely with infe

[11] HEPA filter is a disposable, extended-medium, dry-type filter with a particle removal efficiency of no less than 99.97 percent for 0.3-micron particles.

Figure 2-3. Photo of a NUAIR - Class II Type A-2 BSC[12] with Thimble Connection

traveled laboratory areas. BSC interiors would be cleaned by use of appropriate methods and could include ultraviolet light or chemical disinfection. BSCs would be tested and certified annually and after installation, repair, or relocation in accordance with CDC guidance (CDC 2000b).

No windows would be installed in the BSL laboratory's exterior walls. Non-opening observation windows would be placed on interior doors. Centrifuges or other equipment that have the potential to produce aerosols would be operated in BSCs or with appropriate combinations of personal protective equipment (PPE), physical containment, or control devices. Vacuums would be provided to critical work areas using portable vacuum pumps properly fitted with traps and HEPA filtration.

Each laboratory would also contain at least one refrigerator or freezer. Biological materials would be stored either in regular refrigerators for short-term use or in ultra-low temperature mechanical freezers operating between –50 and –85°C for long-term sample storage or archiving.

The BSL-3 laboratory used for rodent handling would have a tissue digestor for the purpose of sterilizing all animal tissues at the conclusion of each study involving small rodents. Figure 2-4 shows an example of a tissue digestor unit that could be used. The digestor would use an alkaline hydrolysis process at an elevated temperature to convert all of the organic material (as well as infectious microorganisms) into a sterile aqueous solution of small peptides, amino acids, sugars, and soaps. The alkali would be used up in the process. Aside from the aqueous solution, the only byproducts would be mineral (ash) components of the bones and teeth.

[12] The use of a trade name does not constitute an endorsement nor does it indicate that the product would be purchased. This is only shown to be representative of the type of equipment that would be used.

The BSL-3 laboratory used for rodent testing would also contain an rodent caging system similar to that shown in Figure 2-5. These ventilated cages would be pressurized with HEPA-filtered air, thus reducing both ammonia and carbon dioxide. The negative pressurization would provide

Figure 2-4 Photo of a Waste Reduction Inc. ™ small-capacity tissue digestor[1]

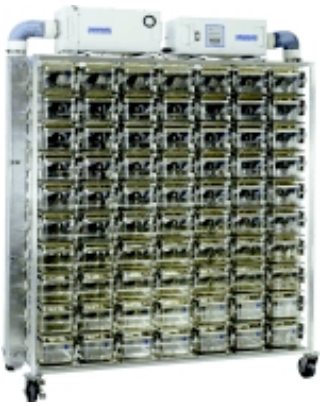


Figure 2-5. Photo of an Allentown Caging Equipment Co.™ BioContainment Unit for small animals[10]

continuous quarantine status, protecting personnel and preventing contact with the other rodents in the cage rack. A maximum of 100 rodents, mainly mice (some rats and possibly guinea pigs), would be used at any one time. Once a rodent would be used in testing it would never leave the cage except for cage-cleaning and inspection which would occur only in the confines of the BSCs. Once removed from a cage the rodents would only be placed back into a clean cage. The dirty cage and its contents would be autoclaved[13] prior to reuse. All rodents used would be supplied by the already-existing rodent quarantine facility located and operated in an adjacent building. The cage rack would be restrained from toppling over by resisting about 1g of lateral acceleration. Cage latches have been tested to 2g's of pull force.

Some rodents would be exposed to infectious agents in the BSC through inhalation via a device known as a collision nebulizer. This device creates aerosol particles of known size (depending upon the specific nozzle used) to which rodents would be exposed through a nose-piece. The nebulizer consists of a 32-ounce Pyrex™ glass liquid storage container with a "T-shaped" stainless steel aerosol jetting-device operated by compressed air. The device would only be used in the BSC and would be chemically disinfected in place after use. Once exposed, the rodent would (while still in the BSC) be placed directly into a clean cage and placed back into the ventilated cage rack for observation.

Physical security of the facility building would be implemented commensurate with the level of work being performed. The facility safeguards would be based upon a security analysis conducted during the project planning stage. As in all facilities managed at LLNL, security in the proposed facility would be maintained by limiting access to only authorized DOE-badged personnel. Employee qualifications and training requirements are described in CDC-NIH guidelines (CDC 1999) along with a discussion of appropriate management of security concerns.

Fire suppression for the BSL-3 facility would be provided by a standard wet-pipe fire sprinkler system. Water flow alarms would be connected to LLNL's fire alarm monitoring station so that designated responders would be notified. Water used for fire suppression that might become pooled on the building floor would be discharged from the floor drains to a retention tank system, for containment, characterization, and disinfection as needed, prior to discharge to the sanitary sewer system.

Two HEPA filter banks in series in the building exhaust system would filter all room air one-time-through and provide secondary filtration for exit air from the BSCs. Filter banks could be switched or alternated to permit disinfection and filter replacement. Routine maintenance of the filter banks would be conducted by certified technicians, including replacement of the filters. Replaced filters would be chemically sterilized prior to disposal. There would be only one electrical room with access for maintenance from the exterior of the building. The BSL-3 facility would employ lightning protection designed to meet the requirements of the National Fire Protection Association (NFPA 1997 and 2000). Entry of personnel into the BSL-3 laboratories would be through the change rooms which would serve as self-closing double-door access.

[13] An autoclave is an apparatus using superheated steam under pressure to kill or sterilize microorganisms

The air-handling systems, including the heating, ventilation and air conditioning (HVAC) systems, would be designed in accordance with CDC guidelines to provide for individual temperature and ventilation control zones as required in the BSL-3 laboratories and support areas. A ducted exhaust HVAC system would draw air into the BSL-3 laboratories from the adjoining areas toward and through the BSL-3 laboratories areas with no recirculation from the BSL laboratories to other areas of the building. The BSL-3 laboratories would be under the most negative pressure with respect to all other areas of the building. Air discharged from the BSL-3 facility would be dispersed well above the roofline and away from adjacent building air intake ducts. Direction of airflow into the laboratories and the BSCs would be verifiable with appropriate gauges and an audible alarm system to notify personnel of HVAC problems or system failure. Operation of all equipment would be designed to avoid interference with the air balance of the BSCs or the designed airflow of the building.

In the event of a power outage, all biological materials would immediately be placed in a "safe" configuration, such as confinement or chemical disinfection. The HVAC systems would be supplied with backup power from an adjacent facility diesel generator to minimize power supply interruption. Exhaust stacks would be placed well above the roof (10 ft (3 m) or greater) and away from the buildings' air intakes.

Should power be lost to the building and the HVAC system, the air supply system would shut down and zone-tight dampers would close automatically to prevent air migrating from the laboratory areas to other areas of the building.

All research-related biological waste from the BSL-3 laboratory would undergo either autoclaving or chemical disinfection. These wastes would be discharged from laboratory sinks, floor drains, or the tissue digestor and would be held and disinfected in retention tanks before being discharged into the sanitary sewer system. Tap water entering the BSL-3 laboratories through spigots in the sinks or shower heads would have backflow preventers to protect the potable water distribution system from contamination. Biological cultures could be disposed of in the sinks after undergoing treatment with chemical disinfectants for an appropriate amount of time.

The electrical requirements for the BSL-3 facility would be about 60 kilowatts (kW); the building would be attached to an adjacent building which has a diesel generator sized to supply laboratories with electric power in the event of a power failure from the supply grid system. In the event of a power outage, the generator would immediately supply electricity to the laboratories so that workers could shut down the laboratories safely.

Parking would be in nearby common-use lots with handicapped-accessible parking near the building entry (ANSI 1998).

Operations: The BSL-3 facility would be operated according to all guidance and requirements established by the CDC and NIH (CDC 1999), DOE, and LLNL. Prior to operating the facility using select agents, the facility would be registered with a unique registration number obtained from the Secretary of the US Department of Health and Human Services (HHS) according to the *U.S. Code of Federal Regulations* (CFR) requirements by providing "sufficient information that the facility meets biosafety level requirements for working with the particular biological agent"

(42 CFR 72). The CDC is the supporting governmental agency under the HHS responsible for the management of the Laboratory Registration/Select Agent Transfer (LR/SAT) Program and would be the main point of contact for LLNL's Facility Responsible Official. LLNL would be required in accordance with the Integrated Safety Management System (ISMS) to participate in and follow the requirements of the CDC LR/SAT Program for handling of select agents[14] and must follow the provisions that apply to the six LR/SAT components as appropriate, which include (1) the list of approximately 40 "select agents" that are "viruses, bacteria, rickettsia, fungi, and toxins whose transfer in the U.S. is controlled due to their capacity for causing substantial harm to human health;" (2) registration of the facilities; (3) filing of approved transfer form; (4) verification using audits, quality control, and accountability mechanisms; (5) agent disposal requirements; and (6) research and clinical exemptions (42 CFR 72). No select agents would be handled in the proposed BSL-3 laboratories without first obtaining IBC approval in accordance with ISMS and secondly prior registration and approval from CDC. Microorganisms that are not select agents would also be used in the BSL-3 laboratories but would still be handled according to CDC and NIH guidances and requirements. Operation of the proposed facility would also involve handling of microorganisms that are regulated by the U.S. Department of Agriculture (USDA) and require BSL-3 containment.

Microorganisms expected to be cultured (i.e., viable organisms) at the BSL-3 facility in the near term would be, but not limited to, the select agents *Bacillus anthracis*, *Yersinia pestis*, *Clostridium botulinum*, *Coccidioides immitis, Brucella spp., Francisella tularensis, and Rickettsia spp.* (see Appendix A). The facility may be used to handle small amounts of biotoxins which are generally handled at the biosafety level established for the microorganisms that produce them. The CDC and NIH guidances and requirements also extend to handling genetically modified microorganisms. All research in microbiology laboratories that involves altering microbial genomes follows standard procedures approved by NIH (NIH 2001). It is possible that the facility would receive genetically altered microorganisms. Before any infectious microorganisms would be handled in the BSL-3 laboratories, the IBC and the researcher, in accordance with CDC guidance, would perform a risk analysis. LLNL occupational medicine and the local medical community would be informed of the microorganisms to be handled in the BSL-3 laboratories and would be aware of the methods of identification and control of associated diseases.

All work with infectious microorganisms in the proposed facility must be approved and authorized by LLNL management in strict accordance with the following:

- Biological Weapons Convention Treaty (BWC 1972) permits defensive research for the purpose of developing vaccines and protective equipment.
- Appendix G of the UC Contract with DOE specifies, among other things, Work Smart Standards, which include adopted standards from CDC (42 CFR 73), NIH (2001), and the U.S. Occupational Safety and Health Administration (OSHA) (29 CFR 1910, 29 CFR 1926).

[14] Select agents are biological agents of human disease whose transfer or receipt requires a facility to be registered with the CDC under 42 CFR Part 72.6; select agents have historically been associated with weaponizing efforts.

- The LLNL Biosafety Operations Committee (LBOC), a diversified group of LLNL operational-level researchers and representatives from all LLNL-affected institutional and regulatory compliance organizations who are responsible for the first-level reviews of projects/microorganisms and provide recommendations to the IBC.
- The LLNL Institutional Biosafety Committee (IBC) who reviews and approves each project such as those involving recombinant DNA or pathogenic organisms and toxins before such work can be undertaken at LLNL.
- When completed,[15] LLNL safety and security documentation (Facility Safety Basis, Facility Safety Plans, Hazard Control Plans, Human Pathogens Exposure Program, and security assessments) would provide the key documentation framework for operation of the BSL-3 facility.
- The BSL-3 facility would undergo a readiness review prior to startup to ensure that the infrastructure for safe operation is implemented and that the health and safety of workers, public, and the environment is protected.

Operation of the proposed BSL-3 facility would also be in compliance with a variety of state and Federal regulations. For example, these regulations would include those promulgated by the U.S. Department of Agriculture (7 CFR 330, 9 CFR 92), U.S. Department of Commerce (15 CFR 730), OSHA (29 CFR 1910.1030), U.S. Postal Service (USPS) (39 CFR 111), U.S. Department of Transportation (DOT) (49 CFR 171-178), and the HHS (42 CFR 73). NNSA, LLNL, and currently applicable BMBL requirements (according to Work Smart Standards) would be certified as having been met before operations would begin at the proposed BSL-3 facility. Other non-governmental organizations that provide guidance for transportation of infectious agents include the *Dangerous Goods Regulations,* the *Infectious Substances Shipping Guidelines* of the International Air Transport Association (IATA 2006), and the *Guidelines for Safe Transport of Infectious Substances and Diagnostic Specimens* of the World Health Organization (WHO) (WHO 1997).

Appropriate PPE used by employees entering the laboratories would include eye protection, gloves (in some cases the worker would be double-gloved), and disposable closed-front gown or clothing (including disposable booties and disposable cap). Air-purifying respirators might be worn as an additional safety measure for some tasks. Workers' hands would be washed with disinfectant immediately before and after putting gloves on or after any potential contamination with infectious agents. Workers could shower after finishing their laboratory work upon removal of their PPE clothing if deemed necessary. Worker's hair would be kept short or secured away from the face and no skin would be exposed below the neck; workers would be required to wear socks, closed shoes, and long pants underneath the disposable coverings. The majority of all materials used in the BSL-3 facility would be disposable, but some reusable laboratory apparatus, such as test tubes or culture dishes may be needed for some minor amount of sterile work. No open flames would be allowed within the BSCs. Work in the three laboratories would be scheduled and planned to avoid conflicts within the laboratory areas. All workers in the BSL-

[15] Safety and security documentation, as well as facility specific protocols, are not completed until after decisions have been made to construct and operate buildings and detailed building designs have been completed. Therefore, these are future documents that would be completed for the BSL-3 facility if NNSA decides to proceed with its construction and operation.

3 laboratory areas would be informed of what other workers would be handling so that appropriate staging of work could occur. Open cultures would only be handled in BSCs. BSCs would be at negative pressure with respect to the room and the rest of the building. Airflow would always be directed away from the worker and into the BSC. Workers would be offered appropriate immunizations for the microorganisms being handled. They would also be tested for normal immunocompetancy[16], and would have medical treatment readily available in the event of an accidental exposure.

No radiological material would be used or stored in the BSL-3 facility. A pest program would be in place to control vector populations.

One of the three BSL-3 laboratories would have rodent handling capability (<100 rodents). The rodents (mice, rats, and possibly guinea pigs) would be in the BSL-3 facility only when part of a research study. These rodents would be cared for in accordance with federal regulations and guidelines. LLNL adopted the requirements of the Animal Welfare Act of 1968 (7 USC 2131-2157, as amended) and voluntarily adheres to the guidelines for the use of vertebrate animals in research established by the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) International. These requirements are administered by the LLNL Associate Director for the BBRP and are implemented by the LLNL Institutional Animal Care and Use Committee (IACUC).

Rodents would be held in quarantine in another Building 360 Complex laboratory for at least 30 days prior to use in a BSL-3 laboratory. They would be maintained in enclosed cages that would individually be connected to the building exhaust air duct. All rodent studies would occur only in the BSL-3 BSCs. Rodents are routinely transferred from dirty to clean cages in the BSCs. Used cages would be closed, autoclaved without dumping the litter, then further cleaned and disinfected prior to reuse. Rodent studies could involve intravenous injections and therefore the laboratories would have sharps, sharps containers, and a “needlestick” program that would be developed at the outset and would focus on ensuring workers do not accidentally inject themselves (autoinjection). All rodents brought into the proposed facility would be euthanized for the purpose of post-mortem medical examination (necropsy). All necropsied rodents and rodent tissues would be sterilized in a tissue digester located in the rodent BSL-3 laboratory.

The BSL-3 facility would <u>not</u> be a large-scale research or production facility, which is defined as working with greater than 10 liters of culture quantities (NIH 2001). Quantities of each cultured microorganism would be further limited by experiment-specific procedures under IBC approval. Less than 1 liter of cultured microorganisms in their stationary growth phase (maximum cell density of about 10^8 cells per ml) would be the maximum quantity handled in any BSL laboratory at any point in time. This 1-liter quantity would only be removed from the BSC in 250 ml double-contained plastic containers with safety-caps. No open cultures (where the free liquid surface is exposed directly to the ambient air) would be allowed outside of the BSC.

Seed cultures or samples would be provided by commercial suppliers, research collaborators, or other parties associated with the LLNL projects. These may contain either previously identified or unidentified organisms. Identification provides diagnostic, reference, or verification of

[16] Immunocompetancy is the ability to have normal immunity from infection.

strains[17] of microorganisms present. Diagnostic and reference strains, which may include the geographic source of the sample, contribute to the understanding of the microorganism's original source and ability to cause disease. Rapid, accurate reference or verification of strains improves containment of infection through early and effective medical intervention, potentially limiting the progress of illness for those exposed to pathogens, determination of antibiotic resistance, and contamination or infection of others.

The CDC would periodically inspect the facility over the life-time of its operation. The inspections would be performed by CDC staff or its contractors.

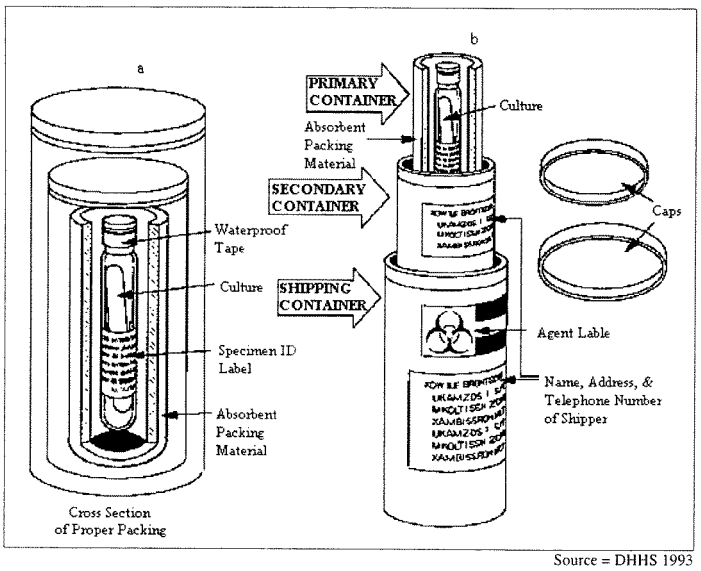
Sample Arrival at the LLNL BSL-3 Facility for Processing: Sample shipments would only be received at the BSL-3 facility operating within the parameters specified in all established guidelines and requirements. If the samples would be select agents, they would only be accepted when the CDC Form 2 has been completed per regulations, the registration verified, and the requesting facility responsible official notified in advance of shipment according to CDC registration requirements. Biological materials or infectious agents could only be shipped to LLNL by commercial package delivery services, the U.S. Postal Service (USPS), other authorized entity, or delivered to the receiving area from an origination point within LLNL by a designated LLNL employee acting as a courier (39 CFR 111; 42 CFR 72; 49 CFR 171-178). Generally, shipment sample sizes would be small; a typical sample would consist of about a milliliter of culture media (agar solid) with live cells (a milliliter is about equal to one-fifth of a teaspoon in volume). Smaller samples could be shipped that would be microliters in size; the maximum probable sample size would be 15 milliliters.

