DOE/EIS-0547

DRAFT SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT FOR CONTINUED OPERATION OF THE LAWRENCE LIVERMORE NATIONAL LABORATORY

OCTOBER 2022

SUMMARY

National Nuclear Security Administration

COVER SHEET

RESPONSIBLE FEDERAL AGENCY: U.S. Department of Energy (DOE) / National Nuclear Security Administration (NNSA)

TITLE: *Draft Site-Wide Environmental Impact Statement for Continued Operation of the Lawrence Livermore National Laboratory* (LLNL SWEIS) (DOE/EIS-0547)

LOCATION: Livermore, California

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Abstract: The NNSA, a semi-autonomous agency within the DOE, is responsible for meeting the national security requirements established by the President and Congress to maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile. The continued operation of the Lawrence Livermore National Laboratory (LLNL) is critical to NNSA's Stockpile Stewardship and Management Program, to prevent the spread and use of nuclear weapons worldwide, and to many other areas that may impact national security and global stability.

NNSA has prepared this SWEIS to analyze the potential environmental impacts of the reasonable alternatives for continuing LLNL operations for approximately the next 15 years. This LLNL SWEIS has been prepared in accordance with Section 102(2)(C) of NEPA (42 U.S.C. §§ 4321–4347, as amended), regulations promulgated by the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] Parts 1500–1508), DOE's NEPA implementing procedures (10 CFR Part 1021), and NNSA Policy (NAP) 451.1.

This SWEIS analyzes two alternatives: (1) No-Action Alternative and (2) Proposed Action. This SWEIS also analyzes the new hybrid work environment due to increase in telework at LLNL under both alternatives. Under the No-Action Alternative, NNSA would continue current facility operations throughout LLNL in support of assigned missions. The No-Action Alternative includes the construction of new facilities; modernization/upgrade/utility projects; and decontamination, decommissioning, and demolition (DD&D) of excess and aging facilities through 2022.

The Proposed Action includes the scope of the No-Action Alternative and an increase in current facility operations or enhanced operations that may require new or modified facilities and that are reasonably foreseeable over the next 15 years. Continued re-investment would allow LLNL to meet mission deliverables and sustain science, technology, and engineering excellence to respond to future national security challenges. Approximately 75 new projects, totaling approximately 3.3 million square feet, are proposed over the period 2023–2035. Of this, 61 projects, totaling approximately 2.9 million square feet, are proposed at the Livermore Site; 14 projects, totaling approximately 385,000 square feet, are proposed at Site 300. In addition, NNSA proposes 20 types of modernization/upgrade/utility projects each involving several facilities. Under the Proposed Action, NNSA would also DD&D about 150 facilities, totaling approximately 1,170,000 square feet. NNSA is proposing operational changes that would increase the tritium emissions limits in the National Ignition Facility (Building 581) and the Tritium Facility (Building 331), decrease the administrative limit for fuels-grade-equivalent plutonium in the Superblock (Building 332), increase the administrative limits for plutonium-239 at Building 235, and revise the National Ignition Facility radioactive materials administrative limits to be consistent with DOE's Facility Hazard Categorization Standard.

Following completion of this LLNL SWEIS, NNSA intends to decide how operations will be conducted at LLNL, including construction and operation of new facilities, modification/upgrade of existing facilities and utilities, modification of operations, and/or DD&D of excess and aging facilities. These decisions will be provided in the NNSA Record of Decision (ROD).

Public Comments: DOE issued a Notice of Intent (NOI) in the *Federal Register* (85 FR 47362) on August 5, 2020, announcing a 45-day SWEIS scoping period to receive input on the preparation of this Draft SWEIS. In response to comments, NNSA extended that comment period until October 21, 2020. Comments received during that scoping period have been considered in the preparation of this Draft SWEIS. Comments on this Draft SWEIS will be accepted following publication of the U.S. Environmental Protection Agency's Notice of Availability (NOA) in the *Federal Register* for a period of 60 days and will be considered in the preparation of the Final SWEIS. Any comments received after the comment period will be considered to the extent practicable. During the public comment period for this Draft SWEIS, NNSA will hold in-person and/or online public hearings. The dates and times of those public hearings will be announced on the DOE NEPA web page and the NNSA NEPA web page (https://www.energy.gov/nepa, https://www.energy.gov/nnsa/nnsa-nepa-reading-room), as well as in local newspapers, and in Federal Register Notices of Availability. All comments received during that public comment period will be considered by NNSA in preparing the Final SWEIS.

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ABBREVIATIONS AND ACRONYMS

Alts	alternation programs
AME	Applied Materials and Engineering
CAMS	Center for Accelerator Mass Spectrometry
CAS	Central Alarm System
CBRNE	Chemical, Biological, Radiological, Nuclear, and/or Explosive
CEQ	Council on Environmental Quality
CFF	Contained Firing Facility
CFR	Code of Federal Regulations
Ci	curies
COVID-19	Coronavirus disease 2019
DARHT	Dual Axis Radiographic Hydrodynamic Test
DD&D	Decontamination, decommissioning, and demolition
DoD	United States Department of Defense
DOE	United States Department of Energy
DPF	Dense Plasma Focus
DRDF	Dynamic Radiography Development Facility
DSA	Documented Safety Analysis
ECFM	Exascale Complex Facility Modernization
EO	Executive Order
ES&H	Environment, Safety, and Health
EWSF	Explosives Waste Storage Facility
EWTF	Explosives Waste Treatment Facility
FFRDC	Federally Funded Research and Development Center
FGE	fuels-grade-equivalent
FXR	Flash x-ray
GAA	General Access Area
GBSD	Ground Based Strategic Deterrent
HC	Hazard Category
HE	high explosives
HEAF	High Explosives Applications Facility
HEMI	High Explosives Manufacturing Incubator
HPC	high performance computing
LDRD	Laboratory Directed Research and Development
LEP	Life Extension Program
LIA	Linear Induction Accelerator
LINAC	Linear Accelerator
LLESA	Livermore Laboratory Employee Services Association
LLNL or Laboratory	Lawrence Livermore National Laboratory
LLNL SWEIS or SWEIS	*Site-wide Environmental Impact Statement for Continued Operation of the Lawrence Livermore National Laboratory*
LLNS	Lawrence Livermore National Security, LLC
LOS	level-of-service
LVOC	Livermore Valley Open Campus
Mod	modification program
NAP	National Nuclear Security Administration Policy

