CHAPTER 2: OPERATIONS OVERVIEW OF LAWRENCE LIVERMORE NATIONAL LABORATORY

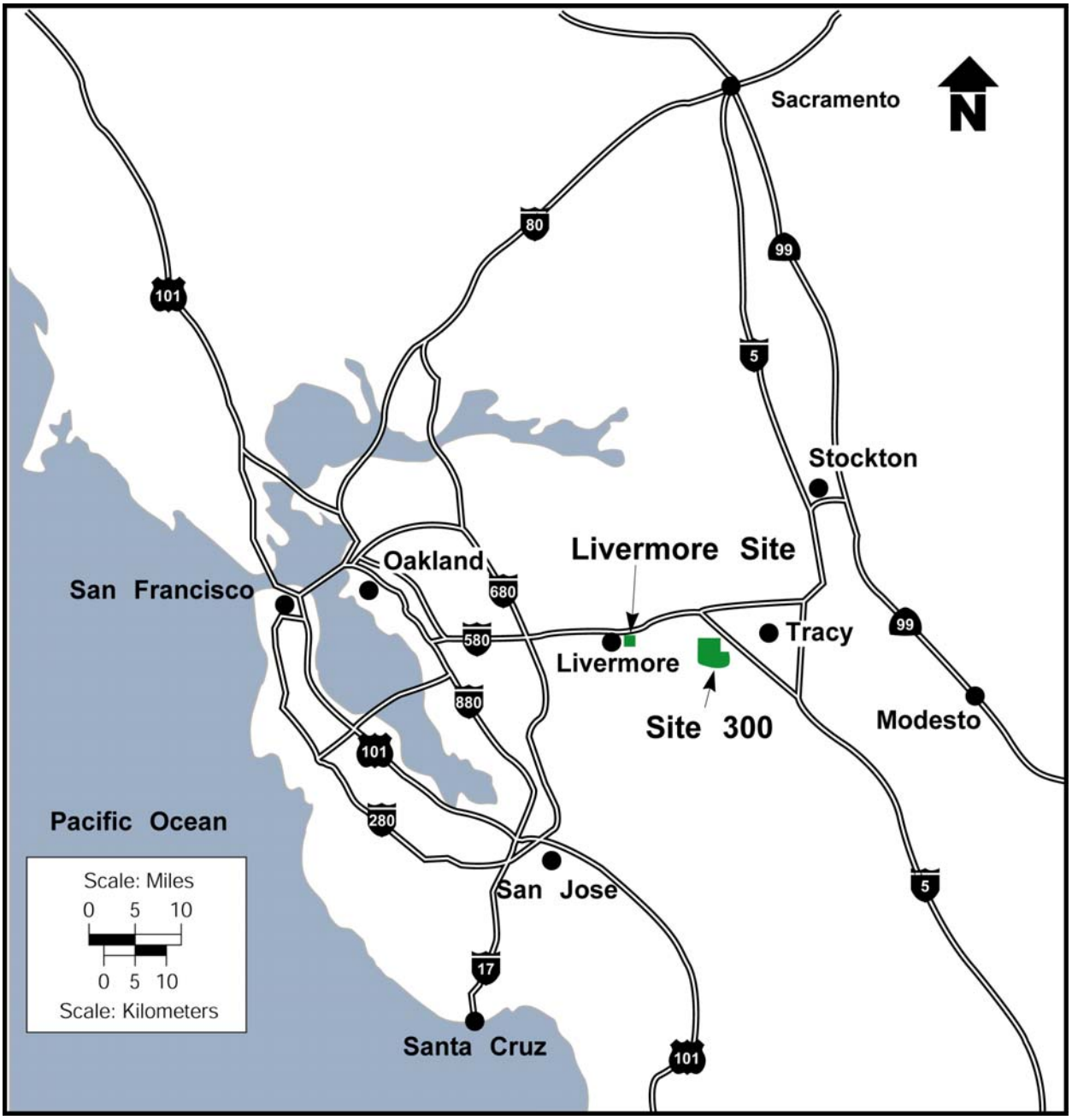
This chapter provides an overview of Lawrence Livermore National Laboratory (LLNL) operations, programs, and facilities. It begins with a brief history of LLNL and its operations, followed by a discussion of programs supported by LLNL. A description of LLNL's organization and facilities is included at the end of this chapter. Descriptions of specific facilities and their operations are summarized in this chapter. Further details of the LLNL programs may be found in Appendix A.

2.1 AN OVERVIEW OF LAWRENCE LIVERMORE NATIONAL LABORATORY

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 science and engineering. The University of California has managed the operations of LLNL since its inception for the U.S. Department of Energy (DOE). During the past five decades, LLNL has also developed advanced technologies in energy, biomedicine, and environmental science.

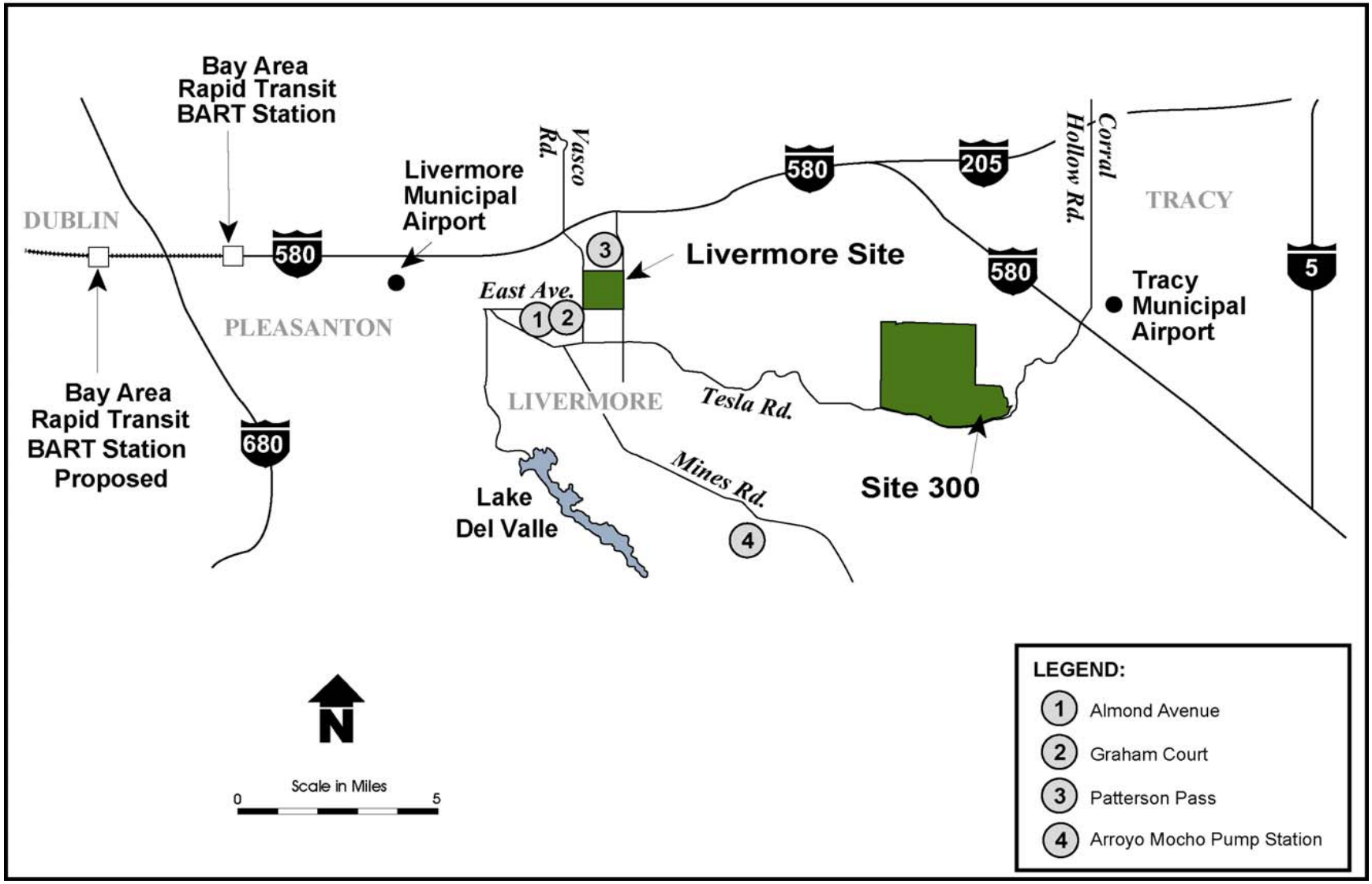
LLNL consists of two sites, the Livermore Site located in Livermore, California (Livermore Site), in Alameda County, and the Experimental Test Site (Site 300), located near Tracy, California, in San Joaquin and Alameda counties. Figures 2.1–1 and 2.1–2 show the locations of the Livermore Site, Site 300, and offsite facilities in the surrounding area. Most LLNL operations are located at the Livermore Site. LLNL also conducts limited activities at several leased properties near the Livermore Site. These include a childcare center and classrooms at the Almond Avenue site and storage facilities at Graham Court and Patterson Pass Road. Additionally, LLNL occupies land leased by the National Nuclear Security Administration (NNSA) for the Arroyo Mocho Pump Station, located 7 miles south of the Livermore Site.