The protocol for receiving and handling of samples (such as soil) would be worked out prior to receipt and reviewed and approved by the IBC. Receipt of the select agents must be acknowledged electronically by the requesting facility responsible official within 36 hours of receipt and a paper copy or facsimile transmission of receipt must be provided to the transferor within 3 business days of receipt. Upon this acknowledgement, the transferor would be required to provide to the LLNL-requesting-facility responsible official a completed paper or facsimile transmission copy of the CDC form within 24 hours to the registering entity (holding that facility's registration), in accordance with §72.6(c)(2) (42 CFR 72) for filing in a centralized repository.

All incoming packages (regardless of origination point) containing infectious agents would have to have been packaged in DOT-approved packages (42 CFR 72) (see Figure 2-6). These packages would be about 6 to 8 inches (15 to 20 cm) in height and about 3-4 inches (8 to 10 cm) in cylinder diameter. All shipping containers would be made of plastic and the samples would be double- or triple-contained. Transportation and interstate shipment of biomedical materials and import of select agents would be subject to the requirements of the U.S. Public Health Service Foreign Quarantine (42 CFR 71), the Public Health Service, and DOT regulations. Additionally, the U.S. Department of Agriculture regulates the importation and interstate shipment of animal or plant pathogens (7 CFR 330 and 9 CFR 92). Strict chain-of-custody procedures for samples arriving at the LLNL receiving site would be followed.

[17] Strains are the very lowest taxonomic (naming organisms) designation; it generally means cells descended from a single isolate which have not mutated significantly from the exact DNA sequence of that original single cell.

Biological shipments to and from LLNL could initially be as much as ten times the current levels (4 in and 2 out per month now) of shipments to existing LLNL biological research laboratories. Once the facility became fully operational and "stocks" of needed materials were established, the level of shipments would remain above current levels for these types of shipments but decrease from start-up levels. Due to the perishable nature of the samples at the BSL-3 facility, receiving and shipping of samples normally would only occur during weekday daylight hours and samples must be opened and used or restored (put in growth media) within 8 hours of arrival. External packaging material from packages received at the facility would be inspected, removed, auto-claved, and disposed of according to LLNL waste handling procedures. The biological material samples and their packaging would be left intact and in accordance with the established chain-of-custody record. The packages would be placed in safe and secure condition within the respective BSL-3 laboratory where workers would process them. Shipment of samples from the BSL-3



Source = DHHS 1993

Figure 2-6. Example of a Primary Shipping Package.

facility to other researchers or the CDC would require following the same guidelines and requirements for the sample shipment that applied to samples received at the facility.

The samples may arrive at LLNL Shipping and Receiving in various fresh, frozen, or "fixed" (for example, in formaldehyde) forms including aqueous liquids, solids, or as material contained in bodily fluids. Samples would normally only contain vegetative forms (active growing stage) of microorganisms, but some spores could be present in samples. Other samples may contain proteins, DNA, or attenuated microorganisms (organisms that have been partially inactivated).

Upon arrival at LLNL Shipping and Receiving, these sample containers would be examined for damage, logged in, and taken to the BSL-3 laboratory for removal of the external packaging material. Damaged packages would be handled in accordance with procedures for BSL-3 laboratories (to be developed once the project obtains approval). The removed packaging would then be autoclaved and disposed as solid waste. The interior packing with the intact sample

would be placed safely and securely in the respective BSL-3 laboratory under chain-of-custody procedure until the authorized researcher is ready to process the samples. Unpacking any select agent primary container would only be done in the BSC. The samples would be stored in the BSL-3 laboratory within a locked freezer or refrigerator, according to the needs of the sample for preservation. Inventories of all samples and cultures would be kept. Samples and cultures would be identified by a numeric or alpha-numeric code rather than by the name of the microorganism or source. Sensitive information about samples and results would be maintained elsewhere at LLNL in a safe and secure manner in accordance with applicable NNSA and LLNL security requirements. The samples could also be immediately processed, in which case the materials would be placed directly into culture media (such as a liquid or semi-solid nutrient material or media). All preparations and manipulations of cultures or samples would only occur within a fully operating BSC. When the external packaging materials were removed, they would be autoclaved within the facility and disposed of according to LLNL's solid waste handling procedures (LLNL 1994).

Culture of Samples in a BSL-3 Laboratory: For culturing, the samples or seed cultures would be removed from their primary containers in a BSC, and a tube, flask, or plate containing a specific nutrient media would be innoculated with the sample to create a culture. All culture work would be completed and cleaned up within one work-shift (8 hours) except for materials being incubated. Culture and culture-storage containers would typically be made of plastic and always be double-contained. The culture container would be transferred to a temperature-controlled incubation chamber to grow the organisms (multiply the number of microorganisms) for a period lasting up to several days. Centrifugation of live, intact microorganisms would be conducted in sealed containers placed inside sealed tubes to minimize the potential for aerosolization[18] of microbes, or, if appropriate, centrifugation could be conducted inside a BSC. Cultured materials, which are sources for research materials, could be "lysed" (broken open) or killed (inactivated) by the addition of a variety of chemicals such as detergents or the chemical known as phenol. The lysed or killed cells and the culture media could be processed into biological material that would later be analyzed by various research methods at various LLNL research laboratories, and potentially at other laboratories off-site. Following incubation (hours to days), all cultured materials would be cleaned up within one work-shift (8 hours). Many cultures would be archived in small quantity and maintained in the ultra-freezers in each laboratory.

Waste Generation at the BSL-3 Facility: It is expected that little soil and construction debris would be generated from site preparation and construction activities of the proposed BSL-3 facility that would require disposal and removal from the construction site. Sanitary waste from portable toilets used during construction would be removed by commercial vendors and be disposed of in a sanitary sewer system offsite from LLNL in accordance with the permit requirements applicable to the commercial vendors.

During operation of the BSL-3 laboratories, the disinfection after each use of the interior working surfaces of the BSCs would generate waste products. All wastes generated in the laboratories of the facility (including sample packaging materials, culture materials, petri dishes,

[18] Aerosolization is the process of converting a liquid into droplets that are small enough to become dispersed in the air. In this case the droplets may contain one or more microbes.

PPE, and associated process wastes) would leave the laboratories only after decontamination using the facility's autoclave or after being chemically sterilized. The autoclaving process involves placing waste to be autoclaved in a special container. When autoclaving occurs, an indicator strip on the container changes color. This allows facility workers and waste management workers to be able to tell at a glance whether waste has undergone autoclaving. Performance of the autoclave is automatically tracked electronically to insure its effectiveness. This method is the same waste management method used by hospitals and similar facilities to sterilize their waste. Solid waste landfills may accept autoclaved or chemically sterilized wastes for disposal depending on their individual waste acceptance criteria and operating permit requirements. Alternatively, LLNL could contract to send sterilized wastes produced by the proposed BSL-3 facility to a licensed commercial incinerator located offsite for waste disposal.

Laboratory research experiments would be expected to generate about 22 lbs (9.9 kg) of lab trash (gloves, pipette tips, culture tubes, tissues, etc.) per week or about 1,144 lbs per yr (515 kg per yr). Other "solid waste" (note-paper, etc.) generated in the non-laboratory portions of the facility would raise the total solid waste production to less than 2,000 lbs per yr (900 kg per yr).

Sanitary liquid waste also would be generated from the proposed BSL-3 facility. Sanitary waste would be generated from research activities and from toilets, showers, and sinks in the building bathroom facilities. Sinks in each of the three laboratories would also generate sanitary waste. Soluble or liquid waste materials generated from laboratory operations can be disposed in the laboratory sinks after first being treated by autoclaving or with disinfectants. Other non-sewerable liquid wastes will be treated with disinfectants and removed by waste technicians. Waste generated from research is projected to be about 3 gal per wk (11 liters per wk) or 156 gal per yr (590 liters per yr), and could be disposed in the sanitary sewer system. An additional 40 gal per day (152 liters per day) or 10,000 gal per yr (37,900 liters per yr) can be produced by toilets and showers, although it shouldn't be considered a net increase since the BSL-3 facility workers are already working in adjacent BSL-2 buildings with toilets and showers.

Minimal amounts of hazardous waste (less than 2 gallons per year) and no radiological waste would be generated by the facility.

Chemical disinfectants would be used to disinfect portions of the laboratories that are not readily accessible, such as the ductwork. These disinfectants would be in a gas form as appropriate for the respective chemical. The space to be disinfected would be sealed, personnel would be excluded, and the gas would remain in the space for several hours before release to the environment. This procedure would be conducted by a certified technician using a standard protocol. The quantities of chemicals used would be well below the reportable quantities for both the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 300) and the Emergency Planning and Community Right-to-Know Act (EPCRA) (40 CFR 350). For example, if paraformaldehyde is used, the CERCLA-reportable quantity is 1000 lb. and for the vapor phase produced, formaldehyde, it is 100 lb. The EPCRA-reportable threshold for formaldehyde is 10,000 lb. Formaldehyde is also listed as a Hazardous Air Pollutant (HAP) under the Clean Air Act Amendments. HAPs are limited to 10 tons per yr individually.

All hazardous chemicals used in the proposed facility (such as: formaldehyde, chloroform, phenol, ethyl alcohol, isopropyl alcohol, amyl alcohol, and sodium hypochlorite) would not become waste for this facility. Only small quantities of these chemicals (sufficient for daily activities) would be present in the facility at any time due to a lack of storage space in the facility. These chemicals would either be used up in process (becoming non-hazardous) or would leave the facility as a stabilizing or sterilizing chemical for samples being sent to other laboratories. About 30 lbs per month (14 kg per month) or 360 lbs per yr (168 kg per yr) of sodium hydroxide or potassium hydroxide would also be used for rodent tissue digestion/sterilization. These chemicals would be used up in the digestion process. Waste fluid generation may need pH adjustment prior to discharge to the sanitary sewer system if it is too alkaline to meet discharge standards.

For any chemical disinfectant used by the BSL-3 facility, quantities used annually would not exceed reportable quantity volumes. Decontamination of the facility would include the use of chemical disinfectants, as discussed in the previous paragraph. This would allow the facility to be decontaminated, decommissioned, and demolished using standard construction practices. The resulting waste could be disposed of at a local landfill.

2.1.3 BSL-3 Facility Decontamination and Decommissioning

It is estimated that the operational design life of the proposed building would be at least 30 years. Decontamination and either demolition, removal, or reuse of the facility would likely occur. After decontamination (which would include disinfection of certain parts of the facility) the building could be disassembled and disposed of through the existing LLNL program for disposition of excess government property. This could ultimately require that the facility's modular components be moved offsite from LLNL. Alternately, the facility could be demolished and disposed of in a solid waste landfill offsite. Another alternative would be the reuse of the facility, either in whole or in part by other LLNL users, since BSL-2 laboratory space is traditionally in short supply at LLNL. Additional NEPA compliance review would be required when the decontamination and future-use options were ripe for review/decision.

The ultimate decontamination and decommissioning (D&D) of the BSL-3 facility would involve only the normal deconstruction and disposal of construction debris. This facility would undergo a final fumigation and testing to insure that microbes were not lingering in the remnants of the building. The building would not contain any radioactive or hazardous components.

2.2 ALTERNATIVE ACTION TO REMODEL/UPGRADE A SINGLE-ROOM LABORATORY IN BUILDING B-365 TO BSL-3

It is expected that the cost of upgrading an old facility, such as a laboratory room in LLNL building B-365 (Figure 2-1) would approach or exceed the cost of constructing a new facility with the same single-laboratory capabilities. The initial problem of upgrading is the need for physical isolation of the laboratory space. Since the facility was not originally intended for this purpose it would not lend itself directly to physical isolation. The most significant retrofits in terms of cost and time would involve HVAC systems; HEPA filtration' fumigation systems; and sealing of walls, floors, ceilings, plumbing and electrical conduits. Often a new room inside the

room must be installed to insure complete sealing of entrance/exit points around all the normal breaches, such as wall electrical outlets. The "remodel" option also often has problems; for example, with: sanitary sewer drainage (where this lab is located relative to others in the same building); HVAC pressure balancing (effects from other room doors opening/closing and BSCs); addition of HEPA filter banks for disinfection without shutdown of system; and location of exhaust stacks relative to other existing intakes.

This option is not necessarily a cost-effective one, but it can and has been done by the CDC in Atlanta, GA. Discussion with personnel from the CDC (PC 2001a, 2001b) suggest that their biggest problems come from retrofit laboratories. The CDC personnel would not recommend this alternative.

2.3 ALTERNATIVE ACTION TO CONSTRUCT AND OPERATE AN ON-SITE-CONSTRUCTED BSL-3 FACILITY

An alternative to a modular construction would be on-site construction. The only appreciable difference in the installation of a modular assembly constructed off-site and the on-site construction option is the duration of the construction phase and the associated noise, traffic, and movement of building materials. The installation of a modular assembly on-site takes a matter of weeks while the on-site construction takes months and is more disruptive for a longer period. Once constructed, there is no appreciable operational difference between them. The operational and D&D phases would, for all intents and purposes, be the same as for the proposed action.

2.4 NO ACTION ALTERNATIVE

The No Action Alternative provides a description of what would occur if the Proposed Action were not implemented to compare with the potential effects of the Proposed Action. This alternative must be considered even when the Proposed Action is specifically required by legislation or court order (10 CFR 1021.321[c]). Under the No Action Alternative, NNSA would not construct or operate the BSL-3 facility. In this event, NNSA would have to continue to rely on meeting its BSL-3 laboratory needs by exporting work and staff to existing or new BSL-3 laboratories located offsite from LLNL. It is expected that while the potential tasking of LLNL by DOE and through work-for-others would grow, no new workers would be hired within the BBRP at LLNL since the only need to hire additional staff under this option would be to be able to export staff and equipment to offsite laboratories as workloads increase rather than to conduct the research on-site with currently existing staff assets which should remain sufficient for the foreseeable future. Also, there would continue to be certain NNSA national security mission needs that could not be met in a timely fashion, or that may not be able to be met at all. The No Action Alternative would not meet NNSA's identified purpose and need for action at LLNL.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Additional alternatives were considered but have been dismissed from detailed analysis in this document.

2.5.1 Construction and Operation of the Proposed BSL-3 Facility at Another Mainsite LLNL Location

The LLNL mainsite is very space-limited. There are few remaining open areas available for new construction, and none in the near vicinity of the BBRP complex. However, any location other than the proposed location would be, at a minimum, a logistical problem. First, it is expected that the researchers and staff who would be working in the proposed BSL-3 facility would have offices and regular work assignments in buildings adjacent to the proposed facility location in the Building 360 Complex under the preferred alternative. This is also where the rodent colony and quarantine areas are located, as are all the supplies for the proposed building. From a safety perspective, the LLNL Biosafety Officer and the most highly trained and experienced staff would also be located in the buildings immediately adjacent to the currently proposed building location. A remote location would be a safety and security risk that is unnecessary. This alternative was dismissed from further consideration in this NEPA analysis although it would meet the Agency's purpose and need for action.

2.5.2 Construction and Operation of the Proposed BSL-3 Facility at Site 300

The same issues apply to Site 300 as they do for another mainsite LLNL location (section 2.5.1), although the significance of the safety issues and issues related to ground transport of infectious agents and toxins between the two sites are greater. This alternative also was dismissed from further consideration in this NEPA analysis although it would meet the Agency's purpose and need for action.

2.5.3 Construction and Operation of the BSL-3 Facility at Another National Security Laboratory

The NNSA supports three national security laboratories: Los Alamos National Laboratory, at Los Alamos, New Mexico, the Sandia National Laboratories at Albuquerque, New Mexico (SNL/NM) and Livermore, California (SNL/CA), and Lawrence Livermore National Laboratory (LLNL), at Livermore, California. Construction and operation of the proposed BSL-3 facility at either SNL or LANL to the exclusion of LLNL was considered, as it is possible to construct such a facility at any of the national security laboratories at approximately the same cost and schedule. This alternative would not, however, meet the purpose and need for NNSA to conduct future BSL-3 level work at LLNL in support of its assigned national NNSA security –and science mission responsibilities.

This alternative would almost be the same as the No Action Alternative with the exception being that work could be done under more precise quality assurance procedures and under conditions that would meet the necessary national security requirements needed. However, it would not allow the work to be performed as quickly or efficiently as may be needed in all cases. LLNL has qualified and experienced personnel and a sophisticated existing biological infrastructure in the BBRP. Placing the BSL-3 laboratory at another NNSA laboratory would require significant duplication of this capability. Also, none of the existing or proposed (DOE 2002b) NNSA locations, which are all now operating at the BSL-2 level, have or would have the capability to conduct aerosol challenges of rodents.

Work at each of the national laboratories is expected to complement rather than be duplicated at each of three national laboratories. While these other facilities may consider the construction and operation of a BSL-3 facility in the future, the operation of these laboratories would be directed toward meeting their individual mission work requirements and would not be identical to that performed by the other laboratories in the NNSA complex. Therefore, the alternative to constructing a BSL-3 facility at either of two other national security laboratories is not considered further in this EA analysis as it does not meet NNSA's purpose and need for agency action at LLNL.