NDE	non-destructive evaluation
NEPA	*National Environmental Policy Act*
NIF	National Ignition Facility
NIF&PS	National Ignition Facility and Photon Science Program
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NOI	Notice of Intent
NPR	Nuclear Posture Review
NPT	Nuclear Nonproliferation Treaty
NSE	Nuclear Security Enterprise
PLS	Physical and Life Sciences
R&D	Research and Development
RDT&E	research, development, test, and evaluation
RHWM	radioactive and hazardous waste management
ROD	Record of Decision
SA	Supplement Analysis
SFTF	Small Firearms Training Facility
SMRDC	Stockpile Materials R&D Center
SNL/CA	Sandia National Laboratories /California
SNM	special nuclear materials
SPEIS	Supplemental Programmatic Environmental Impact Statement
SPP	Strategic Partnership Projects
TSDF	Treatment, Storage, and Disposal Facility
Uranium-AVLIS	uranium- atomic vapor laser isotope separation
U.S.	United States
U.S.C.	United States Code
WCI	Weapons and Complex Integration
WETRC	Weapons Environmental Testing Replacement Capability
WRP	Water Reclamation Plant

CONVERSION CHART

TO CONVERT FROM U.S. CUSTOMARY INTO METRIC			TO CONVERT FROM METRIC INTO U.S. CUSTOMARY		
If you know	**Multiply by**	**To get**	**If you know**	**Multiply by**	**To get**
		Length			
inches	2.540	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.03281	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.6214	miles
		Area			
square inches	6.452	square centimeters	square centimeters	0.1550	square inches
square feet	0.09290	square meters	square meters	10.76	square feet
square yards	0.8361	square meters	square meters	1.196	square yards
acres	0.4047	hectares	hectares	2.471	acres
square miles	2.590	square kilometers	square kilometers	0.3861	square miles
		Volume			
fluid ounces	29.57	milliliters	milliliters	0.03381	fluid ounces
gallons	3.785	liters	liters	0.2642	gallons
cubic feet	0.02832	cubic meters	cubic meters	35.31	cubic feet
cubic yards	0.7646	cubic meters	cubic meters	1.308	cubic yards
		Weight			
ounces	28.35	grams	grams	0.03527	ounces
pounds	0.4536	kilograms	kilograms	2.205	pounds
short tons	0.9072	metric tons	metric tons	1.102	short tons
		Temperature			
Fahrenheit (°F)	subtract 32, then multiply by 5/9	Celsius (°C)	Celsius (°C)	multiply by 9/5, then add 32	Fahrenheit (°F)
Kelvin (K)	subtract 273.15	Celsius (°C)	Celsius (°C)	add 273.15	Kelvin (K)

Note: 1 sievert = 100 rems

METRIC PREFIXES

Prefix	Symbol	Multiplication factor
exa-	E	1,000,000,000,000,000,000 = 10^{18}
peta-	P	1,000,000,000,000,000 = 10^{15}
tera-	T	1,000,000,000,000 = 10^{12}
giga-	G	1,000,000,000 = 10^{9}
mega-	M	1,000,000 = 10^{6}
kilo-	k	1,000 = 10^{3}
deca-	D	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}

S.1 INTRODUCTION AND PURPOSE AND NEED FOR ACTION

S.1.1 INTRODUCTION

The National Nuclear Security Administration (NNSA), a semi-autonomous agency within the United States (U.S.) Department of Energy (DOE), is responsible for meeting the national security requirements established by the President and Congress to maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile (NNSA 2019a). The continued operation of Lawrence Livermore National Laboratory (LLNL or Laboratory) is critical to NNSA's Stockpile Stewardship and Management Program, to prevent the spread and use of nuclear weapons worldwide, and to many other areas that may impact national security and global stability (50 U.S.C. §2521) (*see* Section S.2 for a summary on LLNL missions and support of NNSA Core Capabilities).

Stockpile Stewardship and Management Program

The Stockpile Stewardship and Management Program enables NNSA to extend the lifespan and ensure the continued safety, reliability, and performance of nuclear weapons that have reached the end of their original design life through life extension and modification programs.

NNSA has prepared this *Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory* (DOE/EIS-0547) (LLNL SWEIS or SWEIS) to analyze the potential environmental impacts of the reasonable alternatives for continuing LLNL operations for approximately the next 15 years, through 2035. Following completion of this LLNL SWEIS, NNSA intends to decide how operations will be conducted at LLNL, including construction and operation of new facilities, modification/upgrade of existing facilities and utilities, modification of operations, and/or demolition of excess and aging facilities.

S.1.2 BACKGROUND

LLNL is a federally funded research and development center (FFRDC) managed by a public-private partnership that conducts research for the U.S. government in accordance with Title 48 *Code of Federal Regulations* Section 35.017 (48 CFR 35.017). LLNL has been in existence since 1952, employs approximately 8,000 people (employees and contractors), and has a current annual budget approaching $3 billion. Lawrence Livermore National Security, LLC (LLNS)[1] has been the management and operating contractor for LLNL since October 1, 2007. Prior to that date, LLNL was managed by the University of California.

LLNL consists of two federally owned sites: an 821-acre site in Livermore, California (Livermore Site), and a 7,000-acre experimental test site (Site 300) southeast of the Livermore Site between Livermore and Tracy, California (*see* Figures S.1-1 and S.1-2). Most LLNL operations are located at the Livermore Site, which is situated about 50 miles east of San Francisco in southeastern Alameda County. Site 300 is primarily a test site for high explosives and non-nuclear weapons components; it is located about 15 miles southeast of Livermore in the hills of the Diablo Range.