The Livermore Site occupies 821 acres, 1.3 square miles, about 40 miles east of San Francisco at the southeast end of the Livermore Valley in southeastern Alameda County. The Livermore Site is located approximately 3 miles east of Livermore's central business district. Site 300 is located about 15 miles southeast of Livermore in the hills of the Diablo Range. The site covers approximately 7,000 acres, marked with rolling hills and steep ravines. As of September 2002, approximately 10,360 people worked at the Livermore Site. This total includes LLNL employees, other Federal employees, and contractor personnel. As of September 2002, approximately 240 people worked at Site 300. The base year for data in most cases was 2002; however, data from previous years were used if 2002 data were unavailable or if they provided a more conservative analysis.



Source: LLNL 2001v.

FIGURE 2.1–1.—*Livermore Site and Site 300*



Source: DOE 2003b.

FIGURE 2.1–2.—*Locations of Livermore Site, Site 300, and Offsite Facilities Relative to Surrounding Communities*

2.2 UNITED STATES DEPARTMENT OF ENERGY AND NATIONAL NUCLEAR SECURITY ADMINISTRATION PROGRAMS SUPPORTED BY THE LAWRENCE LIVERMORE NATIONAL LABORATORY

LLNL performs work in support of DOE (including NNSA); other government agencies such as the U.S. Department of Defense (DoD), U.S. Nuclear Regulatory Commission, U.S. Environmental Protection Agency, and the U.S. Department of Homeland Security; and private industry through Work-for-Others projects and interagency agreements. The majority of LLNL activities support five major DOE and NNSA programs: Defense Programs, Nuclear Nonproliferation, Environmental Management, Science, and Energy Efficiency. These programs are described below. LLNL's organization, presented in Section 2.3, is largely structured to support these programs. A more detailed description of major programs and facilities is presented in Appendix A of this *Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (LLNL SW/SPEIS).

2.2.1 Defense Programs

Defense Programs achieves national security objectives for nuclear weapons established by the President and assists in reducing global nuclear danger by planning for and maintaining a safe, secure, and reliable stockpile of nuclear weapons and associated materials, capabilities, and technologies in a safe, environmentally sound, and cost-effective manner. The core functions of Defense Programs are as follows:

- Manage the Stockpile Stewardship Program, which encompasses operations associated with maintaining, refurbishing, surveilling, and dismantling the nuclear weapons stockpile; activities associated with researching, designing, developing, simulating, modeling, and nonnuclear testing nuclear weapons; and planning, assessing, and certifying safety and reliability.

- Manage the research, development, and computer simulation facilities that maintain the safety and reliability of the nuclear weapons stockpile in the absence of underground testing, and ensure the capability for maintaining the readiness to test and develop new warheads, if required.

- Manage cooperation with other NNSA and DOE elements; external scientific, research, and development agencies; industry; and academia.

- Ensure, through close coordination with the DoD, that the materials, capabilities, and technologies are available to support the production of certified components necessary to extend the lifetime of the nuclear weapons stockpile.

2.2.2 Nuclear Nonproliferation

Nuclear Nonproliferation enhances U.S. national security through a four-pronged strategy:

- Enhancing the capability to detect weapons of mass destruction, including nuclear, chemicals and biological systems

- Preventing and reversing the proliferation of weapons of mass destruction

- Protecting or eliminating weapons and weapons-useable material or infrastructure, and redirecting excess foreign weapons expertise to civilian enterprises

- Reducing the risk of accidents in nuclear fuel cycle facilities worldwide

2.2.3 Environmental Management

Environmental management provides program policy development and guidance for assessing and restoring inactive waste sites and facilities and for waste management operations; develops and implements an aggressive applied waste research and development (R&D) program to provide innovative environmental technologies to yield permanent disposal solutions at reduced costs; and oversees the environmental restoration of contaminated facilities from various programs, once the facilities are determined to be surplus to their original mission.

2.2.4 Science

DOE's Office of Science manages programs in high-energy physics, nuclear physics, and fusion energy sciences. It also manages fundamental research programs in basic energy sciences, biological and environmental sciences, and computational science.

2.2.5 Energy Efficiency

Energy efficiency programs strengthen the Nation's energy security, environmental quality, and economic vitality through partnerships that enhance energy efficiency and productivity and bring clean, reliable, and affordable energy technologies to the marketplace.

2.3 LAWRENCE LIVERMORE NATIONAL LABORATORY PROGRAM ORGANIZATIONS

2.3.1 Director's Office

The Director's Office leads LLNL in applying its resources in computing, engineering, science, and technology to NNSA programs to maintain the U.S. nuclear weapons stockpile and reduce the international threats posed by weapons of mass destruction. The Director's Office comprises the Office of the Deputy Director for Operations, the Office of the Deputy Director for Science and Technology, and the Laboratory Executive Officer.

2.3.1.1 *Deputy Director for Operations*

Working with the institutional support organizations, the Deputy Director for Operations is responsible for all operational functions of LLNL and policies and programs to support LLNL's mission and workforce and for promoting excellence in business practices, safety assurances, and facility management in compliance with regulatory and contractual requirements.

2.3.1.2 *Deputy Director for Science and Technology*

The Deputy Director for Science and Technology is responsible for overseeing the quality of science and technology in scientific and technical program disciplines. This includes management of the Laboratory Directed Research and Development Program; the University Relations Program Office; the DoD Programs Office; and the Office of Planning, Policy, and Special Studies.

2.3.2 Defense and Nuclear Technologies

Defense and Nuclear Technologies ensures the safety, reliability, and security of the U.S. nuclear stockpile without nuclear testing; develops advanced manufacturing and materials technologies to maintain the enduring stockpile; and assures the DOE complex of the safe dismantlement of retired weapons. Multidisciplinary teams apply expertise towards the development of technologies that reduce the Nation's vulnerability to terrorist nuclear threats, enhance the conventional defense, and support other national needs (LLNL 2002a). Defense and Nuclear Technologies comprises the AX-Division, B-Division, the Nuclear Materials Technology Program, and the Weaponization Program.

2.3.2.1 *AX-Division*

The AX-Division ensures national and global security by maintaining scientific and technical competence and leadership, in the absence of nuclear testing, in all aspects of thermonuclear weapons physics, design, and operation. This involves applying theoretical, computational, and experimental physics to a wide range of problems relevant to national defense and security. Efforts focus on astrophysics, atomic and nuclear physics, computational physics, fluid dynamics and turbulence, high-energy density physics, radiation transfer, and particle transport.