2.6 RELATED ACTIONS

There are no known related actions.

3.0 AFFECTED ENVIRONMENT

The *Final Environmental Impact Statement and Environmental Impact Report for the Continued Operation of Lawrence Livermore and Sandia National Laboratories, Livermore, August 1992* (LLNL FEIS/EIR) (DOE 1992) and its associated Supplement Analysis (SA) (DOE 1999) provided a detailed discussion of the affected environment baseline for the original version of this EA. In 2005, DOE issued the *Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SWEIS, DOE/EIS-0348, DOE/EIS-0236-S3, DOE 2005). Background information in this version of the EA has been updated to reflect information in the SWEIS if the updated information is pertinent to NNSA evaluation of the effects of the proposed action on human health or the environment.

This section describes the environmental resources that may be affected as a result of implementing the Proposed Action to construct and operate a BSL-3 facility. Resources are described using the sliding scale approach with more detail provided for resources that might be most affected. Resources are either addressed in this section or eliminated from detailed discussion, as shown in Table 3-1 in Section 3.2.

3.1 REGIONAL AND LOCAL SETTING

The LLNL Livermore site occupies a total area of approximately 3.3 km^2 (821 acres) at the southeast end of the Livermore Valley, located about 80 km (50 miles) east of San Francisco, in southern Alameda County, California. The Livermore Valley is characterized by nearly level, shallow-to-deep soils that vary in texture from clays to sandy clay loams or mixed gravels. The valley forms an irregularly shaped lowland area about 16 miles long east-to-west and 7 to 10 miles wide north-to-south. The floor of the valley slopes to the west at about 20 ft per mi (4 m per km). The soils tend to be high in sodium, calcium, magnesium, iron, chlorides, and sulfur, and low in organic matter, nitrates, phosphates, and potassium. The characteristics of the soil series found at the Livermore site are hard when dry and plastic when wet; the soils have high permeability and high water-retention capacity. Since the Livermore site is nearly flat, there would be no areas of potential slope instability in the location of the proposed project.

3.1.1 Climate and Meteorology

The Livermore Valley is characterized by mild, rainy winters and warm, dry summers. The mean annual temperature for the 30-yr period from 1950 through 1980 is 14.5°C (58.1°F) with daily extremes ranging from -8°C (18°F) to 45°C (113° F).

Both rainfall and wind exhibit strong seasonal patterns. Most of the annual rainfall, which averages 36 cm (14 in.), occurs between October and April and is associated with migratory, low-pressure systems from the Gulf of Alaska. Prevailing winds are from the west and southwest from April through September. During the wet season, northeasterly and north-northeasterly winds that are associated with post-frontal, anti-cyclonic flow are also common. Figures 3-1 and

3-2 show the day and nightime wind roses for LLNL for the five-year period from January 1997 through January 2002.

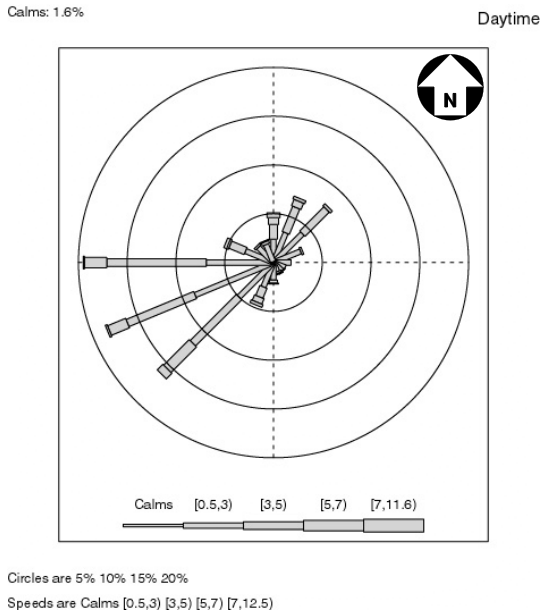


Figure 3-1. 5-Yr daytime wind rose for LLNL

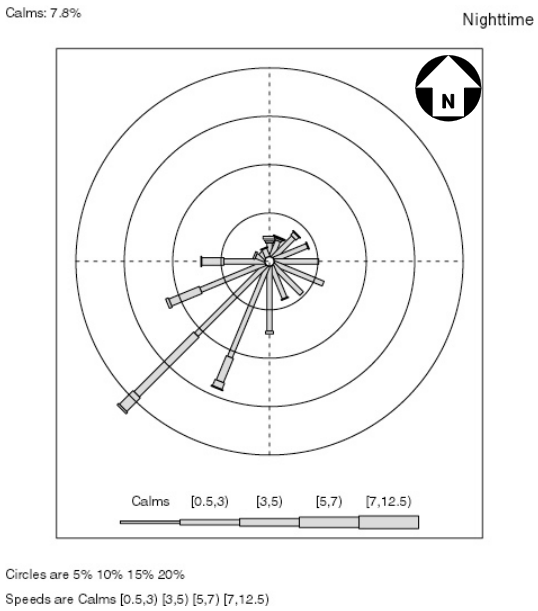


Figure 3-2. 5-Yr nighttime wind rose for LLNL

3.2 ENVIRONMENTAL RESOURCES NOT AFFECTED

Discussion of the Affected Environment is limited to existing environmental information that directly relates to the scope of the Proposed Action and the alternatives analyzed. Table 3-1 shows the resource categories and whether they are applicable or not (EA section is not applicable, NA, and a brief explanation of why not) and where they are discussed if they have a direct bearing on the analysis.

Table 3-1. Applicability of Resource Categories to the BSL-3 Analysis

Resource Category	Applicability	BSL-3 EA Section
Ecological Resources	Yes	3.3.1
Human Health	Yes	3.3.2
Air Quality	Yes	3.3.3
Noise	Yes	3.3.4
Waste Management	Yes	3.3.5
Geology/Soils/Seismology	Yes	3.3.6
Socioeconomics	The projected financial expenditures for the proposed construction project would be too small to have any perceptible affect on the local environment. No net increase in the number of workers would be anticipated.	NA
Visual Resources	This facility would be consistent in architectural style with, and in the midst of, a number of larger buildings. No visual issues would be perceived.	NA
Transportation	The number of LLNL material shipments associated with operating the proposed facility would be imperceptible to LLNL and there would be no net change in the number of individuals working in the Building 360 Complex area.	NA
Utilities/Infrastructure	The small size of the proposed facility and its intended location show that there would be no appreciable impact to utilities and infrastructures.	NA
Cultural Resources	No prehistoric or historic cultural properties greater than 100 yrs old are located at or adjacent to this site (DOE 1992).	NA
Environmental Justice	There would be no disproportionately high or adverse human health or environmental effects on minority or low-income populations (DOE 1992) as a result of operating an on-site BSL-3 facility in addition to the current BSL-2 facilities.	NA
Environmental Restoration	There are no potential release sites at or adjacent to the proposed location (DOE 1992).	NA

Table 3-1. Applicability of Resource Categories to the BSL-3 Analysis

Resource Category	Applicability	BSL-3 EA Section
Floodplains/Wetlands	The proposed facility is not within the 100-yr floodplain nor are there wetlands at or adjacent to it (DOE 1992).	NA
Land Use	The area surrounding the proposed site is made up of office buildings, laboratories, storage and warehouse facilities, and parking lots, all illuminated at night. The proposed construction and operation of a BSL-3 facility would not alter the character of the site areas or introduce new land use elements (DOE 1992).	NA
Water Quality/Hydrology	There would be no effect on surface water or groundwater quality and no perceptible increase in potable water use. There are no NPDES outfalls at the proposed facility location (DOE 1992).	NA

3.3 ENVIRONMENTAL RESOURCES POTENTIALLY AFFECTED

3.3.1 Ecological Resources

The Livermore site is a developed area that provides only marginal wildlife habitat because of the high degree of human activity and the few areas of undisturbed vegetation. Of the 3.3 km^2 (821 acres) comprising the Livermore site, 2.6 km^2 (640 acres) are developed. Annual wild oat along with non-grass annuals and perennials now dominate the grassy areas of the site. The common plant species are ripgut brome (*Bromus diandrus*), slender oat (*Avena barbata*), star thistle (*Centaurea solstitialis*), Russian thistle (*Salsola kali*), turkey mullein (*Eremocarpus setigerus*), alfalfa (*Medicago sativa*), sweet fennel (*Foeniculum vulgare*), California sagebrush (*Artemisia California*), and Italian ryegrass (*Lolium multiflorum*).

The LLNL Livermore site hosts numerous birds, reptiles, and amphibians, with a minimum of 3 species of amphibians and reptiles, 10 species of mammals, and 31 species of birds. Jackrabbits are the most common wild mammal present; gophers, snakes, and field mice can be found in the undeveloped areas of the Livermore site.

Resource surveys of LLNL Livermore, California, were conducted in 1986 (Orloff 1986), and a biological assessment (BA) in 1991 pursuant to the U.S. Endangered Species Act and the State of California Endangered Species Act addressed the status of threatened, endangered, and other species of concern (referred to as sensitive species) that may occur or are known to occur in these areas. Although several listed and proposed endangered and threatened species of plants and animals may occur in the general area of the LLNL Livermore site, the U.S. Fish and Wildlife Service (USFWS) determined that, to the best of its knowledge, these species were not known to occur within the boundaries and proposed future growth areas of these sites at that time (U.S. Fish and Wildlife Service 1991). Since that time, one State-protected bird species, the White-tailed kite (*Elanus leucurus*), has been found to nest along the eastern and northern tree line of the site, in spite of normal daily traffic and routine maintenance activities; also, one state species of special concern, the Burrowing Owl (*Athene cunicularia*), had been found in the north

buffer zone of the LLNL Livermore Site in the mid-1990s. Additionally, the Federally threatened California red-legged frog (*Rana aurora draytonii*) has been found in the Arroyo Los Positas (along the northern buffer zone). A BA was completed in 1997 and amended in 1998 to account for potential impacts to the frog from routine maintenance activities at the LLNL site. In 2001, a narrow strip along the northern and eastern edges of the site were designated as a portion of the federal critical habitat for the frog. The proposed BSL-3 facility would not be located in or near these natural resource-sensitive areas.

Although not usually considered as such, soils are also an ecological resource (Burden and Sims 1999). Soils are known to naturally contain a diversity of numbers and types of microorganisms. The range is substantial as it depends upon the environmental conditions, which dictate the bacteria and fungi microflora (plant microorganisms) that can survive. Infectious microorganisms can also be found naturally in soils. Some of these may be handled in the proposed BSL-3 laboratories (e.g., *Bacillus spp.* and *Clostridium spp.*).

3.3.2 Human Health

In 2000 there were approximately 1.3 million people living in Alameda County (HRSA 2000), in which Livermore is located, and about 6.9 million people living within a 50-mile radius of LLNL (LLNL 2001b). Health of individuals living here is favorable (better) relative to California peer counties and the U.S. as a whole (HRSA 2000). Infectious diseases are not common in the county. In fact, over the three year period of 1996, 1997, and 1998, most of the infectious diseases were diarrheal (63 cases from *Escherichia coli*, 809 cases from *Salmonella spp*. and 441 cases from *Shigella spp*.) associated with either unclean water or improper hygiene and food handling (HRSA 2000). There were also 472 cases of viral hepatitis A (infectious hepatitis), 21 cases of viral hepatitis B (serum hepatitis), 8 cases of the measles virus (Rubeola), and 109 cases of pertussis (whooping cough) reported to Alameda County Health officials (HRSA 2000).

Statewide there are appreciably more cases of infectious diseases. Table 3-2 shows the cases and deaths associated with selected notifiable diseases in the State of California for a four-year period (CDF 2001). These statistics show, for example, that while there were no cases of anthrax for the reported years, there were a few cases of plague (unspecified), psittacosis, Q-fever, brucellosis, tularemia, and typhus, along with a number of more common diseases. Although not on the table, there were 9 hantavirus cases in 1999. Acquired immune deficiency syndrome (AIDS) and venereal diseases are some of the most prevalent infectious diseases in California.

3.3.3 Air Quality

Air quality is a measure of the amount and distribution of potentially harmful pollutants in ambient air. Congress passed the *Clean Air Act* (CAA) to mandate that the U.S. Environmental Protection Agency (EPA) regulate those potentially harmful pollutants through the National Ambient Air Quality Standards (NAAQS) for pollutants of concern known as the criteria pollutants. EPA has identified six criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), ozone (O_3), lead (Pb), and particulate matter (PM). These pollutants are emitted primarily from combustion sources such as boilers, emergency generators, and motor vehicles. Criteria pollutant emissions data for LLNL have not changed appreciably

TABLE 3-2. CASES AND DEATHS, SELECTED NOTIFIABLE DISEASES CALIFORNIA, SELECTED YEARS

T.C.D. 10th Edition		1990		1997		1998		1999	
		Cases	Deaths a/	Cases	Deaths a/	Cases	Deaths a/	Cases	Deaths a/
B20-B24	AIDS	8,827	5,041	6,774	1,857	5,786	1,432	5,358	1,558
A06	Amoebiasis	1,638	2	933	1	700	1	599	---
A22	Anthrax	---	---	---	---	---	---	---	---
A05.1	Botulism	36	---	48	1	51	---	65	3
A23	Brucellosis	26	---	30	1	12	---	18	---
P01.9, P35.8 *	Chickenpox (Varicella-Zoster)	904	32	n/r	23	n/r	22	n/r	---
B38 *	Coccidioidomycosis	441	23	704	50	719	36	939	28
A93.2	Colorado Tick Fever	---	---	---	---	1	---	---	---
P39.1	Conjunctivitis of the Newborn	25	---	23	---	25	---	21	---
	Diarrhea of the Newborn h/	---	---	---	---	---	---	---	---
A36	Diphtheria	---	---	---	1	---	---	---	---
	Encephalitis, Viral	125	17	76	17	79	14	108	---
	Food & Waterborne Illness	1,079	---	1,951	2	3,968	1	3,617	---
P35.0	Rubella-Congenital	8	6	3	1	---	2	2	---
B15-B19 *	Hepatitis, Viral	10,594	265	8,658	704	6,210	860	4,961	248
B15	A (Infectious)	6,408	15	6,422	21	4,178	10	3,439	20
B16	B (Serum)	2,940	145	1,658	186	1,445	222	1,234	58
B17.1, B17.8 *	Non-A, Non-B b/	623	---	467	467	464	595	191	131
B17.0	D	8	105	8	30	6	33	10	---
B19	Unspecified	615	---	103	---	117	---	87	9
A30	Leprosy	79	---	40	1	38	---	36	---
A27	Leptospirosis	3	1	12	---	2	---	1	---
B50-B54	Malaria	328	---	406	---	217	---	218	---
B05	Measles: Indigenous	12,719	39	22	---	6	---	14	---
	Measles: Imported	91	---	8	---	4	---	4	---
A87 *	Meningitis, Viral	1,525	7	2,307	3	3,040	4	1,544	4
A39	Meningococcal Inf.: d/	426	---	402	41	319	28	304	30
A39.2-A39.4 *	Meningococcemia	---	46	156	21	132	12	125	13
A39.0 *	Meningitis	---	---	215	12	153	13	154	10
B26	Mumps	571	1	151	---	110	1	95	---
A37.0 *	Pertussis	467	---	483	---	1,085	---	1,144	---
A20	Plague	---	---	2	---	1	---	---	---
A80	Poliomyelitis	---	---	2	---	1	---	1	---
A70	Psittacosis	8	---	8	---	6	---	3	---
A78	Q Fever	2	1	9	---	4	---	3	---
A82	Rabies, Human	---	---	---	---	---	---	---	---
A68	Relapsing Fever	10	---	7	---	7	---	8	---
100-102 *	Rheumatic Fever	25	11	11	12	5	15	10	2
A77.0	Rocky Mt. Spotted Fever	1	---	2	---	1	---	1	---
A01.1-A01.4, A02 *	Salmonella	5,725	8	5,993	6	4,724	6	4,208	4
A03	Shigellosis	5,703	4	3,221	1	3,033	---	2,364	---
A49.1 *	Streptococcal Infections c/	6	2	---	45	---	46	1	12
A33-A35 *	Tetanus	7	2	11	1	8	---	16	1
B75	Trichinosis	1	---	1	---	3	---	2	---
A16-A19 *	Tuberculosis	4,889	211	4,043	194	3,857	165	3,608	139
A21	Tularemia	---	---	4	---	3	---	3	---
A01.0	Typhoid Fever	149	---	83	---	83	---	73	---
A75 *	Typhus Fever	3	---	16	---	12	---	11	---
A50-A64 *	Venereal Disease e/	137,544	10	90,507	5	98,954	6	106,575	5
A57	Chancroid	159	---	13	---	14	---	6	---
	Chlamydia trachomatis g/	66,213	---	68,599	---	76,401	---	85,022	---
A54 *	Gonococcal Infections	54,076	1	18,002	1	19,555	---	18,656	2

TABLE 3-2. CASES AND DEATHS, SELECTED NOTIFIABLE DISEASES CALIFORNIA, SELECTED YEARS

T.C.D. 10th Edition		1990		1997		1998		1999	
		Cases	Deaths a/	Cases	Deaths a/	Cases	Deaths a/	Cases	Deaths a/
A58	Granuloma Inguinale	7	---	n/r	---	n/r	---	n/r	---
A55	Lymphogranuloma venereum	24	---	n/r	---	n/r	---	n/r	---
A50-A53	Syphilis, Total f/	17,065	9	3,893	4	2,984	6	2,891	3
A51 *	Primary	2,220	---	165	1	123	---	105	---
	Secondary	2,274	---	221	---	202	---	179	---

* The Tenth Revision of the International Classification of Diseases (ICD-10) codes may not be comparable to the Ninth Revision (ICD-9) codes. Caution should be used when looking at the number of deaths by year.

a/ Deaths shown above may not agree with deaths shown in vital statistics tables because some diseases are not listed separately in the International Classification of Diseases List of Causes of Death on which the vital statistics tables are based, or because the definitions of some of the diseases used in the International List differ from the definitions used for morbidity purposes.

b/ Non-A, Non-B is a new category added in 1982 by the Center for Disease Control, Atlanta, Georgia.

c/ Respiratory infections not included after 1988. After May 1989, cases reported only in foodhandlers, dairy workers and outbreaks.

d/ Prior subcategories combined for reporting beginning with 1993.

e/ Does not include NGU or PID.

f/ Also includes congenital, early latent, late and late latent syphilis.

g/ Chlamydia became a reportable disease in mid-1989; 1990 is considered the first full report year.

h/ Outbreak related cases only.

n/r No longer reportable.