[1] The organizations which currently comprise LLNS include Bechtel National, Inc., the University of California, BWX Technologies, Inc., and Amentum.

Figure S.1-1. Location of LLNL Livermore Site and Site 300

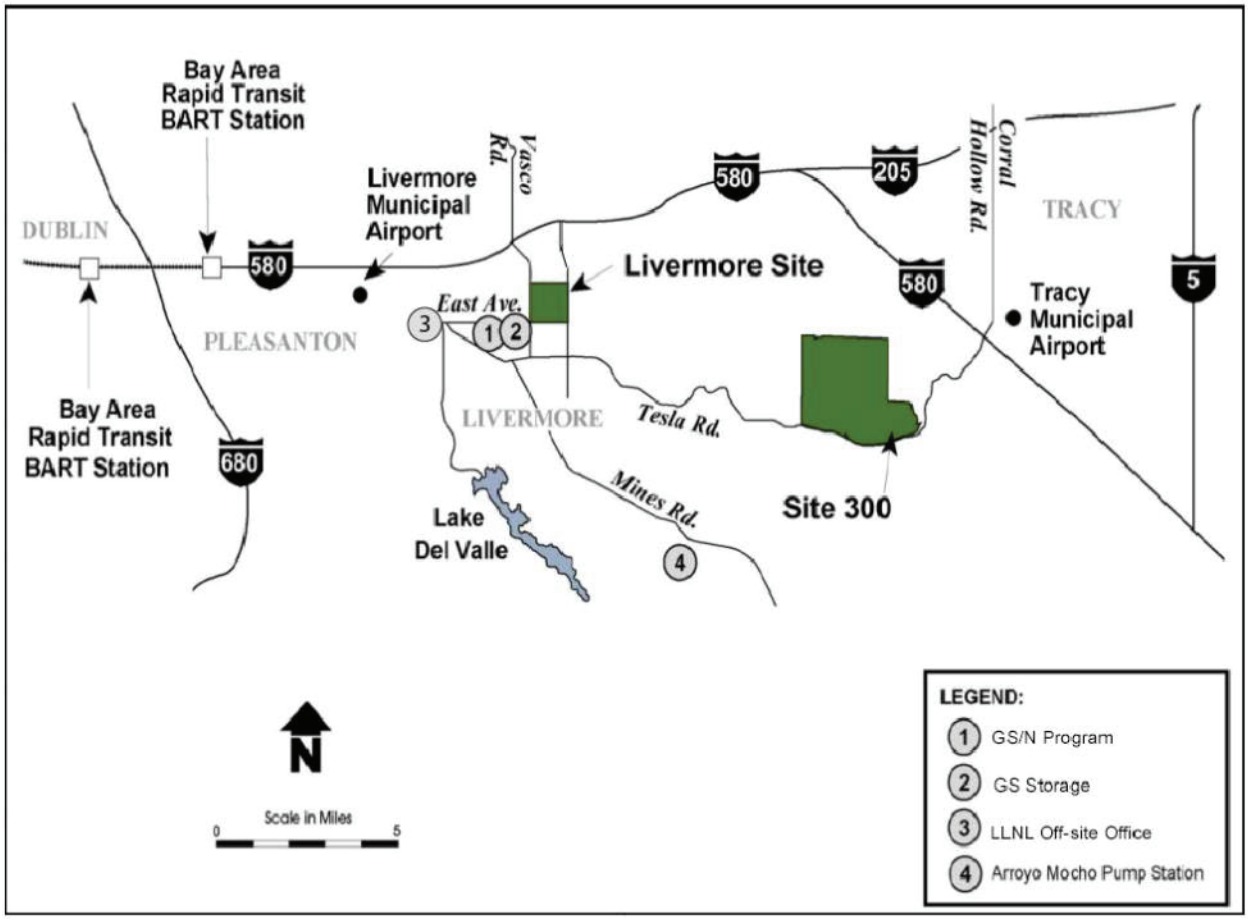


Figure S.1-2. Locations of LLNL's Livermore Site, Site 300, and Offsite Facilities Relative to Surrounding Communities

Most of Site 300 is located in San Joaquin County; the western edge of the site is in Alameda County. LLNL also conducts limited activities at several leased properties, including but not limited to storage facilities and office space. Additionally, LLNL owns and operates equipment at offsite properties including at the Arroyo Mocho Pump Station, located seven miles south of the Livermore Site, and several offsite environmental monitoring locations.

LLNL's primary responsibility is ensuring the safety, reliability, and performance of the nation's nuclear weapons stockpile. However, LLNL's mission is broader than stockpile stewardship, as dangers ranging from nuclear proliferation and terrorism to biosecurity and climate change threaten national security and global stability. Fifteen (15) years have passed since the publication of the 2005 *Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (2005 LLNL SWEIS) (NNSA 2005). Because of proposed plans for new facilities, demolition of older facilities, enhanced and modernized site utilities projects, as well as needed modifications/upgrades of existing facilities to ensure ongoing safe operations, NNSA determined that it was appropriate to update the previous 2005 LLNL SWEIS analysis. With issuance of the Notice of Intent (NOI) on August 5, 2020, NNSA determined that a new SWEIS will be prepared for LLNL (85 FR 47362).

S.1.3 PURPOSE AND NEED FOR AGENCY ACTION

NNSA is responsible for meeting the national security requirements established by the President and Congress to maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile (NNSA 2019a). This requires NNSA to maintain core competencies in nuclear weapons as well as a modern nuclear weapons infrastructure. As one of only three nuclear weapons laboratories in the U.S., LLNL contributes significantly to the core intellectual and technical competencies of the U.S. related to nuclear weapons. These competencies embody approximately 70 years of weapons knowledge and experience. LLNL maintains specific core competencies in activities associated with research, development, design, and surveillance of nuclear weapons, and supports the assessment and certification of their safety and reliability. The continued operation of LLNL is critical to NNSA's Stockpile Stewardship and Management Program and to preventing the spread and use of nuclear weapons worldwide (LLNL 2017a).