2.3.2.2 *B-Division*

The B-Division integrates experimental and theoretical expertise in high explosive properties and materials science through the use of hydrodynamic testing. Extensive use will be made of the NIF when it becomes operational.

2.3.2.3 *Nuclear Materials Technology Program*

The Nuclear Materials Technology Program provides the overall management and strategic coordination for all LLNL special nuclear material and tritium program elements as well as Superblock facility operations (NMTP 1999).

2.3.2.4 *Weaponization Program*

The Weaponization Program provides support for certification and life prediction, the Stockpile Life Extension Program, and information systems. This is accomplished by providing high quality data and assessment in addition to implementing improved tools and predictive technologies to identify stockpile issues. The objective of the Weaponization Program is to support continued confidence in the safety, performance, and reliability of LLNL's weapon systems in the U.S. nuclear stockpile.

2.3.3 National Ignition Facility Programs

The NIF Programs support NNSA's Stockpile Stewardship Program mission of ensuring that the Nation's nuclear weapons remain safe, secure, and reliable. The NIF experiments will access high-energy density and fusion regimes with direct applications to stockpile stewardship, energy research, science, and astrophysics (LLNL 2001w). The NIF Programs are comprised of the NIF Project, the Laser Science and Technology Program, and the Inertial Confinement Fusion (ICF) Program.

2.3.3.1 *National Ignition Facility Project*

The NIF is a key component of NNSA's Stockpile Stewardship Program. On the NIF, up to 192 laser beams will compress small fusion targets to conditions where they will ignite and burn, allowing the study of physical processes at temperatures approaching 100 million degrees Celsius and 100 billion times atmospheric pressure. These conditions exist in the interior of stars and in nuclear weapons explosions. The experiments will help scientists sustain confidence in the nuclear weapon stockpile without nuclear tests as a unique element of NNSA's Stockpile Stewardship Program and will produce additional benefits in basic science and fusion energy.

2.3.3.2 *Laser Science and Technology Program*

The Laser Science and Technology Program provides advanced solid state laser and optics technologies to LLNL, government, and industry to support national needs. The primary activities of the Laser Science and Technology Program in recent years have been to complete laser technology development and laser component testing for the NIF project, develop advanced solid state laser systems and optical components for DoD and DOE, and address the needs of other government agencies and U.S. industry.

2.3.3.3 *Inertial Confinement Fusion Program*

The ICF Program advances research and technology development in areas of fusion target theory and design, target fabrication, target experiments, and laser and optical science and technology. The mission of the ICF Program is to execute high-energy density physics experiments for the Stockpile Stewardship Program in order to demonstrate controlled thermonuclear fusion in the laboratory. Technical capabilities provided by the ICF Program also contribute to other DOE missions, including nuclear weapons effects testing and developing inertial fusion power.

2.3.4 Nonproliferation, Arms Control, and International Security

Nonproliferation, Arms Control, and International Security provides technology, analysis, and expertise to aid the U.S. Government in preventing the spread of weapons of mass destruction and in defending the U.S. against the use of such weapons. The major programs include Proliferation Prevention and Arms Control, Proliferation Detection and Defense Systems, Counter-terrorism and Incident Response, International Assessments, and Center for Global Security Research.

2.3.4.1 *Proliferation Prevention and Arms Control Program*

This program focuses primarily on integrating treaty-monitoring technology R&D with policy analysis to support U.S.' arms control efforts. Major program areas are supporting arms control, monitoring worldwide nuclear explosions, protecting and controlling nuclear materials, disposing of fissile material, and collaborating with former Soviet Union weapons scientists.

2.3.4.2 *Proliferation Detection and Defense Systems Program*

The Proliferation Detection and Defense Systems Program concentrates on proliferation detection and reversal by integrating LLNL capabilities in weapons design to identify signatures of proliferation-related activities and to develop remote and onsite monitoring technologies to detect those signatures. Major program areas are counterproliferation analysis, proliferation detection systems, tactical systems, and missile and nuclear technology.

2.3.4.3 *Counter-terrorism and Incident Response Program*

This program focuses on the response phase, including responding to incidents involving weapons of mass destruction. LLNL develops technologies and capabilities to deal with weapons of mass destruction emergencies or terrorist incidents. This program also serves as the focus for local, national, and international emergency response to weapons of mass destruction incidents. Major program areas are nuclear threat assessment, nuclear incident response, chemical and biological detection technologies, and forensic science.

The Forensic Science Center focuses on chemical, nuclear, and explosives counter-terrorism. The center provides chemical and analytical science and support to the Nonproliferation, Arms Control, and International Security, as well as to other LLNL and national sponsors.

The multidisciplinary staff provides expertise in organic and inorganic analytical chemistry, nuclear science, biochemistry, and genetics, useful for supporting law enforcement and verifying compliance with international treaties and agreements.

2.3.4.4 *International Assessments Program*

The International Assessments Program addresses the need to avoid surprise regarding the weapons programs of foreign countries. LLNL conducts analyses and research related to the development and deployment of weapons of mass destruction by countries, states, and groups hostile to the U.S. These assessments provide important input to policy makers and diplomats as they develop strategies for U.S. responses to events affecting national and international security. Major program areas are nuclear weapons states, export control, emerging threats, counterintelligence, and proliferation concerns around the world.

2.3.4.5 *Center for Global Security Research*

The Center for Global Security Research brings scientists and technologists together with analysts and others from the policy community to study ways in which technology can enhance national and international security. This program supports independent, multidisciplinary research that considers the integration of technology in defense, arms control, nonproliferation,

and peacekeeping. Major program areas are reduction in the threats associated with weapons of mass destruction, security implications of emerging technologies, anticipation and management of threats to international security, and future roles of deterrence and military force.

2.3.5 Homeland Security Organization

LLNL announced the formation of the Homeland Security Organization on December 10, 2002 (LLNL 2002u). The Homeland Security Organization will be the center for LLNL interactions with the Federal Government's Department of Homeland Security. Initially, this organization will be responsible for those LLNL activities explicitly transferred from NNSA to this new organization. Homeland security at LLNL is divided into six programs: Chemical and Biological Countermeasures, Nuclear and Radiological Countermeasures, Systems Analysis and Studies, Information Analysis and Infrastructure Protection, Border and Transportation Security, and Emergency Preparedness and Response.

2.3.5.1 *Chemical and Biological Countermeasures Program*

This program focuses on addressing the national needs for technologies to quickly detect, identify, and mitigate the use of chemical and biological threat agents against the U.S. civilian population. The principal program is the Chemical and Biological National Security Program, within which are several notable projects, including the Biological Aerosol Sentry and Information System Project, Autonomous Pathogen Detection System, Advanced Biodetection Technology, Biological Signatures, the Forensic Science Center, in situ Chemical Sensors, and Remote Chemical Sensing.

2.3.5.2 *Nuclear and Radiological Countermeasures Program*

The Nuclear and Radiological Countermeasures Program develops technical capabilities aimed at countering the threat of terrorist use of a nuclear or radiological device in or near a U.S. population center, or from detecting and tracking nuclear material to forensic attribution in the event of a nuclear incident. Projects include nuclear emergency response, cargo container security, radiation detection, and detection and tracking systems.

2.3.5.3 *Systems Analysis and Studies Program*

This program focuses on identifying and understanding gaps in U.S. preparedness and response capabilities and the associated opportunities for technology. Systems studies are conducted to evaluate the effectiveness of alternative approaches to mitigating the damage and disruption resulting from a full range of catastrophic terrorist threats. Elements of this program include homeland security analysis, vulnerability assessment of the U.S. energy infrastructure, and outreach to operation entities.