Source: Department of Health Services, http://www.dhs.cahwnet.gov/
Cases--Communicable Disease Control Division, Office of Statistics and Surveillance, (916) 323-9808
Deaths--Office of Vital Records and Statistics, Vital Statistics Section, (916) 445-6355

since the 1992 FEIS (DOE 1992) with the exception that the Laboratory now lies within a federal non-attainment area for ozone. None of the criteria pollutants emitted from LLNL, when combined with existing background pollutant levels, substantially contributes to existing or new degradations of air quality in the Bay Area.

3.3.4 Noise

Noise levels to protect worker hearing at LLNL are based on DOE orders (DOE 1984), OSHA regulations (29 CFR 1910.95), and recommendations of the American Conference of Governmental Industrial Hygienists (ACGIH 2000). The standard unit used to report noise or sound pressure levels is the decibel (dB); the A-weighted frequency scale (dBA) is an expression of adjusted pressure levels by frequency that accounts for human perception of loudness. Noise levels that affect residential receptors are normally limited to the maximum of 65 dBA during daytime hours and 53 dBA during nighttime hours (between 9 p.m. and 7 a.m.). Activities that do not meet these noise standards normally require a city or county permit.

Noise levels at the proposed BSL-3 facility would be generated primarily by vehicle traffic and facility HVAC systems except during facility construction. Ambient noise measurements for typical lightly industrialized areas are around 50 dBA during morning and evening rush hours dropping a few dBA during nighttime hours. These levels are comparable to outside noise levels generated at urban centers during daytime hours and common indoor sounds such as the background noise in a large occupied conference room. Noise levels for heavy construction equipment can be more than 20 dBA higher than typical light industrialized areas depending upon the proximity to the source of the noise and the type of equipment being used.

3.3.5 Waste Management

LLNL has established procedures for compliance with all applicable laws and regulations for collecting, storing, processing, and disposing of sanitary liquid wastes, solid wastes and hazardous wastes at LLNL. The quantity of solid waste expected to be generated by construction activities, relative to LLNL-wide waste generation, is negligible and minimal hazardous waste generation (less than 2 gal per year) is projected; therefore, neither will be further evaluated.

Sanitary Liquid Waste. Sanitary liquid waste from LLNL is discharged by sewer to the City of Livermore Water Reclamation Plant (LWRP) in accordance with procedures specified in the LLNL ES&H Manual (LLNL 2001c). All discharges are continuously monitored with a radiation detector, an industrial pH probe, and an x-ray fluorescence unit for most regulated metals prior to discharge off-site. Discharges are regulated by the federal government under the Clean Water Act (also known as the Federal Water Pollution Control Act of 1972, 40 CFR 403). The State of California regulates these discharges under Title 22 of the California Code of Regulations, and the City of Livermore imposes restrictions under the LLNL Wastewater Discharge Permit which is issued under Livermore's municipal code. Discharge limits for non-radioactive parameters include 11 inorganic elements/constituents plus pH (acidity), total toxic organics, volatile halogenated solvents, total identifiable chlorinated hydrocarbons (pesticides), oil and grease, and polychlorinated biphenyls. Although no discharge limits currently exist for infectious materials which are commonly discharged by healthcare and veterinary facilities and laboratories or homes, liquid waste as generated from the proposed BSL-3 laboratory operations would be discharged to a retention tank system, for containment, characterization, and disinfection as needed, prior to discharge to the sanitary sewer system.

3.3.6 Geology/Soils/Seismology

The LLNL Site Seismic Safety Program recently performed a new analysis of the geologic hazards at the Livermore Site (LLNL 2002). Although new data and updated methodologies were used, the most recent study reports essentially the same results as previous studies for the prediction of the peak ground acceleration. The results of these seismic hazard analyses and the evaluation of structures are presented in the Sitewide Environmental Impact Statement for Continued Operations, Lawrence Livermore National Laboratory (DOE 2005).

The Livermore Site is located near the northwest-southeast trending boundary separating the North American and Pacific tectonic plates, or San Andreas Fault system (Figure 3.3). Regionally significant structures are associated with the San Andreas Fault system, including the Hayward and Calaveras faults east of the San Francisco Bay Area. The closest structure to the Livermore Site associated with the San Andreas Fault system, the Calaveras Fault, is situated approximately 15 miles west of the site. The San Andreas, Hayward, and Calaveras faults have produced the majority of significant historical earthquakes in the Bay Area, and accommodate the majority of slip along the Pacific North American plate boundary. These structures will likely continue generating moderate to large earthquakes more frequently than other faults in the region (LLNL 2002). Local structures include the Greenville, Mount Diablo, Las Positas, and Corral Hollow faults. Although the Greenville Fault outcrops are within 1 mile of the Livermore Site,

they have the lowest slip rate of any structures associated with the San Andreas system. The Mount Diablo Thrust Fault, postulated to underlie the Livermore and Sycamore Valleys on the basis of seismic reflection data, is related to the development of fold structures in the area. The Las Positas Fault passes 1 mile southeast of the Livermore Site and is considered capable of generating relatively infrequent moderate earthquakes. Additionally, the Corral Hollow Fault zone passes approximately 2 miles east of the site. In a recent study (LLNL 2002) assessing local seismic hazards, the existence and characteristics of the Verona, Williams, Livermore, and Springtown faults were considered.

A recent U.S. Geological Survey (USGS) study of the likelihood of major earthquakes in the San Francisco Bay Area determined that there is a 62 percent probability of one or more earthquakes with a magnitude of 6.7 on the Richter Scale or greater occurring within the next 30 years (USGS 2003). The study concluded that the probability of these earthquakes occurring along the Calaveras and Greenville faults, and the Mt. Diablo Thrust Fault within the next 30 years was 11 percent, 3 percent, and 3 percent, respectively. The study calculated that there was a 50-percent chance of the Livermore area exceeding a ground shaking of Modified Mercalli (MM) intensity VII to VIII. The Association of Bay Area Governments (ABAG) has mapped the distribution of ground-shaking intensity (Association of Bay Area Governments 2001). A large earthquake on the Greenville Fault is projected to produce the maximum ground-shaking intensities in the Livermore area with intensity ranging from strong (MM VII) to very violent (MM X). The MM IX level would result in damage to buried pipelines and partial collapse of poorly built structures (City of Livermore and LSA 2002).

Seismic hazard analyses have been performed for the Livermore Site to quantify the hazard. The analyses identify the probability of exceeding a given peak ground acceleration. The 2005 SWEIS describes the maximum horizontal peak ground accelerations at the Livermore Site for return periods of 500 and 1,000 years as 0.38 *g*, and 0.65 *g*, respectively. The technical basis for these peak acceleration values is provided in Appendix H of the 2005 Sitewide EIS (DOE 2005).

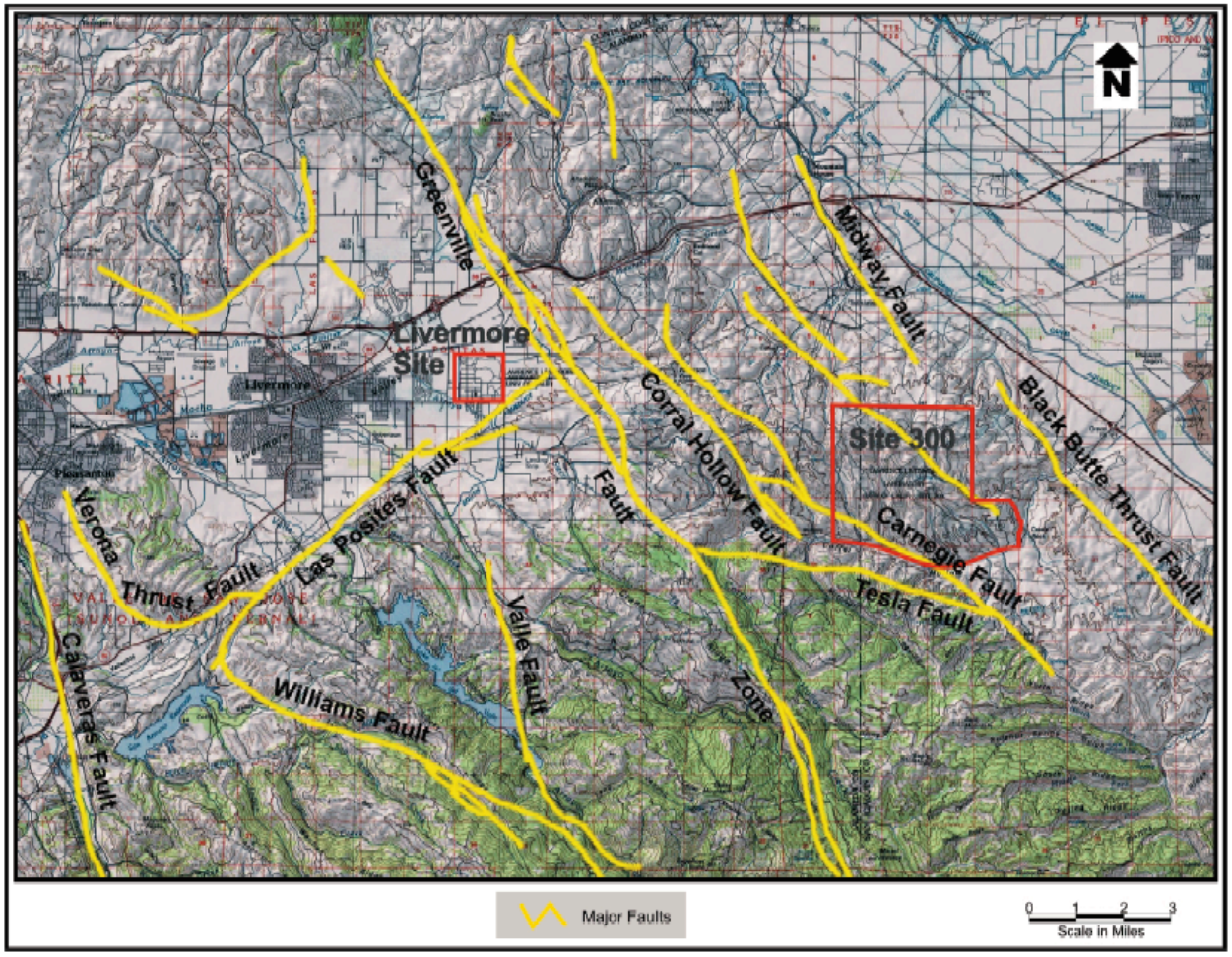


Figure 3-3. Map showing major faults in the Livermore region (DOE 2005)

4.0 ENVIRONMENTAL CONSEQUENCES

This section evaluates the environmental consequences of the Proposed Action, Alternative Actions and the No Action alternative. Except for the No Action Alternative, this evaluation covers site preparation, construction, operation, abnormal events (accidents or malicious acts), and decontamination and decommissioning. The consequences of the Proposed Action and the Alternative to Construct On-site would be the same except for those related to construction. The Remodel/Upgrade Alternative would have no site preparation, so the discussion covers construction, operation, and D&D. The abnormal event (accident or malicious act) issues are the same for all alternatives since the work in all alternatives would be done in an individual laboratory conforming to CDC/NIH guidelines for design and operation of a BSL-3 laboratory.

4.1 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

4.1.1 Ecological Resources

As stated in Section 3.3.1, no threatened or endangered species habitat or buffer areas would be located at or adjacent to the proposed BSL-3 laboratory facility.

Site Preparation and Construction. Less than one-quarter acre of previously disturbed land would be used for site preparation, utility installation, and other construction activities. It would be expected that continuous and impact noise (described in Section 4.1.4) could have temporary effects to non-sensitive wildlife species in the immediate site location area. However, these minor effects would not be long term.

Site preparation and construction would have some effect upon the resulting soil characteristics. A small portion of some shallow soil horizons would be removed where they would be under foundation footings and other parts of the building's base. Soil microflora would be disturbed but only for the duration of soil-intrusive activity.

Operation. The operation of the proposed BSL-3 facility would have little if any effects on biota. Infectious microorganisms handled in the proposed facility might be introduced into the environment under two conditions. The first is the disposal of sanitary wastewater to the City of Livermore Water Reclamation Plant (LWRP) discussed previously. Sanitary waste passing through the wastewater treatment plant undergoes several stages of treatment that would inactivate any microbes that survived the initial disinfectant treatment at the BSL-3 facility (see discussion of water-borne transmission in Section 4.1.2, Human Health). This process is the same as for healthcare and veterinary facilities and laboratories in the area.

The second relates to emergency response operations. There is a potential for microorganisms to be introduced into the environment if they were not contained within the laboratory during a fire-response or natural phenomena event (e.g., seismic). However, even if they should escape containment, a number of environmental factors should effectively kill microorganisms in the vegetative state. These are enumerated in Section 4.1.2. They include ultraviolet light, dehydration, high temperatures, freezing temperatures, and the presence of free oxygen. The survival or death curves indicate that microbial populations die off quickly (DA 1989).

Decontamination and decommissioning. Other than the effect of noise at the localized site area from D&D activities (building demolition), there would be no effect on ecological resources.

4.1.2 Human Health

Site Preparation and Construction. Human health effects during site preparation and construction for the proposed BSL-3 laboratory would be the same as for any small single-story construction project at LLNL. The effects would be very localized and would affect only site workers or visitors to the site. There would be no public human health effects. Routine construction activities have the potential for exposing workers or officially-sponsored site visitors to a number of common hazards including, for example:

- Biological hazards (e.g., snake bites, poison ivy, and insect stings);
- Electrical hazards (temporary electrical drops, excavations in areas with underground utilities, heavy-equipment lifting with nearby overhead utilities);
- Fire and explosion hazards (portable gasoline containers for generators and other gasoline-powered equipment, fuel transfers for onsite heavy equipment operation);
- Physical hazards (slips-trips-falls, walking-working surfaces, powered hand-tool operation, pinch-points, hoisting, motor-vehicle operation, excavations, ladders, noise, heat stress, cold stress, sunburn, dust, and particulates).

These hazards would be reduced or eliminated by compliance with Federal Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1910.12, 29 CFR 1926, 29 CFR 1990), National Fire Protection Association (NFPA) codes (NFPA 1997, 1998, 2000), and the DOE directives which mandate these worker protection requirements for DOE facilities (DOE 1997, 1998).

UC workers at LLNL would not be directly involved in the construction of the BSL-3 facility, but they would be active in management, site inspections, and utility hookups. LLNL workers are currently involved in similar activities on site. Because of the expected limited involvement of LLNL workers in the construction of the new buildings, only minor effects to these workers are anticipated. The Proposed Action is expected to have no substantial effect on the health of any non-LLNL construction workers under normal operation conditions. Construction workers would be actively involved in potentially hazardous activities such as heavy equipment operations, soil excavations, and the handling and assembly of various building materials. Construction activities would take several months to complete. Appropriate personal protection measures would be a routine part of the construction activities (such as gloves, hard hats, steel-toed boots, eye shields, and ear plugs or covers).

Operations. The type and rate of injuries and illnesses expected during operation of the proposed BSL-3 laboratory would be the same as those demonstrated for CDC-registered laboratories, U.S. Army Biological Defense Research Program (BDRP) laboratories and existing biological research laboratories operated by LLNL. While the most obvious potential concern of operating a BSL-3 laboratory involves handling of infectious organisms (listed in the tables in

Appendix A), the proposed facility would have attributes of most laboratories in that it would have identified physical, electrical, and chemical hazards.

The proposed laboratory would not use radioactive materials, propellants, or high explosive materials, and the quantities of hazardous chemicals stored in the facility at any one time would be just a few liters each of chemical disinfectants (such as sodium hypochlorite or potassium hypochlorite) and biologic stabilizers (phenol). Chemicals such as paraformaldehyde would not be stored in the facility but brought in only when required for fumigation (the facility has a minimal amount of storage space). The hazardous chemicals used and stored would be tracked using ChemTrack (LLNL's computerized chemical inventory system) and handled according to the BBRP directives (LLNL 2000a), the Building 360 Complex directives for Biohazardous Operations (LLNL 2001a), and the LLNL Chemical Hygiene Plan for Laboratories (LLNL, 2001c). Use of biotoxins are discussed later in this section.

The potential for injuries and illnesses involving routine laboratory operations presents a greater health risk to workers than does the potential for injury and illnesses associated with handling infectious substances. Moreover, the combination of utilizing the guidelines, standards, practices and procedures established by the CDC, NIH, Human Health Services, and public health services together with BSL-3 safety equipment and facility safety barriers, results in an overall potential risk of illness to site workers or visitors from operations involving select agents that would be best characterized as minor. There would be no discernable public human health effect from routine BSL-3 laboratory operations at the proposed facility.

There has been an extremely low incidence of laboratory-acquired infections associated with operations in CDC-registered laboratories since the implementation of CDC-developed guidelines issued in 1974 (See Appendix A). Specifically, a recent bibliographic database (Collins 2000) based on reports starting from about the beginning of the 20th century and continuing up through August 2000 reveals substantial reductions in laboratory-acquired infections reported in the 1990s. There is a notable lack of reported cases in the literature relating to laboratory-acquired infections in the United States particularly in the last 10 years.