The 21st century presents a growing set of challenges to national security and global stability that are the focus of the Laboratory's national security mission. As discussed below, national security considerations and requirements provide the foundation for the expanding mission areas, and the projects proposed by NNSA to meet these challenges.

S.1.3.1 National Security Considerations and Requirements

S.1.3.1.1 *Nuclear Posture Review*

The Nuclear Posture Review (NPR) is a legislatively mandated, comprehensive review of the U.S. nuclear deterrence policy, strategy, and capabilities. NPRs have been prepared in 1994, 2002, 2010, and most recently in 2018.[2] On January 27, 2017, the President directed the Department of Defense (DoD) to conduct a new NPR (DoD 2018) to ensure a safe, secure, and effective nuclear deterrent that protects the homeland, assures allies, and, above all, deters adversaries. The Administration also emphasized both the long-term goal of eliminating nuclear weapons and the requirement that the U.S. have modern, flexible, and resilient nuclear capabilities that are safe and secure, until such a time as nuclear weapons can prudently be eliminated from the world. The 2018 NPR also states the following (DoD 2018):

- An effective, responsive, and resilient nuclear weapons infrastructure is essential to the U.S. capacity to adapt flexibly to shifting requirements. Such an infrastructure offers tangible evidence to both allies and potential adversaries of U.S. nuclear weapons capabilities, and thus contributes to deterrence, assurance, and hedging against adverse developments. It also discourages adversary interest in arms competition, supporting nonproliferation efforts worldwide.

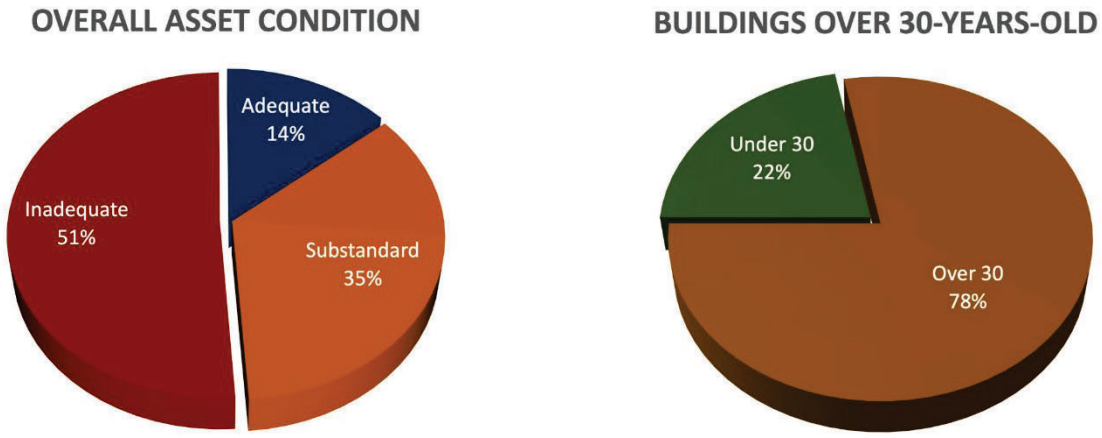
- Over the past several decades, the U.S. nuclear weapons infrastructure has suffered the effects of age and underfunding. Over half of NNSA's infrastructure is more than 40 years old and 25 percent dates back to the Manhattan Project era. All previous NPRs highlighted the need to maintain a modern nuclear weapons infrastructure, but the U.S. has fallen short

[2] The current Administration is conducting a new NPR, which is expected to be finished in 2022.

in sustaining a modern infrastructure that is resilient and has the capacity to respond to unforeseen developments. Just as nuclear forces are an affordable priority, so is a resilient and effective nuclear weapons infrastructure, without which the U.S. nuclear deterrent cannot exist.

- Recapitalizing the nuclear weapons complex of laboratories and plants is long past due; it is vital the U.S. ensure the capability to design, produce, assess, and maintain its nuclear weapons for as long as they are required.

As shown on Figure S.1-3, approximately 78 percent of LLNL facilities are more than 30 years old, and approximately 86 percent of assets (buildings and trailers) are considered substandard or inadequate (LLNL 2021a). Older buildings require more maintenance, including utility replacements and other large-scale refurbishments that are weighed against replacement with newer, more efficient, and better designed buildings. Although LLNL maintains these facilities and conducts operations safely with appropriate environmental and safety controls, there is a need to re-invest in a modern infrastructure for the future.



Source: LLNL 2021a.

Figure S.1-3. Infrastructure Conditions at LLNL

S.1.3.1.2 *Deterrent Requirements by Growing Threats*

Nuclear weapons have played, and will continue to play, a critical role in deterring nuclear attack and in preventing large-scale conventional warfare between nuclear-armed states for the foreseeable future. U.S. nuclear weapons not only defend the U.S. and our allies against conventional and nuclear threats, but also help allies avoid the need to develop their own nuclear arsenals. This, in turn, furthers global security (DoD 2018). While the U.S. has continued to reduce the number and prominence of nuclear weapons, others, including Russia and China, have moved in the opposite direction. They have added new types of nuclear capabilities to their arsenals, increased the prominence of nuclear forces in their strategies and plans, and engaged in increasingly aggressive behavior, including in outer and cyber space (DoD 2018).

An effective, responsive, and resilient Nuclear Security Enterprise offers tangible evidence to both allies and potential adversaries of U.S. nuclear weapons capabilities. This contributes to deterrence, assurance, and hedging against adverse developments. It also discourages adversary interest in arms competition (DoD 2018). LLNL supports the advancement of these capabilities.

S.1.3.1.3 *Annual Weapon Certification Process*

Consistent with the NPR, LLNL participates in the formal annual weapon certification process of the nuclear weapons stockpile. For the past 23 consecutive years, the science-based Stockpile Stewardship and Management Program has allowed DOE/NNSA and DoD to certify the safety, reliability, and performance of the U.S. nuclear weapons stockpile to the President without the use of underground nuclear explosive testing (NNSA 2019a).