2.3.5.4 *Information Analysis and Infrastructure Protection Program*

This program is aimed at developing tools and capabilities for gathering, manipulating, and mining vast quantities of data and information for the purpose of detecting early warnings of terrorist intentions. This program consists of the Computer Incident Advisory Center, operated as

DOE's cyber alert and warning center; the Information Operations and Assurance Center; International Assessments; and Nuclear Threat Assessment.

2.3.5.5 *Border and Transportation Security Program*

Activities in this area address opportunities for technology to enhance U.S. border and transportation security, from nuclear detection systems for maritime and air cargo and automated facial screening of airline passengers, to integrated data management systems for immigration and border control. Projects supporting this program include concrete-penetrating radar, baggage-screening technologies, and truck-stopping devices.

2.3.5.6 *Emergency Preparedness and Response Program*

This program focuses on the development of technical capabilities for minimizing the damage and recovering from any terrorist attacks. This program works with local, regional, state, and Federal first responders to ensure that the tools developed meet real-world needs. This program includes the National Atmospheric Release Advisory Center, a leader in real-time assessment of the atmospheric dispersion of radionuclides and chemical and biological agents; Joint Conflict and Tactical Simulation; and the Homeland Operational Planning System, developed in partnership with the California National Guard, for homeland security and analysis.

2.3.6 Energy and Environment

Energy and Environment performs research in water and environment, energy technology, carbon management and climate change, the national nuclear waste repository, and aspects of homeland and national security. Energy and Environment also provides discipline support in atmospheric, earth, environmental, and energy science to other LLNL programs. The six programs in Energy and Environment are described below.

2.3.6.1 *Carbon Management and Climate Change Program*

The Carbon Management and Climate Change Program includes research in the areas of climate science, the carbon cycle, carbon management, and the interrelationships between the fate and effects of carbon in the biosphere, atmosphere, ocean systems, and climate change. Research areas include the DOE Program for Climate Model Diagnosis and Intercomparison; DOE's Atmospheric Radiation Measurement Program; programs in atmospheric chemistry; climate research, especially involving the coupling of models to carbon and the increase in model resolution; and carbon management, including research into ocean carbon sequestration, geologic sequestration, and carbon monitoring.

2.3.6.2 *Energy Technology and Security Program*

The Energy Technology and Security Program conducts R&D in fossil, renewable, and nuclear energy technologies to increase the efficiency of existing energy technologies while minimizing environmental impact and developing environmentally responsible technologies.

One project is DOE's Highly Enriched Uranium (HEU) Transparency Implementation Program, which monitors the down-blending of HEU from Russian nuclear weapons to low enriched

uranium that is sold to the U.S. Examples of other projects include developing solid oxide fuel cells, reducing aerodynamic drag of heavy vehicles, researching Homogeneous Charge Compression Ignition engines, and researching the cryogenic storage of hydrogen.

2.3.6.3 *National Security Support Program*

This program supports LLNL's mission through research, development, and engineering as it relates to homeland security, weapons programs, stockpile stewardship, nonproliferation, international assessment, and defense-oriented program areas. This program identifies, coordinates, and applies science and technology in the areas of earth, atmospheric, and environmental monitoring; risk assessment; data fusion; energy propagation in complex materials; earth system modeling and simulation; and energy technologies.

2.3.6.4 *Risk and Response Management Program*

This program includes research and technology development in systems safety, systems security, natural and anthropogenic hazards, and atmospheric release assessment and modeling. This program includes Atmospheric Release Assessment Programs for predicting and assessing the dispersal of hazardous material released into the atmosphere, which also encompasses the National Atmospheric Release Advisory Center; Security and Protection Programs to enhance human vigilance, decisionmaking, and control through automation; and Risk and Safety Management, which includes performing risk and hazard assessments, evaluating packaging and transportation safety, and providing regulatory support to government agencies.

2.3.6.5 *Water and Environment Program*

This program covers R&D in water security, environmental fate and transport, environmental technologies, and environmental consequence analysis. This program includes work performed by the Center for Accelerator Mass Spectrometry; the Marshall Islands Dose Assessment and Radioecology Program, at atolls in the Pacific Ocean contaminated with nuclear fallout from earlier weapons testing; water security projects to protect the Nation's water supplies and distribution systems; projects for protection from global environmental threats; and projects addressing issues of the fate, transport, and consequences of these threats in the environment.

2.3.6.6 *Yucca Mountain Program and Repository Science Program*

This program includes materials testing and performance modeling of the storage canister and system of engineered barriers to surround radioactive waste and supports project milestones toward the repository's license application. This program also includes work on international repository initiatives.

2.3.7 Biology and Biotechnology Research Program

The Biology and Biotechnology Research Program conducts basic and applied research in the health and life sciences supporting of national needs to understand causes and mechanisms of ill health, develop biodefense capabilities for national homeland security, improve disease prevention, and lower health care costs. This program focuses on the following five scientific areas (LLNL 2002an):

- **Biodefense**—Provides the underpinning science and tools needed to combat bioterrorism and infectious disease

- **Computational and Systems Biology**—Develops a predictive, systems level understanding of biological processes by applying advanced simulation capabilities to complex experimental data

- **Genome Biology**—Increases understanding of genetic structure, function, regulation, and evolution through genome scale approaches to developing, interpreting, and displaying genetic data

- **Health Effects Genetics**—Increases understanding of the cellular and tissue effects of radiation chemical exposures through novel genomic- and biochemical-based approaches and links this understanding to risk assessments, diagnosis, and treatment

- **Molecular Biophysics**—Develops and applies tools for measuring biochemical and cellular components and processes, emphasizing data that support predictive understanding through complex simulation and modeling

2.3.8 Physics and Advanced Technologies

Physics and Advanced Technologies' (PAT's) focus areas include high-energy density physics, astrophysics, condensed matter physics, and nuclear particle and accelerator physics. Program focus areas also include fusion energy, medical technology, imaging and advanced detectors (LLNL 2002bh). The major facilities supporting experimental research include the Ultra-Short Pulse Laser Facility, a two-stage light-gas gun facility, 100-million-electron volt electron-positron linear accelerator, the Electron Beam Ion Trap Facility, and the Experimental Test Accelerator II Facility. To carry out its mission, the PAT comprises Physical Data Research, Laboratory Directed Research and Development Program, and License- and Royalty-Funded Research and Development.

2.3.8.1 *Physical Data Research Program*

The Physical Data Research Program provides validated physical data and models for the Stockpile Stewardship Program in the areas of nuclear physics, atomic physics, condensed matter/materials science, plasma physics, and the interaction of radiation with matter.

2.3.8.2 *Laboratory Directed Research and Development Program*

The Laboratory Directed Research and Development Program provides a suitable method for LLNL directors to fund projects that are creative and innovative, but that might not otherwise receive funding via the usual process. Program activities are governed by DOE O 413.2a and other NNSA Headquarters and NNSA Livermore Site guidance. Recently, responsibility for this program has been transferred to the Laboratory Science and Technology Office.

2.3.8.3 *License- and Royalty-Funded Research and Development Program*

The License- and Royalty-Funded Research and Development Program provides private funding for R&D through cooperative R&D agreements and licensing technologies developed by LLNL. Cooperative research and development agreement is an agreement between the University of California, as operator of LLNL, and one or more participants including at least one non-Federal party under which LLNL provides personnel, services facilities, equipment, or other resources towards the conduct of specified R&D.

2.3.9 Chemistry and Materials Science

Chemistry and Materials Science provides scientific and technical expertise supporting LLNL's programs, performs work for others under reimbursable contracts, and conducts original research. R&D activities include chemical analysis and characterization, advanced materials, metallurgical science and technology, surfaces and interfaces, energetic materials and chemical synthesis, and energy-related projects. Chemistry and Materials Science contains three divisions: Chemical Biology and Nuclear Science Division, Chemistry and Chemical Engineering Division, and Materials Science and Technology Division.