The experience of the U.S. Department of the Army (DA) at its BDRP facilities over several decades provides further insight to the potential for laboratory-acquired infection. The DA program underwent a programmatic NEPA evaluation in 1989, the *Final Programmatic Environmental Impact Statement, Biological Defense Research Program* (BDRP)(PEIS) (DA 1989). Up to time of that publishing, there were no occurrences of overt disease in laboratory workers handling infectious organisms within the DA BSL-3 facilities, although in 1980, one focal infection with *F. tularensis* occurred at the site of a puncture wound (DA 1989)." Since then there was one incident in 2000 (CDC 2000c) where a worker was exposed to *Burkholderia mallei* the causative agent of human glanders. The individual was hospitalized and shortly recovered. The BDRP PEIS (DA 1989) also estimated laboratory-acquired infection rates for their U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) facility for different biocontainment levels (roughly equivalent to the CDC BSL levels) over different periods of time. For their BSL-3 equivalent laboratory operations from 1960 to 1962 they estimated there were six laboratory-acquired infections for a rate of 2 per million man-hours worked. For their BSL-4 equivalent laboratory operations from 1960 to 1969, they estimated

seven laboratory-acquired infections for a rate of 1 per million man-hours worked. These infections included sub-clinical infections and mild illnesses where hospitalization was not required (DA 1989).

Overall, the BDRP PEIS estimated the rate of public infection from USAMRIID as less than 0.001 per 1,000,000 person-years and the risk of death to a laboratory worker for the "Defensive Period" (1970 to 1989) as 0.005 per 1,000,000 person-years (DA 1989). By way of comparison, the "Offensive or Weapons Period" (1954 to 1964) was associated with values for the risk of death to laboratory workers of about 5 orders of magnitude higher (DA 1989).

Experience with biological research laboratories at LLNL spans a period of many years. Based on information provided by the LLNL BBRP Assurance and Facility Manager, LLNL has operated BSL-1- and BSL-2-equivalent laboratories for at least the last 20 years without any infections associated with their operation (PC 2002). Also, there were no unintentional releases to the environment or to the public associated with the LLNL biological research laboratories. Additionally, the LLNL BBRP Assurance and Facility Manager reviewed available Occurrence Reporting and Processing System (ORPS) Reports (from the past 10 years). These reports include information on workers at BSL-1 and -2 laboratories at LLNL. The result of this review was that there have been no incidences of laboratory-acquired infections recorded for LLNL workers (PC 2002). Based on extensive experience with the safe handling of biological materials at LLNL and the Department of the Army, it is projected that the National Defense-related and scientific research to be conducted at the proposed BSL-3 facility would not result in significant impacts from normal operations to workers or the public.

Anecdotal reporting of human health issues elsewhere at BSL-3 or similar laboratories have indicated that while laboratory-acquired or laboratory-associated infections (specifically, the "all other" category of nonfatal injury and illness rates reported by the BLS) do occur, they should be considered abnormal events due to their infrequency of occurrence (Appendix B). As such, the human health effects of these events are discussed within this chapter in Section 4.2, Abnormal Events. There are a number of reasons that routine BSL-3 laboratory or similar laboratory operations do not normally produce infectious disease-related health effects to workers, their families, or the general public. In general, these are a result of the implementation of the comprehensive CDC and NIH guidelines (see Appendix A) that are based upon historical published accounts (anecdotal information) over many decades of experience in medical and bacteriological laboratories (CDC 1999) (see Appendix B).

Potential Pathways for Infectious Agents to Escape BSL-3 Containment. Potential means for infectious agents to leave the BSL-3 containment and possibly cause human health impacts would include five pathways. These are direct transmission,[19] vector-borne transmission,[20] vehicle-borne transmission,[21] airborne transmission[22], and water-borne transmission.[23]

[19] Direct transmission: Direct and essentially immediate transfer of infectious agents to a receptive portal of entry through which human or animal infection may take place. This may be by direct contact such as touching, biting, kissing or sexual intercourse, or by the direct projection (droplet spread) of droplet spray onto the conjunctiva or onto the mucous membranes of the eye, nose or mouth during sneezing, coughing, spitting, singing or talking (usually limited to about 1 meter or less) (Benenson 1995).

Direct Transmission. Operations as described minimize opportunities for direct transmission. Direct transmission would first require a worker to be exposed to an infectious agent. The likelihood of a worker inhaling or otherwise becoming exposed (for example, through cuts in the skin or ingestion) to an infectious agent would be extremely remote. While it would be very unlikely that a worker would be exposed, if exposed with a sufficient dose, it would be possible for them to be carriers[24] for those agents and through direct transmission expose others. This potential is further reduced through the intervention of effective vaccines or therapeutic measures (CDC 1999).

Vector-borne Transmission. The facility would be designed to severely limit the potential for possible vector-borne transmission through insects and rodents. The use of pest control programs (Appendix G of CDC 1999) would limit the potential for transmission of infectious agents from animals to humans.

Vehicle-borne Transmission. The primary concern for vehicle-borne transmission would be by the workers' clothing or skin and hair, as all other materials leaving the BSL-3 must go through a sterilization by autoclave or chemical disinfection. The guidelines established by the CDC and NIH, which would be followed within the proposed BSL-3 facility, are designed to reduce or eliminate this potential method of transmission. This would substantially reduce any potential for a worker to unknowingly transport infectious microbes from the facility.

Airborne Transmission. All air leaving the BSL-3 laboratories during normal conditions would exit through ductwork that is HEPA-filtered prior to emission through stacks on the building roof. HEPA filters are rated as 99.97 percent efficient at a most-penetrating "design point" of 0.3 microns[25] diameter as tested by dioctyl phthalate (DOP) particles (NSC 1996). This means that HEPA filters are designed to remove at least 99.97 percent of all the particulates that hit the filters, even in the most-penetrating sizes of 0.1 to 0.4 microns. The remaining particles (less than 0.03 percent) can penetrate or pass through the filters. The number of viable vegetative microorganisms after HEPA filtration would be negligible. Filters are made from randomly laid non-woven natural or synthetic fiber materials made into a flat sheet that is pleated and placed

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[20] Vector-borne transmission can include mechanical or biological transmission of infectious agents. Mechanical transmission includes carriage by crawling or flying insects through soiling of feet or proboscis or by passage of organisms through its gastrointestinal tract. This does not require multiplication or development of the organism. Biological transmission includes the propagation (multiplication), cyclic development, or a combination of these (Benenson 1995).

[21] Vehicle-borne transmission is the transmission of infectious agents through contaminated inanimate materials or objects such as handkerchiefs, soiled clothes, surgical instruments, water, food, and biological products (Beneneson 1995).

[22] Airborne transmission is the passage of microbial aerosols to a suitable portal of entry, usually the respiratory tract. Microbial aerosols are suspensions of particles in the air consisting partially or wholly of microorganisms (Benenson 1995).

[23] Water-borne transmission is the transmission of infectious agents through contamination of water. It can be considered a subcategory of vehicle-borne transmission.

[24] A carrier is a person or animal that harbors a specific infectious agent without discernable clinical disease and serves as a potential source of infection (Benenson 1995).

[25] A micron, also known as a micrometer, is one millionth of a meter or four hundred thousandths of an inch.

into a filter container. Pleating increases the surface area and improves filter loading and reduces air resistance. HEPA filters have fiber diameters ranging from 0.65 to 6.5 microns in three diameter groupings. The process of aerosol filtration does not simply rely on the size of the opening between fibers, but uses a number of physical properties of air movement around fibers to capture the particles. These forms of capture are called interception, sedimentation, impaction, and diffusion. Electrostatic attraction also plays a part in capturing small particles and the fiber material is often selected specifically to enhance this effect (for example, electret fibers and wool resins). The exact combination of capture mechanisms varies. Larger particles are generally removed by impaction and interception while light particles are removed by diffusion and interception. These mechanisms remove essentially all particles larger than 0.6 microns in diameter and low flow rates let diffusion remove most all particles below 0.1 micron (NSC 1996). A "most-penetrating particle size" exists between 0.1 and 0.4 microns which is the reason for testing and certifying HEPA filters for particle removal at 0.3 microns (NSC 1996). The DOP test is highly conservative relative to microorganisms that may have sticky cell-walls and/or protuberances such as, flagella and pili (protein fibers 0.5 to 20 microns in length) which help them adhere to other cells. Bacterial spores are larger than their vegetative cells and have charged surfaces that promote attraction to other surfaces. Being sticky or with charges on their surfaces promotes their capture by the HEPA filter.

NNSA acknowledged in the LLNL Supplement Analysis for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore (March 1999, DOE/EIS-0157-SA-01) the issue of reduced removal efficiency of HEPA filters for particles in the size range from 0.1 micron to 0.3 microns. The study which provided this information was from a dissertation written by Ronald C. Scripsick (Los Alamos National Laboratory Report, LA-12797-T, 1994). Even though the most-penetrating particle size in his study was slightly smaller than the HEPA filter "most-penetrating design point" of 0.3 microns, his results still showed a 99.97% removal efficiency or higher in the range from 0.148 to 0.196 microns.

HEPA filters at the LLNL BSL-3 facility (including those in the BSCs) would be tested annually and replaced as necessary. Given the proposed operations of the facility, there is no expectation that the HEPA filters would become moisture-saturated or torn – the two major reasons for HEPA filter failures.

Regardless of the presence or failure of HEPA filters, many environmental factors effectively and naturally kill airborne microbes in their vegetative state. These factors include ultraviolet light, dehydration, high temperatures, freezing temperatures, and the presence of free oxygen. Together these factors account for a substantial reduction in the number of microorganisms. While outdoors, the sun, temperature, and other atmospheric conditions ensure that microbial populations die off quickly, generally within minutes. Mathematical predictions of the potential survival of certain types of microorganisms in the environment estimate that only about 0.01 percent are able to resist the chemical or physical inactivation found in the outside environment (Mitscherlich and Marth 1984).

Water-borne Transmission. Potable water would not be affected by the implementation of the Proposed Action. Facility design features, such as backflow preventers and State of California-adopted uniform plumbing code requirements would prevent microbes within the facility from migrating back through the water supply piping to the public. Water exiting through the sink

drains would be diverted to a retention tank where it would be disinfected before being sent to the sewer system and the LWRP facility.

According to the EPA Surface Water Treatment Rule (40 CFR 9, 141, and 142), public water treatment systems must physically remove or inactivate 99.9 percent of the cyst-forming protozoans *Giardia spp*. and *Cryptosporidium spp*. Treatment system operators comply with this rule by determining the amount of chlorine and contact time (along with temperature and pH) that it takes to produce the required killing of pathogenic microorganisms. Contact time on the order of hours along with a measurable free available chlorine content meets this requirement.

Animal Handling Operations. Appendix B presents some background information on laboratory-acquired infection due to animal handling. The most common effect is for the animal handlers to develop allergies to the hair, dander, urine, and possibly serum of rats or mice. This is, however, very controllable with adherence to standard operating procedures, maintenance of a high standard of quality for anything entering the cages, utilization of cages designed for high standards of ventilation and cleanliness, and a good overall design for the rodent facility. The proposed facility would use a state-of-the-art ventilated caging system similar to the one shown in Section 2. These systems have high rates of exchange air, are designed for easy cleaning, and are HEPA-exhausted for worker protection and for research quality maintenance. Also, once exposed to a pathogen or toxin, the rodents would not leave the cages except inside a BSC. Following proper recognized procedures would help to insure that workers aren't exposed to pathogens from the rodents.

When handling human pathogens or zoonotic disease-causing agents (capable of being exchanged between humans and other animals) workers would use personal protective equipment (PPE) and would be either immunized and/or would have medical treatment available (prophylaxis) for the specific pathogen. Human pathogens for which there is no immunization or prophylaxis would not be handled in the proposed BSL-3 laboratory in accordance with the BMBL guidelines.

Historically the greatest opportunity for contracting a disease from the animals is through an inadvertent needlestick (autoinjection) or from bites and scratches. These can be averted by adhering to standard operating procedures (SOPs) and safety procedures using safety equipment that virtually eliminates these occurrences. These SOPs would be in place, along with the use of appropriate equipment in the proposed BSL-3 facility, prior to operation.

Rodent Challenge Studies.

Activities planned for the proposed action include aerosol-studies using rodents (mice, rats, and possibly guinea pigs). These studies would only be done inside a BSC that meets all currently applicable BMBL requirements (according to WorkSmart Standards) for the materials involved. One possible aerosol-challenge device, a collision nebulizer, would have its reservoir filled while in the BSC from other containers. The rodent would be challenged with the aerosol and the rodent would be placed into a clean cage. The nebulizer would be cleaned and chemically disinfected while still in the BSC. Procedures would be written and adhered to that would insure the device could not be removed from the BSC and be capable of generating an aerosol. Compressed air is necessary for generating the aerosol and it would be immediately disconnected

at the end of the process of challenging the rodent. After removal from the BSC, the device and all its parts would be put into an autoclave to insure sterilization.

Biotoxin Research.

The handling and use of a biologically-derived toxin is essentially the same as the handling of a hazardous chemical. As explained in Appendix B, there are three routes of exposure, but the most likely route of exposure would be the inadvertent needlestick. The probability of being exposed to a biotoxin if appropriate safeguarding and other safety procedures are followed would be extremely low. The Proposed Action facility would have appropriate procedures in place prior to operation of the facility.

Decontamination and Decommissioning. When the time comes for D&D of this facility, there would be no pathogens or toxins in the facility after it has been treated with chemical disinfectants and fumigated. Therefore there would be no human health effects related to biological materials expected from D&D activities. Also, no human health effects would be expected due to the deconstruction activities themselves since OSHA and EPA-type health, safety, and environmental protection procedures to control dust and noise would mitigate these potential issues.

4.1.3 Air Quality

Site Preparation and Construction. During site preparation and construction, the use of heavy equipment would generate combustive-engine exhausts that would contribute to air pollution. However, since there would be very few of these pieces of equipment and their use would be limited in time, the potential effect on ambient air quality would be temporary and localized. During construction there would be a temporary increase in particulate emissions. Operation of construction vehicles such as dump trucks, cranes, and those involved in waste disposal actions would also produce temporary and localized emissions of other air pollutants. Mobile sources, such as construction and waste transport vehicles, would produce other air pollutants (such as sulfur oxide), but the quantities would be minimal relative to the amount of mobile sources already in the area Air District.

Operation. Air quality effects during the operation of the facility relate in part to the generation of gas-combustion engine emissions from private motor vehicles during workers' commutes to and from work. Almost all of the workers are already working in adjacent buildings, so there would be no net effect to air quality from the travel of these individuals. Even the addition of a few new workers (if needed) would not produce a substantial contribution to air emissions. Since vehicle use would not change substantially as a result of operating the new facility, emissions from automobiles would not noticeably increase within the Building 360 Complex Area.

The emergency generator designated for the proposed BSL-3 facility is already operational at an adjacent building and therefore would not add to air emissions. No additional emergency generators, boilers, or other fuel-burning equipment would be added as a consequence of building and operating the proposed BSL-3 facility.

Periodic use of disinfecting gases could be part of the routine operation of the facility. These gases or vapors, such as formaldehyde (from paraformaldehyde) would not affect the local air quality since they would be inactivated at the end of each use. Effects of these gases, if any, would be temporary and localized and would dissipate very quickly. HEPA filtration of all laboratory exhausts removes virtually all biological particles and therefore there would be no incremental increase due to BSL-3 laboratory operation.

Decontamination and Decommissioning. Air emissions from D&D activities would consist of particulate dust emission due to demolition activities (controlled by water application) and mobile emissions due to trucks hauling building debris to the local landfill. These trips to the landfill would be minimal due to the small size of the building.

4.1.4 Noise

Site Preparation and Construction. It is possible that noise levels would exceed at least for periods of several minutes at a time the 8-hour 85-dBA threshold limit value (TLV) (ACGIH 2000), but only during daylight hours and only in the immediate vicinity of the site preparation and construction activity. Members of the public would not be exposed during the daytime or nighttime to noise levels exceeding city planning and zoning code standards (ambient noise level greater than 75 dBA beyond the boundaries of the site, nor greater than 60 dBA at the boundary of a residential district) (City of Livermore 2000). This is predicated on the distance of the proposed facility being about one-half mile to the nearest residence (near West Gate, Figure 1-3).

Heavy equipment such as front-end loaders and backhoes would produce intermittent noise levels at around 73 to 94 dBA at 50 ft (15 m) from the work site under normal working conditions (Cantor 1996; Magreb 1975). Construction truck traffic would occur frequently but would generally produce noise levels below that of the heavy equipment. The finishing work within the building structures would create noise levels slightly above normal background levels for office work areas. Noise levels may go up to around 80 dBA at the work site if light machinery is used in this stage of construction (Cantor 1996). Workers would be required to have hearing protection if site-specific work produced noise levels above the LLNL action level of 80 dBA for steady-state noise. Sound levels would be expected to dissipate to background levels well short of the LLNL boundaries.

The additional construction-worker personal vehicular traffic would not be expected to increase the present noise level produced by vehicular traffic on Vasco and Greenville Roads and East Avenue during rush hour. The vehicles of construction workers would remain parked during the day and would not contribute to the background noise levels during this time.

Operation. The expected noise levels during operation of the proposed BSL-3 facility would be consistent with those of other existing LLNL bench-top research laboratory facilities. These noise levels would be due to vehicular traffic passing through the facility area and from the facility's HVAC system operation. Residential areas would not be exposed to ambient noise level greater than 75 dBA beyond the boundaries of the site, nor greater than 60 dBA at the boundary of a residential district (City of Livermore 2000).

Decontamination and Decommissioning. While there might be more trips from heavy equipment (dump trucks) during this phase of activity, the noise levels and extent of noise to the LLNL boundaries would be no more than that for site preparation and construction, or from other routine site infrastructure maintenance and construction activities.

4.1.5 Waste Management

Site Preparation and Construction. The incremental increase in waste materials produced during this phase of work would be minimal with respect to the waste production of the entire LLNL facility (2,363 tons in 2000, LLNL 2001b). Construction debris primarily comprised of wood, metal, asphalt, paper and plastic would be the typical waste expected to be generated during construction of the BSL-3 facility building and tearing up of associated parking area. This solid waste would probably be disposed at the Altamont Landfill (Alameda County Landfill). Additionally, the project could generate very minor amounts of excess uncontaminated soil from excavation activities. The soil could be stockpiled at an approved soil material management area for future use or disposal.