LLNL is one of three nuclear weapons design agencies for NNSA. As such, LLNL is responsible for maintaining and certifying the safety, security, and reliability of three of the seven active stockpile weapon systems through the annual weapon certification process. LLNL designs the nuclear explosive package for life extension programs (LEPs), modification programs (Mods), and alteration programs (Alts), and certifies the life-extended weapons as they enter the stockpile (*see* Chapter 2 for information regarding LLNL LEPs and Mods activities). Through routine surveillance of the systems and annual stockpile assessment, weapons issues that could lead to future performance degradation, such as aging effects, are discovered and addressed. Depending on the nature of these changes, parts may need to be replaced or refurbished to meet safety, reliability, and performance requirements. In this way, LEPs, Mods, and Alts extend the weapons' lifetimes for an additional 20 to 30 years and are carried out without conducting underground nuclear explosive tests. Weapons refurbishment efforts enable NNSA to maintain the nation's nuclear deterrent without resuming the production of new weapons or underground nuclear explosive tests (LLNL 2017a).

LEPs, Mods, and Alts

LEPs: Life extension activities addressing aging and performance issues within the stockpile as a result of use beyond the originally designed component/system life span.

Mods: Change in operational capability that results from a design change that affects delivery (employment or utilization), fuzing, ballistics, or logistics.

Alts: Material change to, or a prescribed inspection of, a nuclear weapon or major assembly that does not alter its operational capability but is sufficiently important to the user (regarding assembly, maintenance, storage, or test operations) as to require controlled application and identification.

Source: DoD 2020.

The annual weapon certification process of refurbished warheads requires weapons experts to rely upon research and development (R&D) experiments, simulation capabilities, and the historical nuclear test database. Many of those capabilities are located at LLNL, and some need modernization/upgrades to improve LLNL's ability to certify the safety, reliability, and performance of the stockpile.

S.1.3.1.4 *Nonproliferation and Treaty Compliance*

NNSA missions are conducted fully consistent with current treaty obligations. The Stockpile Stewardship and Management Program is fully consistent with and supports the U.S. commitment to the Nuclear Nonproliferation Treaty (NPT) and enables the U.S. to continue the 1992

moratorium on underground nuclear explosive testing. Another benefit of the Stockpile Stewardship and Management Program is that by preventing the loss of credibility in the U.S. nuclear stockpile, it avoids creating an incentive within non-weapon states, whose security relies on the U.S. nuclear deterrent, to develop their own nuclear weapons. In addition to stockpile stewardship responsibilities, LLNL operations also support nonproliferation objectives and nuclear materials stewardship (*see* Chapter 1, Section 1.3, of this LLNL SWEIS for a more detailed discussion).

S.1.3.2 Other LLNL Program Considerations and Needs

Basic science is the engine that drives research at LLNL. Funded by a broad contingent of the scientific community—including the DOE Office of Science, academic and industry partners, and Laboratory Directed Research and Development investments—basic science ensures that LLNL's research capabilities remain at the cutting edge and that LLNL scientists and engineers are prepared to solve critical challenges across national missions. As discussed in detail in Chapter 2, these other missions include counterterrorism, energy security and long-term energy needs, advancing bioscience and biosecurity, and breakthroughs in fundamental sciences and applied technology. Additionally, LLNL supports other government organizations and science and industry through the transfer of technology (LLNL 2017a).

Much of the same infrastructure used to support the national security missions supports other LLNL program missions. Consequently, the effects of age and lack of infrastructure recapitalization have resulted in a similar need for facility and infrastructure investments.

S.1.3.3 Purposes to be Achieved by the Proposed Action

Nuclear dangers persist, and in many ways, are growing. Through the Stockpile Stewardship and Management Program, NNSA will continue to extend the stockpile life of aging U.S. nuclear weapons and certify their safety, reliability, and performance. Over the next 15 years, one of LLNL's primary responsibilities will be to continue to support LEPs and Mods, which extend the service life and enhance the safety, security, and reliability of nuclear weapons. One such project is the W80-4 LEP, which involves refurbishing the existing W80 warhead, which will be paired with a new cruise missile that is being developed in parallel by the U.S. Air Force. This would represent the first life-extended warhead to be implemented in a new delivery system since the start of the Stockpile Stewardship and Management Program more than 25 years ago (LLNL 2020a). The W87-1 Modification Program (W87-1 Mod) will be the second program to use a new delivery system, Sentinel, formerly known as the Ground Based Strategic Deterrent (GBSD). The Sentinel is the replacement for the Minuteman III. Programs like the W80-4 LEP and the W87-1 Mod require the full array of NNSA's computational, experimental, and manufacturing capabilities to meet all the prototyping, proof-of-concept testing, and certification requirements.

Stemming nuclear proliferation is also a top national priority. LLNL's nonproliferation program supports NNSA by providing expertise pertaining to weapons of mass destruction worldwide and leadership in advancing technologies to monitor, detect, and limit or prevent the proliferation of nuclear materials and technology. The goal of the program is to prevent proliferation and reduce the global risk posed by inadequately secured and/or noncompliant development of chemical,

biological, radiological, nuclear and explosive (CBRNE) materials by both State and non-State actors. The program also includes activities to reduce the risk of cybersecurity.

LLNL is home to many key facilities that provide essential support to NNSA missions and enable LLNL to pursue many strategic partnership programs that meet a wide range of national security needs. Several LLNL facilities are flagships for stockpile stewardship, including the Livermore Computing Center, the National Ignition Facility (NIF), the High Explosives Applications Facility (HEAF), the Superblock facilities, and Site 300's Contained Firing Facility (CFF) (LLNL 2017a). As an example of Stockpile Stewardship and Management Program activities at LLNL facilities, hydrodynamic experiments fired in the CFF supported down-select decisions for the W80-4 LEP (LLNL 2019a).