2.3.9.1 *Chemical Biology and Nuclear Science Division*

The Chemical Biology and Nuclear Science Division performs applied research in radiochemistry, radiation detection and spectroscopy, mass spectrometry, biochemistry, and analytical chemistry to support LLNL programs. This division also conducts fundamental research in several areas including computational biology, deoxyribonucleic acid (DNA) detection and single cell proteomics, heavy element research, noncovalent interactions among biomolecules, transport of actinide colloidal complexes in groundwater, cycling of iodine in the environment, isotopically enhanced molecular targeting, and nanophotonics.

2.3.9.2 *Chemistry and Chemical Engineering Division*

The Chemistry and Chemical Engineering Division conducts fundamental and applied research in chemistry under extreme conditions and on energetic materials and provides chemical engineering in support of national security programs. This division also provides chemistry and chemical engineering support to LLNL programs, including optics development for the NIF, high explosives and energetic materials development for the Stockpile Stewardship Program, and foreign threat assessments and capabilities for development of weapons of mass destruction.

2.3.9.3 *Materials Science and Technology Division*

The Materials Science and Technology Division conducts fundamental and applied research with a focus on materials properties and performance under extreme conditions. The division also provides metallurgy, ceramics, electrochemical processing, materials science, material characterization, surface science, solid state chemistry, and materials theory and modeling support to LLNL programs.

2.3.10 Engineering

Engineering contains two distinct disciplines: Electronics Engineering and Mechanical Engineering. Engineering also operates five technology centers.

2.3.10.1 *Electronics Engineering*

Electronics Engineering is responsible for the design and development of the core technologies needed for the development of microtechnologies, laser systems and electro-optics, pulsed-power electronics, diagnostic instrumentation, and advanced computational modeling and simulation. Electronics Engineering also provides instrumentation services, electronics fabrication, design drafting and documentation, computer systems support, and communications systems.

2.3.10.2 *Mechanical Engineering*

Mechanical Engineering provides a wide range of design, analysis, fabrication, and testing services to support LLNL programs. This group tests and evaluates engineering materials, designs and develops new experimental hardware and machine tools, fabricates parts, and inspects and assembles mechanical components.

2.3.10.3 *Engineering Technology Centers*

Engineering's five technology centers explore future innovations in computational engineering, microtechnology, precision engineering, nondestructive characterization, and complex distributed systems. The centers are responsible for the viability and growth of the core technologies each represents, including designing and building complex instruments and machines ready for production, designing and helping construct most of LLNL's unique test facilities, and conducting research in advanced, broad application technologies for application across all LLNL programs (LLNL 2003g).

2.3.11 Computation

Computation provides integrated computing and information environments, scientific visualization facilities, high-performance storage systems, multi-resolution data analysis, scalable numerical algorithms, computer applications, and information management systems in support of LLNL missions and programs. Directorate missions include providing a balanced, seamless, high-performance computing environment that scales from desktop to petaflop; design, development, and delivery of integrated information systems and multidisciplinary applications; and development and implementation of software technologies to optimize software development and maintenance (LLNL 2003h). Computation is a key partner in the execution of the Advanced Simulation and Computing Initiative (ASCI). To carry out its mission, Computation is organized into three groups.

2.3.11.1 *Integrated Computing and Communications*

The Integrated Computing and Communications group provides computing and networking environments to support stockpile stewardship computational efforts and a variety of other programs at LLNL. This group also undertakes essential computational, communication, and

computer security research required to sustain this computing environment. Divisions in this group include High Performance Systems, Science and Development, Computer Systems Support, and Networks and Services.

2.3.11.2 *Computing Applications and Research Department*

The Computing Applications and Research Department partners with other LLNL programs to develop software technologies and application codes in support of NNSA's mission in the defense, energy, and life sciences. This organization also conducts collaborative R&D in computer science, mathematics, and scientific computing focused on the long-term needs of LLNL and NNSA programs.

2.3.11.3 *Chief Information Officer*

The Chief Information Officer for the Computation Directorate provides oversight for information technology at LLNL. Of chief concern are maximizing common information technology solutions for economy of scale and uniformity of purpose, providing information technology solutions, and interacting with DOE, NNSA, and the U.S. Office of Management and Budget on regulatory issues in security, information architecture, and government initiatives.

2.4 LAWRENCE LIVERMORE NATIONAL LABORATORY INSTITUTIONAL SUPPORT ORGANIZATIONS

2.4.1 Administration and Human Resources

Administration and Human Resources is responsible for executing the policies affecting LLNL personnel and administrative support functions. The mission is to promote initiatives that develop and retain a high-quality workforce and create an environment that enhances LLNL's performance. The Directorate includes: Human Resources; Office of Strategic Initiatives and Diversity; Financial/Facility Manager; Information Technology and Projects Office; Staffing and Employment Development; Compensation, Benefits and Worklife Programs; Office of Laboratory Counsel; Public Affairs; Audit and Oversight; Office of Contract Management; and Industrial Partnerships and Commercialization.

2.4.2 Laboratory Services

Laboratory Services manages a major segment of LLNL infrastructure and provides services in the areas of administrative information systems, plant engineering, procurement and material, innovative business and information services, utilities, and telecommunications systems.

2.4.3 Safeguards and Security Organization

The Safeguards and Security Organization is responsible for protective force operations; information and personnel security, including clearances, badging, and information and security awareness; physical security systems, alarm design, installation, and maintenance; and program planning for policy, risk management, audits and inspections, order compliance, and contract performance.

2.4.4 Safety and Environmental Protection

The Safety and Environmental Protection supports LLNL programs and employees by providing resources and services to meet its objectives of environmental protection, occupational health, employee safety, emergency response, and quality assurance. Safety and Environmental Protection is divided into three departments to manage operational activities: the Environmental Protection Department, Hazards Control Department, and Health Services Department.

2.4.4.1 *Environmental Protection Department*

The Environmental Protection Department is responsible for environmental restoration, environmental monitoring, environmental regulatory compliance, and hazardous waste management.

2.4.4.2 *Hazards Control Department*

The Hazards Control Department is responsible for minimizing the risks associated with research and support activities at LLNL. This includes biological, chemical, and physical agents and radioactive and industrial hazards associated with both normal operating conditions and emergencies.

2.4.4.3 *Health Services Department*

The Health Services Department provides LLNL personnel with onsite medical treatment for urgent drop-in services, personal counseling, health risk evaluations, medical surveillance, and library services, to help each employee achieve personal health.

2.5 LAWRENCE LIVERMORE NATIONAL LABORATORY FACILITIES AND INFRASTRUCTURE

2.5.1 Existing Lawrence Livermore National Laboratory Facilities

Table 2.5.1–1 provides physical attributes of the facilities, such as gross square footage and usage, for distinguishing primary buildings. Figure 2.5.1–1 shows the major buildings and facilities at the Livermore Site. Table 2.5.1–2 provides an overview of selected facilities at Site 300.

Since 1992, a number of the LLNL facilities described in the 1992 LLNL EIS/EIR (LLNL 1992a) have changed in status. They have either been demolished, renumbered, excessed, returned to vendor, or subjected to some other status change. Figure 2.5.1–2 identifies facility changes since the 1992 LLNL EIS/EIR for the Livermore Site and Site 300, respectively (see Appendix A for a more detailed description of LLNL facilities).

2.5.2 Infrastructure

In addition to the facilities described above, LLNL operations at the Livermore Site and Site 300 are supported by a facility infrastructure that includes drainage, parking, pathways, telephones, lighting, landscaping, roads, and utilities.