Operation. No additional waste disposal facilities would be developed as a result of the Proposed Action. Waste quantities and disposal practices were discussed in Chapters 2 and 3. The incremental sanitary sewer waste production associated with the operation of the facility would be minimal (on the order of 10,000 gal per yr or 37,900 liters per yr) with respect to the total waste volumes generated by the entire LLNL facility (256,000 gal per day or 970,000 liters per day in 2000) (LLNL 2001b) and negligible with respect to the City of Livermore's sewer system discharge (6.5 million gal per day or 25 million liters per day in 2000) (LLNL 2001b). Retention tanks would be used to capture research-related biological liquid waste to ensure disinfection is adequate prior to discharge to the sanitary sewer system. There would be no need for waste accumulation areas since minimal quantities of hazardous waste would be generated (hazardous chemicals would typically be used up in process or leave the building as a stabilizing product for microorganisms and biological material).

Decontamination and Decommissioning. At the conclusion of operations, the building would be fumigated and surfaces would likely be washed down with dilute concentrations of household bleach to kill any pathogens. No appreciable hazardous waste would be generated from this operation. D&D of this facility would mainly generate solid waste which would be comprised almost entirely of construction debris. Construction debris is comprised primarily of wood, concrete, gypsum wall board, metal, asphalt, paper and plastic and would be typical of waste expected to be generated during demolition of any laboratory or light-industrial facility. This solid waste would probably be disposed at the Altamont Landfill (Alameda County Landfill).

4.1.6 Geology/Soils/Seismology

Site Preparation and Construction. Except for the temporary disturbance of up to a depth of a few feet on parts of one-quarter acre of land during site preparation and construction, there would be a negligible effect upon geology, soils, or seismicity. Soil erosion prevention measures (application of the SWPP Plan for mainsite LLNL activities) would be in place during the construction phase to minimize erosion from stormwater. Also, dust suppression measures

would be employed to minimize wind erosion. The disturbed construction areas not covered by the building footprint or by parking areas would be reseeded.

Operation. There would be no effect from the proposed BSL-3 facility operation on geology, soils, or seismicity. Soils surfaces not covered by the building footprint or not paved would be landscaped to control erosion from stormwater runoff.

Decontamination and Decommissioning. Except for the temporary disturbance of portions of up to one-quarter acre of land during building demolition, there would be a negligible effect upon geology, soils, or seismicity. As noted above, soil erosion prevention measures would be in place during this phase to minimize erosion from stormwater. Also, dust suppression measures would be employed to minimize wind erosion. Once demolished, the building debris would be removed and the site would be stabilized for water and wind erosion.

4.2 ANALYSIS OF ABNORMAL EVENTS AND ACCIDENT SCENARIOS

4.2.1 Site Preparation and Construction

The site preparation and construction part of Section 4.1.2 deals with routine injury and illness related to nonresidential building construction. Routine accidents are those that commonly occur on construction sites (for example, slips, trips and falls). Because they are routine, they are not considered abnormal events, nor do they take into consideration accidents with more substantial consequences, such as those resulting from catastrophic events.

4.2.2 Operation

This section evaluates potential abnormal event scenarios for operation of the BSL-3 facility that have a reasonable probability of occurrence and scenarios that involve malicious acts. Abnormal events are all selected on the basis of historical knowledge at similar facilities over many years of operation involving similar laboratory activities. The first discussion covers the potential for laboratory-acquired infections which, in the literature, is considered both a routine health risk and as an accident due to the frequency of exposures through, for example, needlesticks. The accident potential is discussed in Sections 4.2.2.1 through 4.2.2.3. The following sections discuss the potential for laboratory-acquired infection, a laboratory accident, and the potential for transportation accidents. Section 4.3 describes the potential for terrorist acts.

4.2.2.1 Analysis of Seismic Events for Facility Operation

The facility has the potential to be affected by earth movements due to earthquakes. Seismic analyses of the Livermore Site were performed to quantify the hazards (DOE 2005). The analyses identify the probability of exceeding a given peak ground acceleration. The 2005 SWEIS lists the maximum horizontal peak ground accelerations at the Livermore Site for varying return periods of 500 and 1,000 as 0.38 *g*, and 0.65 *g*, respectively (the technical basis for these peak ground acceleration values is provided in Appendix H of the SWEIS) (DOE 2005). The document also considers the effects of an earthquake with a peak ground acceleration of 0.73g.

The facility is capable of withstanding the g-force predicted for a return period of 1000 years without loss of containment or structural integrity (i.e., Performance Category-2, LLNL 2001c). As a result of conservative assumptions in the design process, damage to the structural systems from a horizontal peak ground acceleration of 0.73 g is expected to be very slight. Nonstructural elements, including ceilings and cladding, could experience minor cracking but would remain secured.

4.2.2.2 Analysis of Abnormal Events and Accidents for Facility Operation

Laboratory-acquired infection. Laboratory-acquired infections are those infections acquired by workers due to the routine performance of their duties. When the exposure to an infectious agent occurs during an event, it is often considered an accident (such as a needle-stick). When the exposure occurs incidentally during contact with a contaminated surface, it is considered a routine health risk. The following discussion deals only with the accidental laboratory-acquired infection.

Many sources were reviewed that compiled laboratory-acquired infection statistics (CDC 1999; Collins 2000; Collins and Kennedy 1999; Pike 1979, 1976; Pike et al. 1965; Sewell 1995; and Sulkin and Pike 1951, 1949). Much of these data are reviewed and discussed in Appendix B, Section B.1. The most recent bibliographic compilation of microbial disease reports (Collins 2000) covers the period from the turn of the century up until August of 2000, and shows a noticeable lack of laboratory-acquired infection reports in the United States during the last ten years. The Department of the Army (DA) *Final Programmatic Environmental Impact Statement, Biological Defense Research Program* (BDRP) (PEIS) (DA 1989) states that since 1976, there have been no occurrences of overt disease in laboratory workers handling infectious organisms within BSL-3- and BSL-4-equivalent BDRP laboratory facilities. The DA estimated the risk to its workers for laboratory-acquired infection for the period from 1970 to 1989 as 0.005 per 1,000,000 person-years (DA 1989). This was a period of heavy activity using large volumes of infectious agents. The incidence of infection appears to be much lower today in large part due to decreased laboratory activity levels since 1968, and in part due to greatly improved preventive measures.

Control of infection in laboratories has achieved a high level of sophistication, to the point that virtually no reports of infection occur in microbiological laboratories. The CDC says that common acceptance of standard laboratory practices indicates that laboratory-acquired infections should be virtually non-existent today (CDC 1999). However, they do still rarely occur and the primary route of exposure is through autoinnoculation by the unintentional injection or needle-stick (Sewell 1995). Needles would be used in the proposed BSL-3 facility. Broken glass with sharp edges could result from accidents with (infrequently used) glassware. Broken glass, needlesticks or even scalpels present a low likelihood of exposure but are obvious when they happen and can be promptly treated with antibiotics, antiviral drugs, or other appropriate medical strategies. The potential for accidental laboratory-acquired infection by these means would be reduced to the improbable level of occurrence.

Since this Environmental Assessment was originally issued in 2002, the CDC has investigated several laboratory incidents involving exposure of personnel to biological agents that resulted in

infection. For example, in November 2004, three cases of tularemia were reported for Boston University laboratory researchers working with the live vaccine strain of *Francisella tularensis* (BPHC 2005). In February 2006, a worker at Texas A&M University was exposed to the select agent *Brucella* during cleaning of an aerosol chamber following an experiment (GAO 2007). Three Texas A&M researchers also tested positive for the bacterium that causes Q fever in April 2006 (Houston Chronicle, 2007). These and other exposures to biological agents during laboratory incidents since 2002 resulted only in treatable illness, and are not known to have resulted in either death or secondary infections. The relatively small number of accidental exposures during this 5-year period supports NNSA's assertion that although it is possible, it is improbable laboratory staff would acquire an accidental laboratory-acquired infection during the operation of the proposed BSL-3.

The Laboratory Release Accident Scenario. The potentially hazardous material to be handled in the proposed facility would consist of infectious microorganisms in containers holding liquid suspensions or on semi-solid media. Accident scenarios usually envisioned for DOE facilities would normally be seen to exacerbate or enhance a release or spread of the hazardous materials, but for the BSL-3 facility would potentially render these materials innocuous (heat, fire, sunlight, and wind). These would be avoided when working with microorganisms and would usually result in microorganisms being killed. Consequently, catastrophic events such as earthquake, fire, explosions and airplane crashes, normally considered as initiating events in DOE radiological or chemical accident analyses, were viewed as having the potential to actually reduce the consequences of microbiological material releases. An earthquake, explosion, or similar event that would result in a breech or rupture of the facility's walls would be bounded by the hypothetical centrifuge-accident analysis of a *Coxiella burnetti* release from the proposed BSL-3 facility structure described later in this section. The probability of catastrophic events (due to earthquake) is already very low. The low probability of an earthquake capable of rupturing the facility containment, coupled with an additionally low probability of such an event occurring during a daytime activity where microorganism containment would be vulnerable, also makes it an unlikely event. The proposed laboratory hypothetical centrifuge accident-release scenario, which itself is very unlikely due to the simultaneous occurrence of several events/conditions that must be combined to produce a release, bounds the catastrophic release scenario. This accident-release scenario is the bounding biological accident-release scenario in the 2005 Sitewide EIS (DOE 2005) for all biological research activities at the Livermore Site. Appendix B provides background information on microbiological accidents. This scenario is also very similar to the BSL-3 accident analyzed in the recently published Final Environmental Impact Statement for the Construction and Operation of the New USAMRID Facilities at Fort Detrick, MD (USAMRMC 2006).

The BSL-3 facility would have only a few operations or activities that would hypothetically place up to 1 liter quantities of material containing infectious organisms at risk at any point in time. These operations or activities would occur at infrequent times and a release to the environment from a catastrophic event would require several simultaneous conditions to coexist: a worker is transferring a quantity of infectious material when the catastrophic event occurs; the containers aren't properly sealed; the entire set of containers is dropped; the containers break open; and the catastrophic event simultaneously causes a structural breach in the BSL-3 containment walls. Engineering and procedural controls minimize opportunities for this

hypothetical scenario. For example, culture samples would be kept in locked freezers or within incubation chambers most of the time and would not become aerosolized in such an event. Therefore, catastrophic events capable of resulting in a substantial release of microorganisms from the confinement of the facility (specifically at greater than infectious dose quantities) would be unlikely to occur.

A literature search and discussions with BSL-3 laboratory regulators and operators (CDC, NIH, and the U.S. Army) revealed no incidents of infectious materials released from catastrophic accidents at microbiological laboratories. According to the U.S. Army (DA 1989), the likelihood of such catastrophic occurrences is too small to be considered as reasonably foreseeable. No such event has occurred in the more than 50 years in which the military has been conducting biological defense research activities (DA 1989). Based on this historical information, this hypothetical scenario was not analyzed further in this EA.

Historical information suggests that other types of accidents would be reasonably foreseeable; these could involve infectious material. Accidents involving the production of aerosols during the use of normal laboratory equipment such as centrifuges, blenders, homogenizers, shakers, sonicators, and mixers are reported. According to *Laboratory-Associated Infections and Biosafety*, this is the second most common route of exposure, the first being laboratory-acquired infection due to needle-sticks (Sewell 1995). Even though these accidents are more frequently reported, they rarely result in workers actually contracting diseases due to the use of vaccines and drug therapies.

Appendix B describes accident scenarios used in other NEPA documents for analysis of BSL facilities. One accident scenario that was analyzed involved the release of a biotoxin from the common soil bacterium *Clostridium botulinum* (BMI 1993). The accident scenario analysis resulted in an estimated potential release of biotoxin that was several orders of magnitude lower than the dose at which "no effect" resulted. Another NEPA document (DA 1996) accident scenario postulated the release of *Brucella spp*. bacteria transmitted by direct contact with animal secretions. The qualitative analysis indicated no release to the public.

Another relevant NEPA accident analysis was prepared by the U.S. Army for its BDRP PEIS covering several facilities across the United States and is considered most relevant to the Proposed Action. The DA has for decades operated a series of the most extensive infectious agent laboratory facilities in the world. This PEIS addresses the entire BDRP, including multiple facilities, and involves a far greater level of operations than NNSA proposes at LLNL. The reason this accident analysis should be considered relevant to the proposed BSL-3 facility at LLNL is because the PEIS analyzed BSL-3 facilities with engineering and operating characteristics similar to those proposed for LLNL, such as similar HVAC system designs for negative pressure and air turnover; the facilities having similar HEPA filtration; the facilities would operate under the same procedures established by CDC (CDC 1999; 32 CFR 627); and the facilities would be designed to handle the same types of microorganisms.

Important differences between the DA's accident analysis modeling and the conditions at the proposed LLNL BSL-3 facility would be due to the model's input parameters (also called modeling assumptions) associated with the meteorological conditions and the proximity to non-involved workers and the public. The DA's accident scenario assumes to have essentially non-

windy site conditions and nearby non-involved facility workers and members of the public. The LLNL site is usually windy and members of the public would usually be a minimum of one-half mile away. The differences in the DA's modeling assumptions and the conditions at LLNL result in the accident analysis being much more conservative for LLNL conditions than the analysis modeled at the DA site. Therefore, the effects of such a scenario, if it were to actually occur, would be much less adverse at LLNL than those hypothesized for a DA site.

The BDRP PEIS accident scenario is referred to as the Maximum Credible Event (MCE) in accordance with the DA's *Biological Defense Safety Program, Technical Safety Requirements* (32 CFR 627). The microorganism chosen for the MCE accident is *Coxiella burnetii (C. burnetii)*, the organism responsible for causing Q fever. According to the *Control of Communicable Diseases Manual* (Benenson 1995), this organism has an unusual stability, can reach high concentrations in animal environments, and is relatively resistant to many disinfectants. The CDC states that *Coxiella burnetii* probably presents the greatest risk of laboratory infection. The organism is highly infectious and remarkably resistant to drying and other environmental conditions. The estimated human infective dose (HID) with a 25 to 50 percent chance of contracting the disease through the inhalation route for Q fever is 10 organisms (CDC 1999).

The rickettsial microorganism*, C. burnetii,* is considered representative of all types of BSL-1, BSL-2, and BSL-3 laboratory microorganisms (bacteria, rickettsia, viruses, fungi, parasites, and prions) because it is highly durable, infectious, and transmissible, and has excellent environmental survivability. Other types of microorganisms were considered for accident scenarios but rejected for specific analysis because they represent a relatively lower human health hazard (fungi and parasites) or have a generally lower environmental survivability (specifically, the prions and viruses). All animal prions and human parasites are Risk Group 1 or Risk Group 2 microorganisms. Only one fungus identified by the CDC requires BSL-3 and all the rest only require BSL-2 or below (CDC 1999). Many viruses require BSL-3 procedures and equipment but cannot survive long in the environment without a host such as a human or other animal. Bacteria and their subcategory, rickettsia, represent a high risk to human health and many require BSL-3 or BSL-4 procedures and equipment.

Of the bacteria, *C. burnetii* is a durable rickettsia that can be handled in the laboratory with little or no loss in viability. It can survive being aerosolized and remain viable, although once separated from a nutrient food source, it dies off at a slow rate. This microorganism can be as infectious as any other microorganism. The CDC reports that exposure to only 10 microorganisms can cause an individual with normal immunocompetency to develop symptoms of disease. Others report this to be as low as five microorganisms or possibly even one (CDC 2001b). *C. burnetii* has the added "advantage" of being one of the CDC "select agents" (42 CFR 72) and is also considered a critical biological agent[26] (CDC 2000a) (also called Bioterrorism agents).

[26] The CDC Strategic Planning Workgroup has prepared a plan to address the deliberate dissemination of biological and chemical agents. Certain organisms are designated as "critical biological agents" and are assigned priority ratings based on characteristics that pose a risk to national security.

The scenario for the MCE (detailed in Appendix B) involves an instantaneous release of a fixed amount of infectious material as follows. A worker uses a BSC to place a 1-L slurry of *C. burnetii* into six 250-ml polypropylene centrifuge tubes. The worker fails to insert the O-rings or tighten the centrifuge caps, which are the screw-on type. The worker takes the tubes out of the BSC and inserts them into a free-standing centrifuge and turns the equipment on. All six tubes leak, with some of the slurry leaking into the rotor, and some leaks into the centrifuge compartment. Most of the slurry that is not aerosolized settles (99 percent) and 90 percent of that which settles becomes droplets inside the chamber. The worker opens the centrifuge and notices the leak. The worker obtains help from two co-workers, and four more workers enter the laboratory not knowing what has happened. The room air exhausts to the outside of the building through a stack on the roof after passing through two sets of HEPA filters that, for conservatism, were estimated to have a filter efficiency of only 95 percent.

For the workers, the accident produces 9,900,000,000 (9.9×10^9) airborne HIDs at a 50 percent rate of contracting the disease (HID_{50} or ID_{50}) which occurs in a 3 ft^3 of space above and around the centrifuge. This volume of contaminated air then disperses throughout the room in response to the ventilation system flow characteristics (for example, the volume of air in the room and the HVAC ducting, and the room air turnover rates). The excited worker who opened the centrifuge is potentially exposed to 100,000 HID_{50} due to a higher rate of respiration at l5 L or 0.5 ft^3 per minute (normal is 4 to 6 L or 0.14 to 0.21 ft^3) (NSC 1996). The two co-workers coming to his assistance receive an only slightly lower dose. The other four workers incidentally exposed receive 100 to 300 HID_{50}.

The result to the general public was calculated for this scenario using a gaussian plume dispersion model under relatively calm wind conditions (stronger winds would dilute more readily). At the maximum air-concentration described above, the model predicted less than 1 HID_{50} per liter of air at a distance of 7 ft (2 m) from the stack, less than 0.1 HID_{50} per liter of air at 53 ft (16 m) from the stack, and less than 0.01 HID_{50} per liter of air at a distance of 125 ft (38 m) from the stack. The concentrations dissipate readily after reaching these maximums since the accident scenario resulted in a one-time instantaneous release.