As discussed in Section S.1.3.1.1, more than half of the LLNL operating buildings are considered substandard or inadequate to meet future mission requirements. The deterioration of assets presents program and operational risks in meeting national security requirements and other mission needs, attracting and maintaining a high-quality workforce, and meeting regulatory requirements (LLNL 2017a). The Proposed Action and alternatives represent an investment in the facilities and infrastructure that would enable LLNL to successfully meet national security requirements and other mission needs. The net effect of the Proposed Action would increase LLNL's footprint, improve efficiency, and enhance the safety of required operations.

S.1.4 PROPOSED ACTION, ALTERNATIVES, AND SWEIS SCOPE

This LLNL SWEIS has been prepared in accordance with Section 102(2)(C) of the *National Environmental Policy Act* (NEPA) (42 U.S.C. §§ 4321–4347, as amended), regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500–1508),[3] DOE's NEPA implementing procedures (10 CFR Part 1021) and NNSA Policy (NAP) 451.1. This SWEIS analyzes two alternatives: (1) No-Action Alternative and (2) Proposed Action. In addition, the SWEIS also analyzes the new hybrid work environment due to increase in telework at LLNL under both alternatives. A brief description of the alternatives is presented below. Section S.3 provides a more detailed description of the alternatives.

Under the No-Action Alternative, NNSA would continue current facility operations throughout LLNL in support of assigned missions. It is important to note that effects of age and the absence of adequate infrastructure recapitalization have resulted in a need for facility and infrastructure investments. NEPA regulations require analysis of the No-Action Alternative to provide a benchmark for comparison with environmental effects of the other alternatives. The No-Action Alternative includes the programs and activities described in Chapter 2 and Chapter 4, and those activities for which NEPA review is already completed or underway.

The programmatic context for the Proposed Action is the continued support of existing programs, and the development of additional projects that would be needed to meet DOE/NNSA current and future mission requirements. The Proposed Action includes the scope of the No-Action

[3] On July 16, 2020, the CEQ issued a final rule to update its regulations for federal agencies to implement NEPA (85 FR 43304). The effective date for the new regulations is September 14, 2020. Because this SWEIS was initiated prior to that effective date, this SWEIS has been prepared in accordance with the CEQ regulations dated 1978, as amended in 1986 and 2005.

Alternative and an increase in current facility operations or enhanced operations that may require new or modified facilities and that are reasonably foreseeable over the next 15 years. Continued re-investment would allow LLNL to meet mission deliverables and sustain science, technology, and engineering excellence to respond to future national security challenges. In addition to ongoing missions and programs, NNSA has identified four categories of actions associated with the Proposed Action: (1) New Facility Construction Projects; (2) Modernization/Upgrade/Utility Projects; (3) Operational Changes; and (4) Decontamination, Decommissioning, and Demolition (DD&D) Projects. Each of these categories of actions is described in Section S.3.

This SWEIS presents the direct, indirect, and cumulative impacts associated with the No-Action Alternative and the Proposed Action. Methodologies for the resource analyses are described in Appendix B. Because the Proposed Action has the potential to impact floodplains and wetlands, NNSA has also prepared a floodplain and wetlands assessment (Appendix E of this LLNL SWEIS) concurrently with this SWEIS. That assessment demonstrates NNSA's efforts to avoid, as much as possible, adverse impacts to floodplains and wetlands as directed by Executive Order (EO) 11988, "Floodplain Management," and EO 11990, "Protection of Wetlands." That assessment was prepared in accordance with 10 CFR 1022, "Compliance with Floodplain and Wetlands Environmental Review Requirements."

Elements of the Proposed Action

- Ongoing missions and programs;
- New facility construction projects;
- Modernization/upgrade/utility projects;
- Operational changes; and
- Decontamination, decommissioning, and demolition projects.

S.1.5 PUBLIC PARTICIPATION PROCESS

Figure S.1-4 depicts the NEPA process. The process includes two opportunities in which NNSA specifically requests public involvement: the scoping process and the public comment period for the Draft SWEIS. Additionally, after the Final SWEIS is issued, there is a 30-day waiting period during which the public can provide additional input. Scoping is a process in which the public and stakeholders provide comments directly to the federal agency on the scope of an EIS. This process begins with the publication of an NOI in the *Federal Register*. On August 5, 2020, NNSA published a NOI to prepare this LLNL SWEIS (85 FR 47362) and announced a 45-day SWEIS scoping period that was scheduled to end on September 21, 2020. In response to public comments, NNSA extended the comment period until October 21, 2020.

Due to recent health concerns associated with the Coronavirus Disease 2019 (COVID-19), NNSA elected to hold online scoping meetings instead of in-person meetings. That approach allowed NNSA to reach a broader audience with the same presentation. Online NEPA meetings have previously been implemented within DOE and other federal agencies and are consistent with Council on Environmental Quality (CEQ) regulations and/or DOE NEPA implementing procedures.

In addition to online scoping meetings, NNSA provided other methods (i.e., email or postal mail) for submitting comments on the SWEIS scope. NNSA held the first online scoping meeting on September 2, 2020, to discuss the SWEIS and to receive comments on the potential scope. In response to public comments, NNSA held a second online scoping meeting on October 5, 2020.

A court reporter provided a transcript of the comments made at the online scoping meetings. Twelve people spoke at the first scoping meeting and five people spoke at the second meeting. In addition to the oral comments made at the scoping meetings, NNSA received 116 documents with comments. NNSA considered all comments received during the scoping process for this SWEIS, including comments received after the close of the comment period. Comments were systematically reviewed by NNSA. Where possible, comments on similar or related topics were grouped under comment issue categories as a means of summarizing the comments. The comment issue categories were used to identify specific issues. Table 1-1 in Chapter 1 provides a summary of the comments received during the public scoping process. All comments were considered in preparing this Draft SWEIS. The transcripts from the scoping meetings and all comment documents received are included in the Administrative Record for this SWEIS.