TABLE 2.5.1–1.—*Overview of Major Buildings and Facilities at the Livermore Site*

Number	Facility Name	Gross ft^2	Office	Laboratory/ Research	Service/ Support	Storage	Other	Hazards		
								Chemical	Radiological	Other [a]
121	Physics and Advanced Technologies	91,145	Yes	Yes	Yes			Yes		Yes
131	Engineering	287,192	Yes	Yes	Yes	Yes		Yes	Yes	
132N	DPRF	204,559	Yes	Yes	Yes	Yes		Yes	Yes	Yes
132S	NAI/Physics	168,715	Yes	Yes	Yes	Yes		Yes	Yes	
134	Storage (part of B132S Complex)	1,284				Yes				
135	Storage (part of B132S Complex)	1,338			Yes	Yes				
141	Electronics Shop	50,927	Yes	Yes	Yes	Yes		Yes		Yes
151	Isotope Sciences Facility (Part of B151 Complex)	87,963	Yes	Yes	Yes	Yes		Yes	Yes	Yes
152	Generator House (Part of B151 Complex)	751			Yes	Yes		Yes	Yes	
153	Microfabrication Laboratory	24,967	Yes	Yes	Yes	Yes		Yes	Yes	
154	BioSecurity and Nanosciences Laboratory (part of B151 Complex)	9,504	Yes	Yes	Yes			Yes	Yes	Yes
155	Isotope Sciences Facility (Part of B151 Complex)	22,000	Yes							
161	Physics and Advanced Technologies	6,119		Yes	Yes			Yes		Yes
162	Research/Crystal Growth	19,840	Yes	Yes				Yes	Yes	Yes
165	Optics/ Development Lab	8,347	Yes	Yes				Yes	Yes	Yes
166	Development Lab	10,864		Yes	Yes	Yes		Yes	Yes	Yes
171	Development Lab	8,632		Yes		Yes		Yes	Yes	Yes
173	Welding Shop	413			Yes					Yes
174	Laser Target Research	19,360	Yes	Yes				Yes	Yes	Yes
174A	Laser Target Research	20,365		Yes				Yes	Yes	Yes
176	Shipping/Receiving	3,958	Yes		Yes	Yes		Yes		Yes

TABLE 2.5.1–1.—*Overview of Major Buildings and Facilities at the Livermore Site (continued)*

Number	Facility Name	Gross ft^2	Office	Laboratory/ Research	Service/ Support	Storage	Other	Hazards		
								Chemical	Radiological	Other [a]
179	Development Lab.	2,720		Yes				Yes		Yes
190	CAMS Facility	10,086		Yes				Yes	Yes	Yes
191	High Explosives Application Facility	120,116	Yes	Yes	Yes	Yes		Yes	Yes	Yes
194	100-MeV Accelerator LINAC Facility	42,031	Yes	Yes	Yes			Yes	Yes	Yes
197	Development Lab.	10,500		Yes	Yes			Yes		Yes
198	Physics	966		Yes		Yes		Yes		Yes
231	Development and Assembly: Engineering	131,454	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
231V	Materials Management Vault	5,426			Yes			Yes	Yes	
232	Fenced Area for Materials Management	1,200		Yes				Yes	Yes	
233	Materials Management	4,900	Yes		Yes	Yes		Yes	Yes	
235	WMRDF	88,475	Yes	Yes	Yes	Yes		Yes	Yes	Yes
239	Radiography Facility	12,517	Yes	Yes	Yes			Yes	Yes	
241	Material Science	53,935	Yes	Yes	Yes	Yes		Yes	Yes	Yes
243	Energy and Environment Research Facility	17,884	Yes	Yes	Yes	Yes		Yes	Yes	
251	Heavy Element Facility	31,809	Yes	Yes	Yes	Yes		Yes	Yes	
253	HC Department	32,276	Yes	Yes	Yes			Yes	Yes	Yes
254	Bioassay Lab	2,465		Yes				Yes	Yes	
255	Calibration Facility	21,813	Yes	Yes	Yes			Yes	Yes	Yes
261	Office	41,221	Yes	Yes	Yes	Yes		Yes		
262	Development Lab	11,976		Yes		Yes		Yes	Yes	
271	Protective Force Office	17,278	Yes			Yes				Yes

TABLE 2.5.1–1.—*Overview of Major Buildings and Facilities at the Livermore Site (continued)*

Number	Facility Name	Gross ft^2	Office	Laboratory/ Research	Service/ Support	Storage	Other	Hazards		
								Chemical	Radiological	Other [a]
272	Electro-Opt. Devel. Lab.	9,978	Yes	Yes		Yes		Yes		Yes
280 Dome	RHWM Waste TSDF	5,343		Yes		Yes		Yes	Yes	
281	HEA Labs	18,549	Yes	Yes	Yes			Yes	Yes	Yes
298	Fusion Target Fabrication	47,780	Yes	Yes	Yes			Yes	Yes	Yes
313	Dispatch Center	4,444	Yes							Yes
321	Materials Fabrication Shop	149,489	Yes		Yes			Yes	Yes	Yes
322	Plating Shop	5,822	Yes	Yes	Yes			Yes	Yes	
322A	Plating Shop Annex	340			Yes	Yes		Yes		
323	Fire Station	18,555	Yes		Yes	Yes				Yes
327	Radiography	19,052	Yes	Yes	Yes			Yes	Yes	Yes
328	Hazards Control Fire Test	372		Yes						Yes
329	Laser Weld Shop	5,214	Yes	Yes	Yes			Yes	Yes	Yes
331	Tritium Facility	28,493	Yes	Yes	Yes	Yes		Yes	Yes	
332	Plutonium Facility	104,687	Yes	Yes	Yes	Yes		Yes	Yes	
334	HETB	8,600	Yes	Yes					Yes	
341	Physics and Advanced Technology	44,322	Yes	Yes	Yes	Yes		Yes	Yes	Yes
343	Pressure Test. (West Wing Mothballed)	25,590	Yes	Yes	Yes			Yes	Yes	Yes
361	Biological Research	67,672	Yes	Yes		Yes			Yes	
362	Biological Research	3,749	Yes	Yes		Yes			Yes	
363	Biological Research	1,584		Yes					Yes	
364	Biological Research	10,951		Yes					Yes	
365	Biological Research	8,871	Yes	Yes				Yes	Yes	Yes
366	Biological Research	2,620	Yes	Yes					Yes	
368	Biological Research	1,500		Yes						Yes

TABLE 2.5.1–1.—*Overview of Major Buildings and Facilities at the Livermore Site (continued)*

Number	Facility Name	Gross ft^2	Office	Laboratory/ Research	Service/ Support	Storage	Other	Hazards		
								Chemical	Radiological	Other [a]
376	Machine Shop	1,560	Yes		Yes					Yes
377	Biological Research	4,333	Yes	Yes		Yes			Yes	
378	Environmental Radioactivity Analysis Lab	3,840	Yes	Yes		Yes		Yes	Yes	Yes
379	Gamma Spectrometry Facility	1,500		Yes				Yes	Yes	Yes
381	Laser Facility	101,598	Yes	Yes		Yes			Yes	Yes
391	ICF Laser Facility	186,594	Yes	Yes	Yes				Yes	
392	Optics Laboratory	8,401		Yes				Yes		Yes
431	Accelerator Research Center	150,366	Yes	Yes	Yes	Yes		Yes	Yes	Yes
432	Mechanical Shop-NIF	34,747	Yes	Yes	Yes	Yes		Yes	Yes	Yes
435	Corrosion Research and NIF Support	54,768	Yes	Yes	Yes	Yes	Yes	Yes		Yes
446	YMP Experimental Facility	1,730		Yes		Yes		Yes	Yes	Yes
453	Terascale Simulation Facility	253,000	Yes	Yes			Yes	Yes		Yes
511	Crafts Shop	76,552	Yes		Yes			Yes		Yes
513	RHWM Liquid Waste TSDF	5,638		Yes	Yes	Yes		Yes	Yes	
514	RHWM Liquid Waste TSDF	4,957	Yes	Yes	Yes	Yes		Yes	Yes	
518	Gas Cylinder Dock	3,270			Yes	Yes		Yes		Yes
518A	Chem Track Facility	195				Yes		Yes		Yes
519	Shop Facility / Fuel Storage	10,206	Yes		Yes	Yes		Yes		Yes
520	Pesticide Storage	400				Yes		Yes		
531	Custodians and Gardeners Shop	12,589	Yes		Yes			Yes		
581	NIF LTAB	677,757	Yes	Yes				Yes	Yes	Yes
612	RHWM Waste TSDF	11,308		Yes	Yes	Yes		Yes	Yes	
614	RHWM Waste TSDF	1,188			Yes	Yes		Yes	Yes	