This hypothetical accident can be used as a bounding accident analysis for the Proposed Action LLNL BSL-3 facility. However, it is exceedingly conservative. From a slightly more realistic perspective, there are some aspects of this accident scenario that would significantly lessen the possible outcome to the point that it would not produce even one HID_{50} at the end of the stack in the case of the proposed facility at LLNL. Some of these are:

- Cultures in a centrifuge in their stationary phase (with 10^8 cells per ml) would quickly pack to the bottom of the centrifuge tube and the upper liquid phase that would become aerosolized would have very few cells (depending upon when the accident occurred in the cycle) – therefore the concentration of cells in the aerosol would likely be many orders of magnitude below that used for the analysis (extremely conservative).
- At LLNL (and most small BSL-3 laboratories) normally only two workers would be allowed in a BSL-3 laboratory at a time for safety reasons.
- In an emergency response mode, the responder would enter only after ascertaining the risk and donning appropriate personal protective equipment.

- The worker(s) would have the appropriate prophylaxis available or immunization prior to working in the laboratory and would not become symptomatic.
- If all the room air were doubly HEPA-filtered with each at a minimum of 95 percent efficiency, the overall filtration would be 99.75 percent efficiency (passing through the first filter with 95 percent efficiency would leave 5 percent to pass through and the second filter would remove 95 percent of the 5 percent – resulting in 99.75 percent overall removal efficiency).
- HEPA filtration is rated at 99.97 percent efficient at the most penetrating design point of 0.3 microns using the DOP standard for calibration and measurement which is a uniform size, shape, and non-charged. Removal efficiency is not based upon size alone because there are several physical processes which actually cause the particulate removal. Penetration of larger- or smaller-sized particulates than 0.1 to 0.3 microns (the most penetrating size range) is negligible (less than 0.03 percent). Actual microbes, especially wet, have biofilms on their surfaces, are not uniform in size or shape, agglomerate together, and would not likely penetrate even at 95 percent efficiency because of their physical characteristics.
- The hypothetical accident results of even these extremely small effects rely on compounding of several independent actions whose combined probability of sequential occurrence would be extremely low (o-rings are not inserted, caps not screwed on properly, all six tubes leak, the worker opens the lid not realizing the tubes leaked, the worker gets two other workers to come over and look, and four more enter not knowing what has happened).
- The aerosol efficiency of 0.1% assumed for the scenario is at least one order of magnitude higher than would be likely in a real situation.
- The modeling assumptions (as described in Appendix B) are for the most stable open-terrain conditions and LLNL is both urban and non-open due to the predominance of buildings and trees which increase turbulence and tortuosity (i.e., mixing) and settling.
- Increases in wind speed over the modeled rate of 4.5 mph would increase aerosol dilution while humidity (not considered by the model) enhances the settling of particulates and would also decrease airborne concentrations.
- The normal high rate of air-changes for a laboratory like this would not generate a single "concentrated slug" of aerosolized material to exit the building as proposed in the model.
- Last, but not least, Risk Group 3 agents (those handled in BSL-3 laboratories) are associated with serious or lethal human diseases for which preventative or therapeutic intervention may be available (high individual risk but low community risk).

The conclusion is that members of the public would have a very low likelihood of being exposed to even a small fraction of one HID_{50}. At LLNL, the nearest member of the public is about one-half mile away. Adverse health effects to uninvolved workers in adjacent buildings or the public would be extremely unlikely to develop from this scenario. Similarly, adverse effects to the environment from the accidental release of non-indigenous organisms would be extremely unlikely as well.

4.2.2.3 Transportation Accident

Infectious substances (etiologic agents) in transit on the Nation's highways, railways, and airports are regulated by the U.S. Department of Transportation (DOT) regulations (49 CFR 171, 172, 173, and 178). As a consequence of these regulations, the DOT tracks and reports accidents and, in particular, hazardous materials incident reports. The general population risk report by DOT from 1994 to 1998 from all hazardous materials transportation is 1 in 8,129,000, or as otherwise stated, 0.11 fatalities per million shipments (DOT 2001a). By comparison, the general population risk per year for motor vehicle accidents is 1 in 6,300 or 1.7 deaths per 100 million vehicle miles (161 million kilometers). The number of hazardous materials shipments is about 800,000 per day with at least 10,000 involving waste hazardous materials identified generally as medical wastes and various other hazardous materials. For the hazardous materials category that includes infectious substances, about 80 percent of these shipments are carried by truck with the remainder carried by rail (DOT 1998). There are an estimated 4,300 non-hospital waste generating facilities (laboratories) that are potential generators of medical waste and other kinds of infectious substances including diagnostics specimens. These facilities generate 73,037 tons per year of infectious medical waste and ship about 200 tons (181,000 kg) per day (DOT 1998). Information extracted from the DOT Hazardous Materials Information System (HMIS) database (DOT 2001b) on infectious substances transportation from 1995 to 1999 show that infectious substance incidents are too few to even be ranked. There is, however, an apparent national increase in overall hazardous materials incidents, which rose from 14,700 in 1995 to 17,069 in 1999.

LLNL has never had a biological-material transportation accident (PC 2002). However, an incident occurred in August-September 2005 in connection with a shipment of a collection of vials containing the select agent Bacillus anthracis (anthrax) to two laboratories, one located in Florida and the other in Virginia. At one lab, workers unpacking the shipment discovered that some of the vials had leaked from their primary containers into the inner packaging of the secondary container. However, the material did not escape from the secondary container into the packing material within the tertiary shipping container. Although the unpacking process was conducted in a laboratory, it was not conducted in a Biological Safety Cabinet (BSC), as required, which resulted in five workers being exposed to liquid from the packages while unpacking the secondary containers. These employees received medical treatment as a precaution and there were no adverse health effects. No liquid penetrated the outer shipping container and there was no public release. At the second lab, discrepancies were noted between the shipping inventory and the samples in the container. As required by 42 CFR 73, the recipients of the shipments notified the Centers for Disease Control and Prevention (CDC) of these problems. As a result, the CDC suspended all LLNL transfers of select agents. An NNSA Occurrence report was filed regarding the incident and LLNL issued a full stand-down of all select agent work.

An analysis of the shipping incident resulted in multiple corrective actions to strengthen LLNL's packaging and transportation program for select agents and other bio-hazardous materials at LLNL. Actions taken to prevent recurrence included an expansion of the Select Agent Security Plan, additional training related to packaging and shipping regulations, clarifying roles and responsibilities, a new bio-governance model, and an improved inventory system.

The CDC and the Department of Transportation (DOT) conducted an inspection of the LLNL Select Agent Program in February 2006 in response to this shipping incident. The inspection noted improvements in the management of select agents that were made to address the root causes of the shipping incident. Following the inspections, CDC approved the resumption of select agent transfers to and from LLNL and re-authorized the select agent program at LLNL for an additional 3 years.

The Office of the Inspector General (OIG) of the Department of Health and Human Services (HHS) assumed lead responsibility for enforcement of the Select Agent and Department of Transportation Regulations. In a January, 2007 letter, OIG alleged that during these shipments, LLNL violated the transfer requirements of the select agent regulations by failing to comply with the applicable shipping and packaging laws when transferring a select agent. In addition, the OIG also alleged that LLNL failed to comply with security and access requirements by allowing an individual not authorized to have access to select agents to package the shipments of anthrax, and that LLNL's Responsible Official (RO) failed to ensure compliance with the shipping and packaging requirements of the select agent regulations. The individual had been authorized to package shipments before, but this authorization had lapsed and the RO had not requested a reinstatement of her registration prior to this shipment. The Regents of the University of California (UC) agreed to resolve its liability for these alleged violations through a settlement agreement. Under the terms of the agreement, UC agreed to pay the OIG $450,000 to resolve these allegations.

Accidents due to transportation of microorganisms are not expected to increase due to the Proposed Action. The addition of milliliter-quantity samples shipped to and from the BSL-3 facility through federal or by commercial or private courier would not be expected to change the overall incidence of risk of transportation accidents. Samples could consist of cells in media contained within DOT-certified packages. The consequences of such accidents would be anticipated to be minor, based on the historical data.

4.3 Analysis of Threat of Terrorist Activity

Environmental reviews prepared under CEQ implementing regulations and DOE NEPA regulations require a presentation of the environmental impacts of the proposed action and the alternatives in comparative form, thus defining the issues and providing a clear basis for choice among options by the decision-maker. With regard to intentional malicious acts, the assessment should compare potential impacts of acts by a terrorist that could derive from the proposed action, or that could occur with significantly greater probability as a result of the proposed action, to the potential impacts from those that could already occur if research with pathogenic agents requiring BSL-3 level containment is not conducted at LLNL (the "No Action" alternative).

Intentional malevolent acts, such as terrorist acts, do not lend themselves to the type of probability analysis conducted in NEPA documents for accidents (DOE 2002a). For a typical NEPA accident analysis, one would attempt to estimate the likelihood of a particular accident

scenario. If it was high enough to warrant concern, one would then consider the potential consequences and analyze them accordingly. Probabilities for accidents and catastrophic events can often be estimated by studying historical data of similar events. For malevolent acts, probability data is generally unavailable, since in addition to technical feasibility, one would also need to devise a means for assessing and quantifying as a weighting factor the willful intent of a purpose-driven individual or group. Such factors are not subject to estimation, and are likely to vary over time.

Therefore in dealing with the potential for terrorism and its NEPA implications, NNSA has adopted an approach based on that which is used in designing security systems and protective strategies, where one begins with the assumption that a terrorist act will occur, regardless of the actual probability of such an act. Increasing levels of protective strategies are then put into place to reduce the risk of a successful terrorist attack to an acceptable level, and subsequently the potential for the facility to be an attractive target for terrorism. The conclusions of the NNSA in the analysis that follows reflect the influence of that approach.

There is a broad range in malevolent and terrorist act scenarios that have been considered and taken into account in planning the design and operation of this facility. Malevolent acts centered on the facility could be perpetrated by a terrorist who has no other intent and no legitimate connection to the facility, but also by other individuals, including a knowledgeable insider. One could postulate that catastrophic damage to the facility could be accomplished either by air or ground attack or by an individual gaining direct access to the building. Similarly, one could postulate other acts of terrorism such as the covert theft of a sample of pathogenic material, so as to avoid immediate detection or discovery which would activate corrective measures and defeat the motives and intent of the terrorist. Research conducted in the proposed facility would be specifically directed to developing technologies and systems to improve national defense against, and mitigate the consequences of these, and other similar terrorist acts.

As discussed below, because of the safeguards and security measures to be taken, NNSA considers the probability of a successful terrorist act at the LLNL BSL-3 Facility would be extremely low and is not expected during the life of the facility. However, potential impacts of acts by terrorists at the LLNL BSL-3 facility were evaluated. Three types of threats were considered:

1) facility damage or destruction from direct terrorist attacks that results in loss of containment;
2) the theft and subsequent release of a pathogenic material by a terrorist from outside LLNL; and
3) the covert theft and subsequent release of a pathogenic material by an insider with access to the facility.

Each of these scenarios are evaluated and the measures NNSA would implement to counter these threats are described. The potential impacts of these three scenarios were evaluated, including the potential impact that a successful terrorist attack would have.

NNSA believes the probability of a successful terrorist act at the LLNL BSL-3 Facility is very low, and it is not an event expected during the life of the facility. In addition, the Research that

would be conducted in the facility would be directed to developing technologies and systems to improve national defense against bio-warfare and bio-terrorism, and thus increase the nation's ability to mitigate the consequences of terrorist acts in the future.

4.3.1 Facility Damage or Destruction from Terrorist Attacks that Result in Loss of Containment

Deliberate facility damage with the intention of releasing small tube-stored samples or working cultures of pathogenic agents would be possible if an individual were able to gain direct access to the facility or cause a catastrophic breach of all containment systems. For example, a suicidal plane crash could breach the facility's containment. Similarly, an explosive device delivered by a vehicle or an individual on foot could breach facility containment. Depending on the time of day and the type of research underway, a loss of containment could result in a release of pathogenic materials. It is probable that the organic biological material would be destroyed by any resulting fire (DOE 2002b). These types of scenarios at the Livermore Main Site would not be possible under the No Action Alternative as the facility would not exist, and are therefore scenarios unique to the proposed NNSA action.

Impacts of a Release Following Loss of Containment. Catastrophic events such as fire, explosions, and airplane crashes, normally considered as initiating events in NNSA radiological or chemical accidents, have the potential to actually reduce the consequences of microbiological material releases due to the heat produced by these events (DOE 2002b). As discussed below, the consequences of a malicious act designed to breach containment are bounded by the accidents and natural catastrophic events evaluated in the EA because they would result in a similar loss of containment.

During routine operations, very limited quantities of biological agents (such as *C. burnetii*) would be in use, usually only enough to begin cultures in petri dishes. Biological agents would typically be handled in a liquid- or solid -medium container, such as a petri dish or flask, which would release very few organisms to the air if spilled. As noted in Section 4.2.2.1, a few operations or activities could hypothetically place up to 1 liter quantities of a slurry of material containing pathogenic organisms at risk at any point in time. One liter of *C. burnetii* generated in tissue culture would contain a maximum of about 1 trillion bacteria. The remaining material would be stored in freezers. An explosion with a subsequent fire would result in a lower risk than without a fire because much of the biological material available for release would likely burn or be killed by heat rather than released to the environment (DOE 2002b). Breach of containment in the absence of an explosion is likely to rupture containers of disinfectant, such as bleach, which would also reduce the amount of viable agent expected to escape the facility following the attack. Additionally, exposure to several environmental factors could kill many airborne microbes in their vegetative state. These factors include ultraviolet light and dehydration. Together, these factors would account for a substantial reduction in the number of microorganisms released, generally within minutes. Therefore, a terrorist act, such as a plane crash, would not be expected to result in a release of greater magnitude than from other catastrophic events already considered in this document or, for example, from releases that routinely occur during lambing season at numerous local ranches, or from births of other infected

domestic or wild animals. By way of comparison, one placenta from a ewe infected with *C. burnetii* contains about 10^{15} organisms (Welsh et al, 1951).

Risk Group 2 and Risk Group 3 agents proposed for use in the facility cause human diseases for which preventive or therapeutic interventions may be available. Nationally, health care providers have been trained to recognize symptoms of exposures to Risk Group 2 agents (such as anthrax) and Risk Group 3 agents. Local hospitals and health care providers in the Livermore area have been briefed by LLNL medical staff. For agents studied in the BSL-3 facility, prophylactic measures are available in the event of exposure. Individuals could be inoculated to prevent infection or treated to recover from exposure to a known biological agent, just as presently is done in medical facilities across the country when these same biological organisms from natural sources infect members of the general public. There have been a number of reported cases (in 4 selected years) of Q-Fever (18), Tularemia (10), and Plague (3), and other select-agent diseases, from natural and accidental exposures in California (see Table 3-2). Only one death (from Q-Fever) was reported within this group of select-agent diseases. These statistics reflect the widespread availability of diagnostic testing and treatments procedures for typical Risk Group-2 and -3 select agents in case of exposure and infection.

In general, considering the current levels of security awareness and response available, it is probable that if a successful terrorist attack on the facility resulted in the release of a biological agent to the environment, the effects of such a release would be localized in time (hours immediately following the terrorist act) and place (downwind from the BSL-3 facility). As noted, exposed individuals could be inoculated to prevent infection or treated to assist in recovery. For example, studies (DA 1989) reported that if a non-immunized person were exposed to defined aerosols of up to 150,000 pathogenic doses of virulent *C. burnetii*, the disease could be avoided by giving one milliliter of vaccine within 24 hours after exposure and by instituting antibiotic therapy.

Security Measures to Counter Direct Attacks. It is not possible to accurately predict the probability of intentional attacks at LLNL or at other critical facilities, or the nature of these attacks. The number of scenarios is large, and the likelihood of any type of attack is unknowable (DOE 2002a). Nevertheless, in the aftermath of the attacks of September 11, 2001, NNSA reevaluated scenarios involving malevolent, terrorist, or intentionally destructive acts at LLNL in an effort to identify potential security vulnerabilities and assess possible improvements to security procedures and response measures. Security is a critical priority at DOE facilities, and DOE continues to identify and implement measures designed to defend against and deter attacks at its facilities. Substantive details of terrorist attack scenarios and security countermeasures are classified, because disclosure of this information could be exploited by terrorists to plan attacks.

The requirements for possession, use, and transfer of Select Agents (SAs) and toxins in the United States are established in 42 CFR Part 73. Section 73.11 requires facilities subject to the regulations to develop and implement a security plan establishing policies and procedures that ensure the security of areas containing SAs and toxins based on a risk assessment. A risk methodology, agreed to by the University of California /NNSA/Sandia National Laboratories/Department of Energy Risk and Threat Assessment Methodology Working Group,

guides the development of security risk and threat assessments as they relate to LLNL operations. This methodology is still being used under the new LLNL M&O contractor.

The *Biological Risk and Threat Assessment* (BRTA) (LLNL 2005) developed for the BSL-3 facility at LLNL follows the methodology established by the Working Group and uses the DOE Design Basis Threat[27] to examine the potential vulnerabilities of the facility and its operations, and to mitigate risks. The BRTA is an in-depth analysis that focused on the Design Basis Threat and other potential scenarios, such as acts by terrorists or violent activists.[28] The *LLNL Select Agents and Toxins Security Plan* (LLNL 2006) is based on the BRTA and provides an integrated safeguards and security management approach to implementing a protection program for LLNL's SA and toxin use and storage areas in conformance with the SA requirements of 42 CFR Part 73. In addition to general security programs at the LLNL main site, this program encompasses both physical and personnel security aspects as described below.

When compared with other facilities and locations in the environment for which pathogenic agents could be obtained, the LLNL BSL-3 facility is one of the most physically secure against such efforts. Part 73 outlines minimum security requirements for possession and use of select agents and toxins. The key requirements are locking refrigerators and freezers to store select agents, and controlling access to areas where select agents and toxins are stored or used from the public areas of the building.