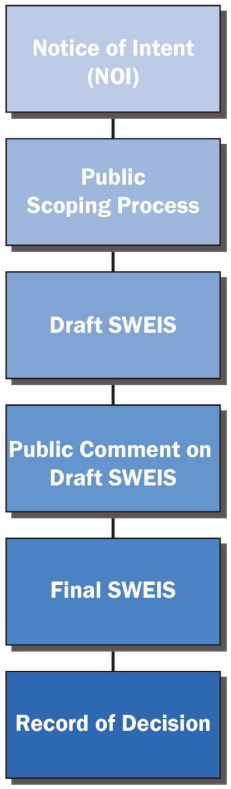


Figure S.1-4. NEPA Process

During the public comment period for this Draft SWEIS, NNSA will hold in-person and/or online public hearings. The dates and times of those public hearings will be announced on the DOE NEPA web page and the NNSA NEPA web page (https://www.energy.gov/nepa, https://www.energy.gov/nnsa/nnsa-nepa-reading-room), as well as in local newspapers, and in Federal Register Notices of Availability. All comments received during that public comment period will be considered by NNSA in preparing the Final SWEIS.

S.2 U.S. DEPARTMENT OF ENERGY AND NATIONAL NUCLEAR SECURITY ADMINISTRATION CAPABILITIES SUPPORTED BY THE LAWRENCE LIVERMORE NATIONAL LABORATORY ACTION

S.2.1 LLNL ORGANIZATIONAL STRUCTURE

The LLNL organizational structure is shown in Figure S.2-1. As described in this section, LLNL employs a highly matrixed management structure to support the Laboratory's missions and programmatic objectives. The major program areas are managed within one of three Principal Directorates (Global Security, Weapons and Complex Integration, and NIF and Photon Science) with technical discipline capabilities provided by the three scientific organizations (Computing, Engineering, and Physical and Life Sciences). DoD activities are supported by the three major program areas and coordinated through the Office of Defense Coordination in the Laboratory Director's Office. Operations and Business functions are supported by a fourth organizational Principal Directorate, with additional functionality provided and managed by the Deputy Director. The Operations and Business Principal Directorate is responsible for administrative, business, and operations which are broadly applied across the Laboratory. Environment, Safety, and Health (ES&H) and the Security Organization are also managed by the Operations and Business Principal Directorate. Integration and oversight of all basic LLNL science and technology (including the Laboratory Directed Research and Development [LDRD] program) are managed by the Deputy Director for Science and Technology.

S.2.2 LLNL MAJOR PROGRAMS

A summary of the major programs at LLNL is described below. More detailed discussions are provided in Chapter 2 of this SWEIS.

S.2.2.1 Weapons and Complex Integration Program

The NNSA Weapons Program provides for continued maintenance and investment in the NNSA Nuclear Security Enterprise (NSE) to be more responsive and resilient. A key priority at LLNL is to support NNSA's production capability and capacity to produce necessary warhead components. This is reflected in this SWEIS. The Weapons and Complex Integration (WCI) Program works to ensure that the nation's nuclear deterrent remains safe, secure, and reliable. The Program accomplishes this through the NNSA Stockpile Stewardship and Management Program, an ongoing effort to develop and apply a science-based fundamental understanding to the assessment and certification of nuclear weapons, enhanced warhead surveillance tools that detect the onset of problems, and advanced manufacturing capabilities that produce critical components. Essential to this work is the use of high performance computational capabilities and advanced experimental facilities.

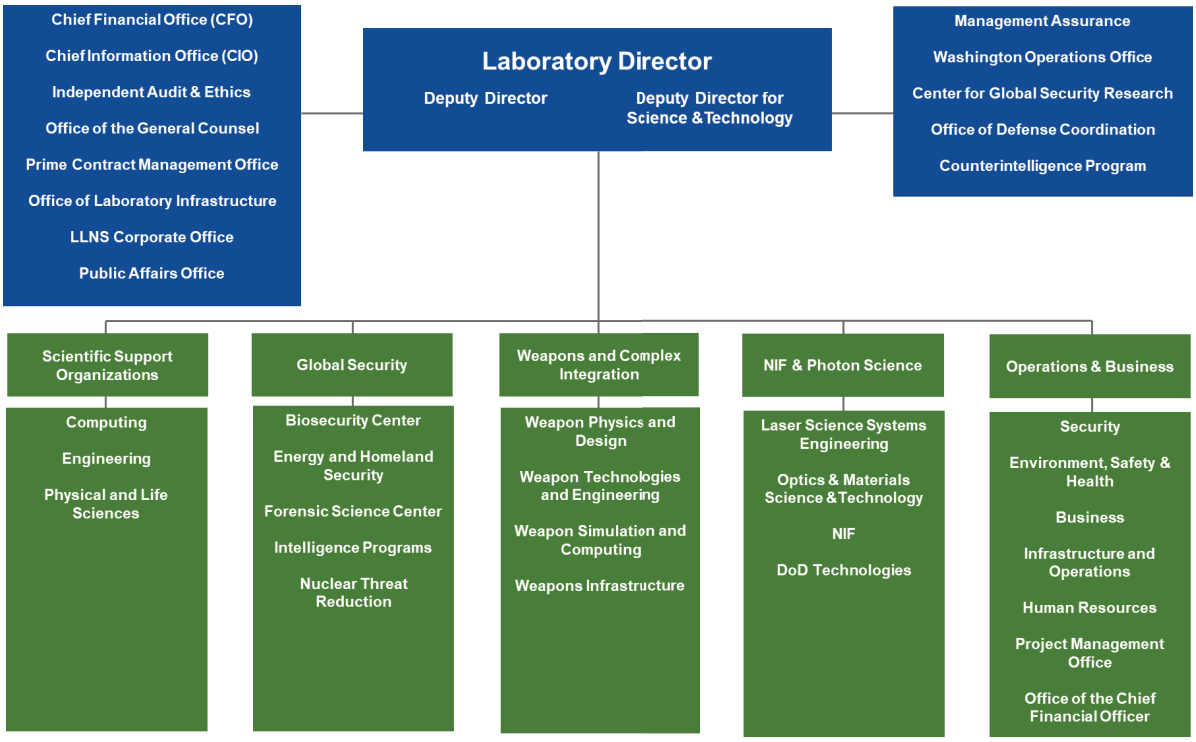


Figure S.2-1. LLNL Organization Chart 2022

S.2.2.2 National Ignition Facility and Photon Science Program

The NIF and Photon Science (NIF&PS) Program is an important national scientific resource that uses advanced lasers to research materials at temperatures and pressures that otherwise would only exist in the cores of stars, giant planets, and inside nuclear weapons explosions. NIF&PS's primary purpose is assuring viability of the nation's nuclear deterrent as part of the NNSA Stockpile Stewardship and Management Program. With the most powerful laser in the world, NIF&PS also supports national security research and discovery science working with other DOE national laboratories, the Department of Defense (DoD), and academia.