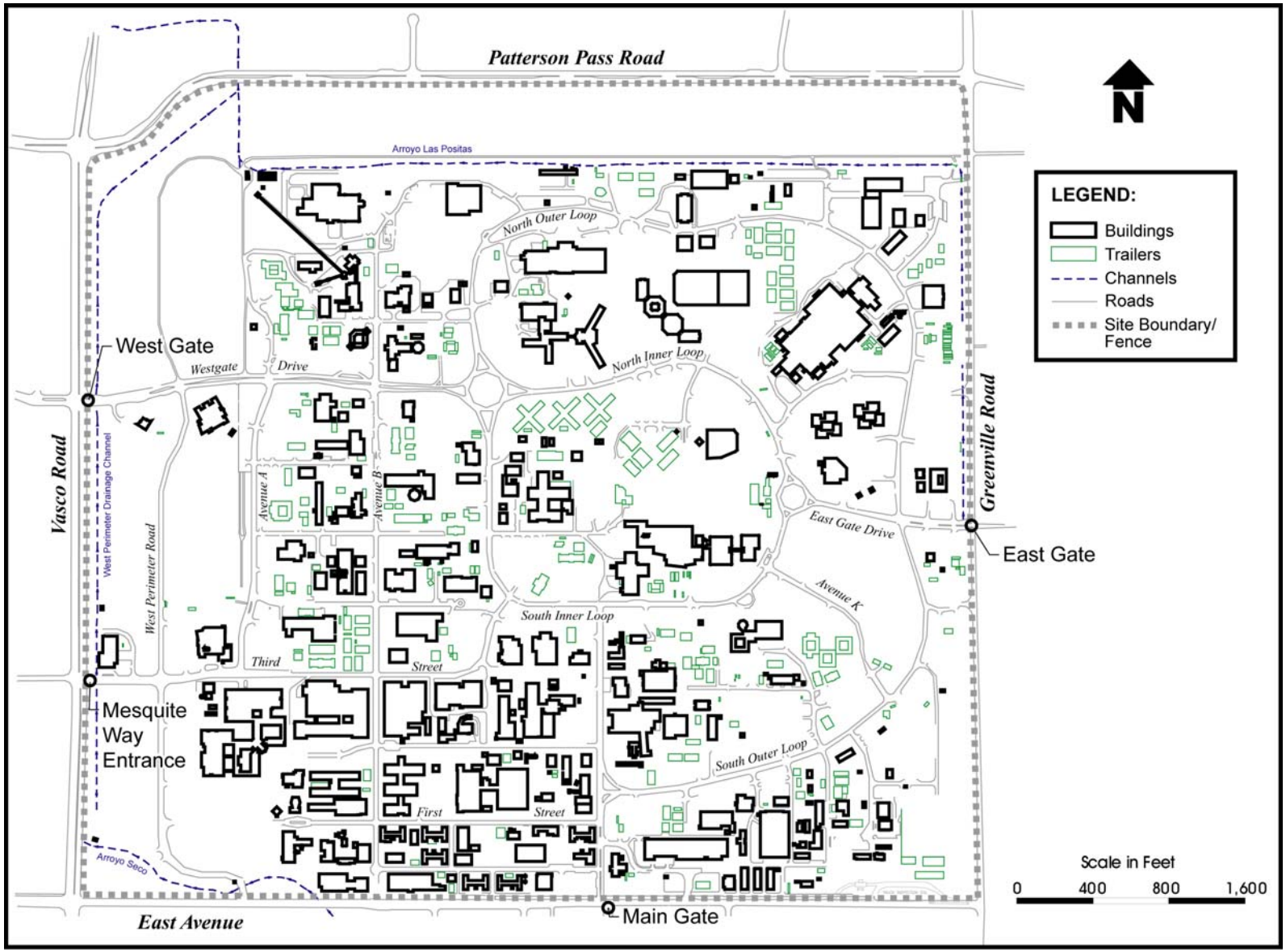
TABLE 2.5.1–1.—*Overview of Major Buildings and Facilities at the Livermore Site (continued)*

Number	Facility Name	Gross ft^2	Office	Laboratory/ Research	Service/ Support	Storage	Other	Hazards		
								Chemical	Radiological	Other [a]
621	CNG Fuel Station	824			Yes					Yes
625	RHWM Waste TSDF	4,800		Yes		Yes		Yes	Yes	
663	Health Services	24,784	Yes					Yes		Yes
681	Optics Assembly Building	46,885		Yes				Yes		Yes
693	HWM Waste Storage	9,600		Yes		Yes		Yes	Yes	
695	DWTF	33,000	Yes	Yes		Yes		Yes	Yes	
696	DWTF	10,184		Yes	Yes	Yes		Yes	Yes	
696R	RWSA	9,960				Yes			Yes	
697	EPD/RHWM Waste Storage/ Warehouse	3,780	Yes	Yes	Yes			Yes	Yes	
T1527	Bioagent Sensing and Testing Lab	3,841	Yes	Yes	Yes			Yes		Yes
T1879	Electronic Fabrication and Testing (part of 197 Complex)	11,118	Yes	Yes				Yes		Yes
T3203	Materials Fabrication (part of 321 Complex)	632			Yes			Yes	Yes	Yes
T6675	Edward Teller Education Center	3,200		Yes		Yes	Yes	Yes		Yes
NA	Container Security Testing Facility (Planned)	54,000		Yes		Yes		Yes	Yes	Yes

Source: Original.