Several aspects of the layered physical security systems at LLNL exceed the security requirements imposed by Part 73 on similar facilities. There are over 1350 of these facilities nationwide; the majority of which are either academic or clinical/diagnostic facilities (GAO 2007). First, the LLNL site is surrounded by a patrolled security fence with badge-identification required for entry. The LLNL Protective Force Division provides numerous types of protection, including perimeter access control, fixed access and surveillance points, random vehicle patrols, and an armed response force. The Protective Force Division conducts periodic drills and training to maintain its effectiveness. In March 2004, DOE's Office of Safeguards and Security Evaluations completed a comprehensive review of LLNL security programs and rated the protective force operations as "Effective Performance," which is the highest rating possible.

Building 368 is inside the LLNL protected perimeter. In addition, access to Building 368 is controlled by badge identification and limited to employees registered with CDC for work with select agents, authorized by LLNL management, and enrolled in the Select Agent Human Reliability Program. (This program is discussed in Section 4.3.3) Access to individual laboratories is further controlled by an additional personal identification system to only those staff members approved for work during specific shifts. Building and laboratory access are continuously monitored. Finally, all points of access to the facility, including foundation and HVAC access point, have been physically secured against unauthorized entry. Motion detectors have also been installed in the laboratories and mechanical rooms. Within the facility's laboratories, all select agents are kept in locked freezers when not in use.

[27] The Design Basis Threat identifies credible threats that are postulated for the purpose of analyzing security programs, systems, components, equipment, information, or material.
[28] A violent activist is defined in the Design Basis Threat as an individual who commits violent acts out of opposition to Department programs for ideological or other reasons.

4.3.2 Theft and Subsequent Release of a Pathogenic Material by a Terrorist from outside LLNL

The CDC defines a bioterrorism attack as "the deliberate release of viruses, bacteria, or other germs (agents) used to cause illness or death in people, animals, or plants." The CDC recognizes that terrorists may consider using biological agents because they can be extremely difficult to detect and some may not cause illness immediately. The CDC separates bioterrorism agents into three categories depending on how easily they can be spread and the severity of effects they cause. "Category A" agents are considered the highest risk. These agents include organisms or toxins that pose the highest risk because:

- they can be easily spread or transmitted from person to person;
- they result in high death rates and have the potential for major public health impacts;
- they might cause panic and social disruption; and
- they require special actions for public health preparedness.

As noted in other sections of this EA, several Risk Group-2 and Risk Group-3 organisms which may be handled and stored in the BSL-3 facility at LLNL are Category A agents (See Appendix A.3, Table A-1). These agents are routinely handled and stored at over 250 BSL-3 facilities in the United States, and in hospitals that specialize in infectious disease treatment.

Evaluation of the potential terrorist threat that could result from the presence of pathogenic agents in the BSL-3 facility is fundamentally different from that associated with threats to nuclear materials and other hazardous materials at a nuclear facility. As opposed to materials such as spent nuclear fuel rods or special nuclear material, pathogenic agents studied in a BSL-3 facility are usually zoonotic organisms that are present in many locations and occur widely in domestic and wild animal stocks. As such, these agents are already obtainable from the environment. For instance, anthrax (*B. anthracis*, a Risk Group 2 agent) can be found near certain sheep raising operations. The organism causing Q fever, *Coxiella burnetii*, (a Risk Group 3 agent requiring BSL-3- level protection and handling procedures) also occurs in livestock animals. Coxiella burnetti organisms are found in huge numbers in birth fluids, especially amniotic fluid, placenta (up to 10^{12}/g), and fetal membranes of parturient ewes, goats, or cows (Stocker, 1955). Valley Fever in is commonly contracted in California as a result of breathing airborne dust containing *Coccidioides immitis,* a Risk Group 3 fungus readily found in soil throughout most of the Central Valley. Hantavirus is can be found in disused buildings containing wild mice feces. Plague is caused by *Yersinia pestis*, which is endemic in rodent populations throughout the Sierra Nevada mountains. The organism that causes rabbit fever, *Francisella tularensis*, derives its name from Tulare County, just one of the counties in California where the organism is prevalent. Thus, a knowledgeable terrorist could collect environmental samples of many Risk Group-2 or Risk Group-3 microorganisms and grow large quantities of them for dissemination without attacking or stealing from a government or private BSL-3 facility. This is clearly different than the analogous risk to the security of high-level radioactive spent fuel rods at a nuclear power plant, as those "source materials" are uniquely concentrated radioisotopes that are not readily obtainable or producible and cannot be "grown" to larger volume from a minute sample.

The most serious ultimate potential impacts of a terrorist act using material stolen from the LLNL BSL-3 facility would be similar to those that could occur should a terrorist collect the same organisms from infected livestock, wild animals or the locations in the environment where they occur naturally. Because these and other pathogenic organisms to be studied in the proposed BSL-3 facility are typically collected from environmental samples in the first place, they are just as accessible to a technically-competent terrorist (or group) as to any legitimate researcher. As such, the proposed action does not measurably add to the avenues already available to a terrorist for obtaining pathogenic materials or measurably increase the likelihood of this type of malicious act. Therefore, the facility is not considered an attractive target for an outside terrorist. Because a malicious individual could already obtain pathogenic material by other methods under the No-Action ("status quo") Alternative, the presence of pathogenic agents in the proposed, highly secured BSL-3 facility would not pose any new or greater risk to human health or the environment from an outside terrorist or terrorists than already accrues without operation of the BSL-3 facility at LLNL.

4.3.3 Covert Theft and Subsequent Release of a Pathogenic Material by an Insider with Access to the Facility

Although not expected to occur due to stringent personnel security and screening programs at LLNL, surreptitious removal of a small vial containing a few milligrams of a select agent, or material swabbed from a vial, could be accomplished by a motivated, technically competent insider with access to the locked storage freezers. Following theft, five essential steps need to be accomplished in order to cause large numbers of human health impacts using the stolen organism:

One must obtain the appropriate strain of the pathogen;
One must know how to handle the organism;
One must know how to grow it in a way that will produce the appropriate characteristics;
One must know how to store the culture and to produce sufficiently large quantities; and
One must know how to prepare and disperse the agent properly.

In addition, the material must be managed in a way that maintains the virulence or infectivity during production, storage, transportation and dispersion. Accomplishing these requirements was difficult even for long-term and well-funded programs in the former Soviet Union and other state-run programs.

Once offsite, the initial stolen swab or sample could be cultured to increase the amount available for use in an attack against the public. As noted above, refining the cultured product to obtain a highly dispersible form of the select agent requires a high degree of technical skill and specialized equipment. However, a dispersible form of *B. anthracis* was distributed through the U.S. Postal Service in 2001. As a result of this attack, 22 people were infected and 5 people died. Assuming a highly technically competent individual (or group) was successful in obtaining pathogenic material, and given general constraints such as access and use of a single biosafety cabinet in a general laboratory setting, it might be possible to grow quantities of dispersible *B. anthracis* similar to those released in 2001 (although it has never been officially confirmed, the New York Times reported in 2002 that the amount in one of the 4 letters was 0.871 grams

[Broad and Johnston, 2002]). This material could then be distributed through the U. S. Postal Service in local major cities such as Oakland or San Francisco to the public or elected officials.

Impacts of a Theft and Subsequent Release of a Pathogenic Material. As shown in 2001, dramatic human health impacts and economic disruption can result following the release of pathogenic materials. If a terrorist was able to obtain material from any source, refine the material to a dispersible form, and then disperse it through mechanisms such as the postal service. One could assume that tens of people could be infected and a few unsuspecting or untreated people might die. However, limitless other scenarios could be postulated involving greater amounts, different agents and different pathways such as air, water or food. Some scenarios could have greater consequences (e.g., use of larger quantities), and some of which would have lesser consequences (e.g., agent dilution and partial or complete destruction upon release to air, water, or food environments as the transport mechanism). Taken to extremes, one can even postulate scenarios with catastrophic implications. (SNL/LLNL, 2006)

Since the 2001 letter attacks, emergency response systems have been put into place to respond to a release of biological agents in the U.S. Postal Service and other means that might be used for dispersal. The Postal Service has implemented anthrax-related engineering controls and work practices that reduce the potential for an undetected re-aerosolization event. In other areas, BioWatch, a system designed to detect and locate an aerosol release of a bio-threat organism quickly and accurately enough for an effective response, is now deployed in major cities nationwide under the auspices of the U.S. Department of Homeland Security (DHS). BioWatch laboratories, including LLNL, are part of the Laboratory Response Network operated by the CDC. The continuing LLNL research support to these already-vital National Security programs/systems is one of the reasons the DOE BSL-3 facility at LLNL was proposed; it is considered essential to national defense programs administered by DHS.

Personnel and Inventory Security Measures to Counter Theft of Pathogenic Materials. In addition to physical security measures described above, and as specified in 42 CFR Part 73, persons possessing, using, or transferring select agents and toxins must first:

- successfully pass the Department of Justice Security Risk Assessment;
- be authorized by the HHS Secretary or APHIS administrator; and
- be registered with the CDC.

In addition to these federal requirements, UC also requires that personnel having access to select agents and toxins must enroll in and be approved by the LLNL Select Agent Human Reliability Program (SAHRP). SAHRP is a security reliability program that selects, trains, certifies, and monitors individuals whose work requires unescorted access to select agents and toxins. Personnel in the SAHRP are screened for physical, mental and personality disorders potentially affecting their judgment and reliability, alcohol abuse, use of illegal drugs or the abuse of legal drugs or other substances, or any other condition or circumstances that may be a security concern. In addition to SAHRP approval, personnel must be verified by Laboratory management and approved by the Responsible Official (RO) as having received the appropriate education, training, and experience for access to select agents. (As by 42 CFR Part 73, the RO is the person charged with ensuring compliance with the applicable regulations.) Access to select agents in the BSL-3 facility would be limited to a very small number (generally less than 10) of qualified and cleared employees.

CDC regulations require extensive documentation of activities involving select agents. Only personnel on LLNL's CDC registration are allowed to handle the agents. All access to select agent handling areas would be recorded. Records would be kept every time an individual enters or leaves an area with select agent samples, regardless of how brief a time or how often they do so. Freezers will have logs to record access, transfer, and use of the stored select agents. To satisfy the requirements of 42 CFR Part 73, LLNL's Responsible Official (RO) must ensure that detailed records of information necessary to give a complete accounting of all activities related to select agents or toxins access and operations are maintained. The RO reviews the inventory at least annually.

4.3.4 Overall Risk Assessment

The M & O contract for LLNL, DOE directives, and federal law require that LLNL protect the laboratory and the public against a broad range of terrorist threats and other hostile acts that may cause unacceptable impacts on national security or on the health and safety of employees, the public, or the environment. A multi-level security strategy is used, with measures applied site-wide and at the facility and personnel levels.

Across the site, extensive security measures are in place to detect and repel intrusions consistent with LLNL's mission as a nuclear weapons laboratory. The Biological Risk and Threat Assessment developed for the BSL-3 facility examined the potential vulnerabilities of the facility and its planned operations, and identified additional measures to mitigate risks. This assessment guided the development and implementation of multi-layered and robust security programs

specifically designed to mitigate threats to select agents at the facility. Personnel security policies and practices have been implemented for work with pathogenic agents at LLNL. By denying access to insiders whose backgrounds suggest they are at risk for engaging in unreliable, untrustworthy, or disloyal behavior, these measures provide an additional safeguard against the loss of pathogenic materials.

When these measures are considered together, the probability of a successful terrorist attack at the LLNL BSL-3 facility has been minimized to an extent commensurate with the potential threat. A direct assault of the facility is highly unlikely to succeed, and would have impacts bounded by the catastrophic events already evaluated in Section 4.2. Because pathogenic agents are already available in nature and at other, less secure locations, the risk of an outside terrorist acquiring pathogenic material is not significantly increased by having pathogenic material at LLNL (one of the most secure facilities in the nation). And while the theft of pathogenic materials by an insider from any bio research facility could have very serious consequences, this scenario is not expected to occur at LLNL due to human reliability programs, security procedures, and management controls at the facility and the laboratory.

NNSA believes that the potential for terrorist activity targeting the proposed BSL-3 facility does not result in measurable impacts to human health or the environment. As stated in section 1.3, operation of the facility would support NNSA's mission to "develop, demonstrate and deliver technologies and systems to improve domestic defense capabilities and, ultimately, to save lives in the event of a chemical or biological attack." The work that would be conducted in the biodefense field at the BSL-3 facility would focus on providing both the basic bioscience and the tools necessary to present bioterrorism. Work would be conducted on topics such as detection of biowarfare threats, human and microbial forensics research and applications, and presymptomatic disease detection. LLNL could use this information to develop advanced detection systems to provide early warning, identify populations at risk and contaminated areas, and facilitate prompt treatment. Researchers at the facility would attempt to develop DNA signatures and biological forensics technologies to identify infectious agents, their geographical origin, and initial sources of infection. Similar approaches are applied to human forensics, and are used in both law enforcement and intelligence-gathering activities.

4.4 REMODEL/UPGRADE ALTERNATIVE

Construction: This alternative would mainly be disruptive to the other workers in the building being remodeled or upgraded. The first step would be deconstruction of the identified laboratory. The laboratory room would first be stripped to the bare walls, floor and ceiling. Ducting, plumbing and electrical work would be done next, then new walls would be installed that could be made seamless. This work would be noisy, but periodic exceedance of the OSHA standard would be infrequent, depending upon the specific task. This activity could interrupt research in adjacent laboratories due to the additional dust, vibration, and the effect on electrical or "plumbed" service being periodically shut off. The most difficult task would be air-balancing of the BSC and the effects of activities in the adjacent laboratories.

Operations. The effects of operation would be the same as for the Proposed Action.

Decontamination and Decommissioning. The effects of D&D would be the same as for the Proposed Action.

4.5 CONSTRUCT ON-SITE ALTERNATIVE

Site Preparation and Construction. The difference between this alternative and the Proposed Action is the time it would take to construct the facility at the proposed LLNL site. This alternative would mainly be more disruptive to workers in the adjacent buildings for a longer time (many months).

Operations. The effects of operation would be the same as for the Proposed Action.

Decontamination and Decommissioning. The effects of D&D would be the same as for the Proposed Action.

4.6 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

Under this alternative, LLNL would continue contracting with other laboratories for services or laboratory space for the work proposed for the BSL-3 laboratory. This would represent no change in the level of operations at LLNL, even though mission requirements can be expected to continue to grow. There would be no change from the current conditions with respect to human health, ecological resources, transportation, waste management, utilities and infrastructure, noise, geology, soils, seismicity, visual resources, or air quality.

While not considered a “resource area” for analysis of impacts, continuing problems with the quality and security of data produced by outside laboratories could adversely affect the ability of LLNL to conduct high-quality, efficient research on BSL-3 organisms and may additionally adversely affect NNSA’s security mission capabilities.

5.0 CUMULATIVE EFFECTS

Cumulative effects on the environment result from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes them. These effects can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7). This section considers the cumulative effects resulting from the implementation of the Proposed Action and reasonably foreseeable future actions in the Building 360 Complex Area and adjacent lands.

Readers of this document should note that since this EA was originally issued, DOE has issued the *Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SWEIS, DOE/EIS-0348, DOE/EIS-0236-S3, DOE 2005). This document contains an extensive discussion of the cumulative effects of LLNL operations, which includes this facility.

LLNL Operations at the Building 360 Complex Area. No new types of operations and very few, if any, new personnel would be introduced into LLNL as a result of the Proposed Action. Land use within the Building 360 Complex Area would remain unchanged. Local traffic congestion would be unaffected by the Proposed Action since there would be no net increase expected in the number of workers for the Complex Area.

Due to the small size of the proposed facility the projected quantities of water, wastewater, and energy consumption would be insignificant relative to that used by LLNL. All workers in the proposed facility would likely be relocated from adjacent buildings and the net increases due to the new facility in these areas would be expected to be very minor.

Parking availability in the Building 360 Complex Area would change from the current configuration due to the effects of removal of parking spaces to erect the proposed new facility. However, since adjacent parking lots are existing and readily available, the Proposed Action would not significantly alter the general employee parking space availability at LLNL.

The overall visual quality within the Building 360 Complex Area would not change significantly because the new construction is in the middle of and directly adjacent to several older buildings. The minor negative effects on viewsheds of LLNL-area development and the slightly increased lighting in the night sky would be considered a minor regional effect. The Proposed Action is not expected to be a major contributor to this effect; the building would be one-story and would therefore not be visible above the building outlines of nearby structures. Additionally, the parking area and the BSL-3 facility would require little nighttime lighting and those lights required would be designed to shine downward toward the parking lot and ground surfaces.

Implementing the Proposed Action would generate noise primarily during the daytime hours during initial construction activities and during D&D. This noise generation would be mostly confined to the immediate Building 360 Complex Area and would be mostly heard only by the involved workers.

Alameda County, the City of Livermore, and LLNL have historically been in a non-attainment area for air quality with regards to criteria pollutants; but, visibility has always been excellent. Implementation of the Proposed Action is expected to have an insignificant impact on the overall air quality of the valley.

As stated in Table 3-1 (Section 3.2), there would be no Environmental Justice issues associated with the proposed facility since there would be no disproportionately higher adverse human health or environmental effects on low income or minority populations.

6.0 AGENCIES AND PERSONS CONSULTED

In the process of preparing material for this EA, DOE had discussions with various federal agencies and organizations including the CDC, NIH, General Services Agency (GSA), U.S. Department of the Army (DA), Utah Department of Environmental Quality, Colorado State University, and Lawrence Livermore National Laboratory. These contacts were made to gain an understanding about their respective experiences with BSL-3 laboratories and the operational and accident history of their own operations.

No project-specific consultation with the U.S. Fish and Wildlife Service was conducted in compliance with the *Endangered Species Act (ESA)*, as the Proposed Action and alternatives would not be expected to affect either individuals of threatened or endangered species or their critical habitat. Recent sitewide consultations under Section 7 of the ESA were conducted by the DOE in 1997 and 1998 concerning maintenance activities at LLNL. No consultation with the State Historic Preservation Office was conducted in compliance with the *National Historic Preservation Act* (16 U.S.C. § 470, 36 CFR 800.5), as the Proposed Action and alternatives would not be expected to affect any cultural resource.

7.0 REFERENCES

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