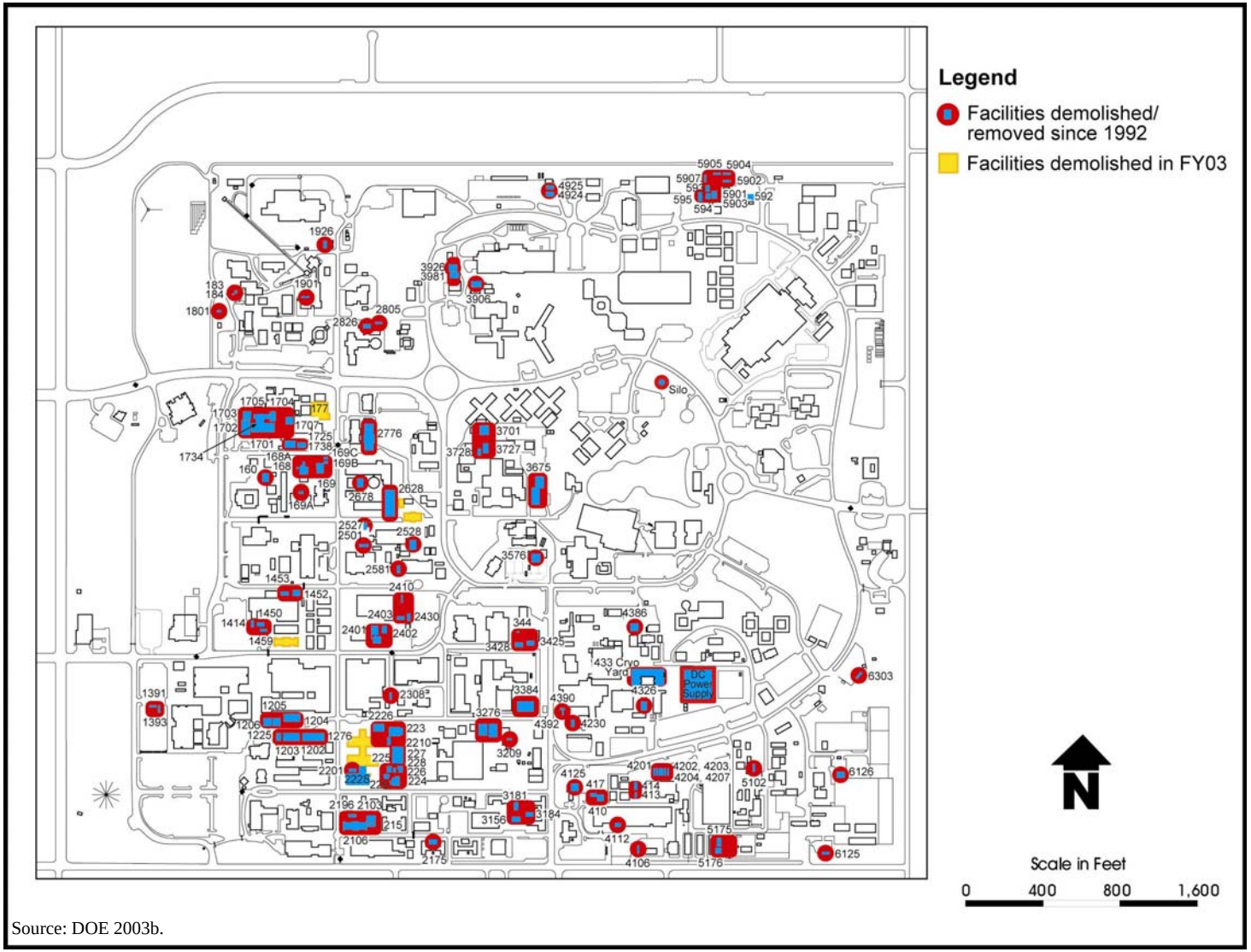
[a] Other hazards include explosives, non-ionizing radiation (accelerators, x-ray machines, lasers, etc.), biological, the storage and handling of compressed gas cylinders, and electrical hazards.

CAMS = Center of Accelerator Mass Spectrometry; CNG = compressed natural gas; DPRF = Defense Program Research Facility; DWTF = Decontamination and Waste Treatment Facility; EPD = Environmental Protection Department; ft_2 = square feet; HC = hazards control; HEA = Health and Environmental Assessment; HETB = Hardened Engineering Test Building; HWM = Hazardous Waste Management; ICF = inertial confinement fusion; LTAB = Laser and Target Area Building; LINAC = linear accelerator; MeV = million electron volts; NA = not available; NAI = Non-Proliferation, Arms Control, and International Security; NIF = National Ignition Facility; RHWM = radioactive and hazardous waste management; RWSA = Radioactive Waste Storage Area; TSDF = Treatment, Storage, and Disposal Facility; WMRDF = Weapons Materials Research and Development Facility; YMP = Yucca Mountain Project



Source: LLNL 2003o.

FIGURE 2.5.1–1.—*Livermore Site Map*



Source: DOE 2003b.

FIGURE 2.5.1–2.—*Facility Changes from the 1992 Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of the Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore at the Livermore Site*

TABLE 2.5.1–2.—*Overview of Major Buildings and Facilities at Site 300*

Facility Number	Facility Name	Gross ft^2	Office	Laboratory/ Research	Service/ Support	Storage	Other	Hazard		
								Chemical	Radiological	Other[a]
801	Contained Firing Facility	51,000	Yes	Yes	Yes			Yes	Yes	Yes
804	Low Level Waste Staging Area	3,733				Yes			Yes	
805	HE Assembly/Machining	6,802	Yes		Yes			Yes		Yes
806	HE Machining	8,314	Yes		Yes	Yes		Yes		Yes
807	HE Machining	1,575			Yes			Yes		Yes
809	HE Pressing Facility	3,005	Yes		Yes	Yes		Yes	Yes	Yes
810	HE Assembly	5,079	Yes		Yes	Yes		Yes	Yes	Yes
812	Explosives Test Laboratory	5,532		Yes	Yes	Yes		Yes	Yes	Yes
816	Explosives Waste Storage Facility	1,200				Yes		Yes		
817	HE Pressing	2,739			Yes	Yes		Yes		Yes
819	Decontamination Facility	811			Yes	Yes		Yes		
821	Chemistry Storage	454				Yes		Yes		
822	Controlled Materials Storage Vault	296				Yes		Yes	Yes	
823	LINAC Radiography	2,748	Yes		Yes			Yes	Yes	Yes
825	Chem Process (Explosives Research)	1,224		Yes				Yes	Yes	Yes
826	Chem Process (Explosives Research)	1,742	Yes	Yes				Yes	Yes	Yes
827	Chemistry Process Facility	7,744	Yes	Yes	Yes	Yes		Yes	Yes	Yes
829	Energetic Materials Processing Center	40,000	Yes	Yes	Yes	Yes		Yes	Yes	Yes
832	Materials Management Shipping/Receiving Facility	10,970	Yes		Yes	Yes		Yes	Yes	Yes
834	Thermal Test Facility	8,267		Yes		Yes		Yes	Yes	
836	Dynamic Test Facility	13,288	Yes	Yes	Yes			Yes	Yes	
845	Explosives Waste Treatment Facility	666				Yes		Yes		Yes
850	Hydrodynamic Test Facility	5,840	Yes	Yes	Yes			Yes	Yes	Yes
851	Hydrodynamic Test Facility	13,681	Yes	Yes	Yes			Yes	Yes	Yes
854A, H, V	Site 300 Response Training Facility	6,142		Yes		Yes		Yes	Yes	Yes

TABLE 2.5.1–2.—*Overview of Major Buildings and Facilities at Site 300 (continued)*

Facility Number	Facility Name	Gross ft^2	Office	Laboratory/ Research	Service/ Support	Storage	Other	Hazard		
								Chemical	Radiological	Other[a]
857	Materials Management Storage Facility	440						Yes		
882	PFD Communication Center	4,912	Yes		Yes					
883	EPD/HWM Container Storage	1,733				Yes		Yes		
889	Health Services/Badging Facility	2,709	Yes		Yes					Yes
890	Fire Station	6,752	Yes		Yes					
NA	HE Rinsewater Surface Impoundment Ponds	42,000					Yes			Yes

Source: Original.

[a] Other hazards include explosives, non-ionizing radiation (accelerators, x-ray machines, lasers, etc.), biological, the storage and handling of compressed gas cylinders, and electrical hazards.

CAMS = Center of Accelerator Mass Spectrometry; CNG = compressed natural gas; DPRF = Defense Program Research Facility; DWTF = Decontamination and Waste Treatment Facility; EPD = Environmental Protection Department; ft_2 = square feet; HC = hazards control; HEA = Health and Environmental Assessment; HETB = Hardened Engineering Test Building; HWM = Hazardous Waste Management; ICF = inertial confinement fusion; LTAB = Laser and Target Area Building; LINAC = linear accelerator; MeV = million electron volts; NA = not available; NAI = Non-Proliferation, Arms Control, and International Security; NIF = National Ignition Facility; RHWM = radioactive and hazardous waste management; RWSA = Radioactive Waste Storage Area; TSDF = Treatment, Storage, and Disposal Facility; WMRDF = Weapons Materials Research and Development Facility; YMP = Yucca Mountain Project