S.2.2.3 Global Security

The Global Security Program supports a broad range of national security missions for a wide sponsor base, which includes DOE/NNSA, as well as other federal, state, and local agencies. This includes R&D support for counterterrorism, nonproliferation, intelligence, and energy security. LLNL provides technical and programmatic support to help prevent and mitigate catastrophic incidents arising from Chemical, Biological, Radiological, Nuclear, and/or Explosive (CBRNE) materials. LLNL's Intelligence Program delivers comprehensive analysis, policy, and operational support in areas where technology R&D are critical to national strategic priorities ranging from combating weapons of mass destruction and cybersecurity to space and other emerging and disruptive technologies. Additionally, the Global Security Program advances the nation's energy security through innovative science and technology solutions, while understanding and reducing their environmental impact.

S.2.3 LLNL Technical Discipline Support Organizations

S.2.3.1 Engineering

The Engineering Directorate creates and applies engineering knowledge to advance national security and support the key mission areas of the Laboratory. Since LLNL's founding, applied science and engineering has been the focus to advance technology from science to design, to prototype development, and testing. Engineering at LLNL relies on multidisciplinary collaboration to achieve breakthroughs in fields vital to national security, such as nuclear engineering, materials engineering and manufacturing, bioengineering, data analytics, machine learning, sensing, and autonomous systems.

S.2.3.2 Physical and Life Sciences

The Physical and Life Sciences (PLS) Directorate anticipates and delivers essential scientific expertise and technology to support the Laboratory's national security and research programs. PLS researchers are leaders in a wide range of disciplines and use the latest models, capabilities, and technologies to tackle large and complex scientific challenges. The PLS Directorate combines unique Laboratory capabilities in measurement science, simulation, and information science to find solutions for national security problems, and to advance the scientific foundations of the Laboratory. Among the many science and technology areas that PLS actively pursues are six core scientific research areas: (1) atmospheric, earth and energy science, (2) biosciences and biotechnology, (3) nuclear and chemical sciences, (4) high energy density science, (5) advanced materials science, and (6) modeling and simulation.

S.2.3.3 Computing

Since LLNL's creation in 1952, computing has been essential to mission related R&D, basic science and technology, and supporting operations. The Computing Directorate has pioneered the development of computational tools and their application to complex scientific and engineering problems. Computing develops and deploys the world-class, next-generation machines and computational science expertise that enable the science and engineering critical to NNSA national security missions. This organization designs, develops, and deploys high-performance computing (HPC) capabilities to advance all the programmatic goals at LLNL under the direction of the Weapons Simulation and Computing Program in WCI. LLNL is currently home to some of the world's most powerful supercomputers.

S.2.4 LLNL Capabilities and Supporting Infrastructure

The missions of the Laboratory represent an unprecedented challenge, requiring rigorous application of the scientific method to further the understanding of weapons phenomena, assess the condition of weapons, and pursue programs to extend the stockpile life of aging systems. The process of scientific and technical innovation must be supported by a viable and sustained capability and infrastructure foundation. LLNL's defining purpose is to sustain confidence in, and to maintain the U.S. strategic deterrent, as well as enhance national security. LLNL continues its strong tradition of scientific and technical excellence—anticipating, innovating, and delivering solutions for the nation's most challenging problems. NNSA has established infrastructure

capability requirements to be executed by LLNL, as shown in Table S.2-1, along with the LLNL infrastructure associated with each requirement.

Table S.2-1. Definitions of LLNL Assets Supporting NNSA Infrastructure Capabilities

NNSA Infrastructure Capabilities	LLNL Assets Associated with NNSA Capabilities
Design and Certification	Weapons engineering, hydrodynamics, radiochemistry, and surveillance.
Tests and Experiments	Environmental tests, high energy density physics, radiography, radiation effects, subcritical experiments, material tests, and flight tests.
Simulation	Simulation, codes and models and high-performance computing.
Plutonium, enriched Uranium, depleted Uranium, Tritium, and Lithium	Strategic Defense Materials (including Special Nuclear Materials) infrastructure and capabilities, including assets for R&D, waste, and storage.
High Explosives	Infrastructure for development and testing of highly energetic materials, including assets for R&D, waste, and storage.
Non-Nuclear Components	Radiation hardened microelectronics, power sources, neutron generators, advanced manufacturing, manufacturing R&D, and multiple non-nuclear components.
IT/Communications	Information technology and voice and data services, including assets for data centers, communication systems, towers, and switching stations.
Security	Physical security of sites, including fencing, towers, ranges, guard houses, and security lights.
Mission Enabling Infrastructure	Power, water, emergency services, office and laboratory, roads and parking, storage, maintenance shops, and waste management.
Global Security	Counterterrorism and counterproliferation, nonproliferation, and incident and emergency response.
Strategic Partnership Projects	Work for federal agencies and non-federal entities that are outside of DOE and NNSA and involve broader national security, energy security, and scientific development missions.

Source: LLNL 2019b.

Figure S.2-2 presents a high-level display of facility layouts at the Livermore Site. Table S.2-2 and Table S.2-3 identify key buildings/facilities utilized by the Laboratory at the Livermore Site and Site 300, respectively, to accomplish its missions. Notable facilities are shown on Figure S.2-3 (Livermore Site) and Figure S.2-4 (Site 300).

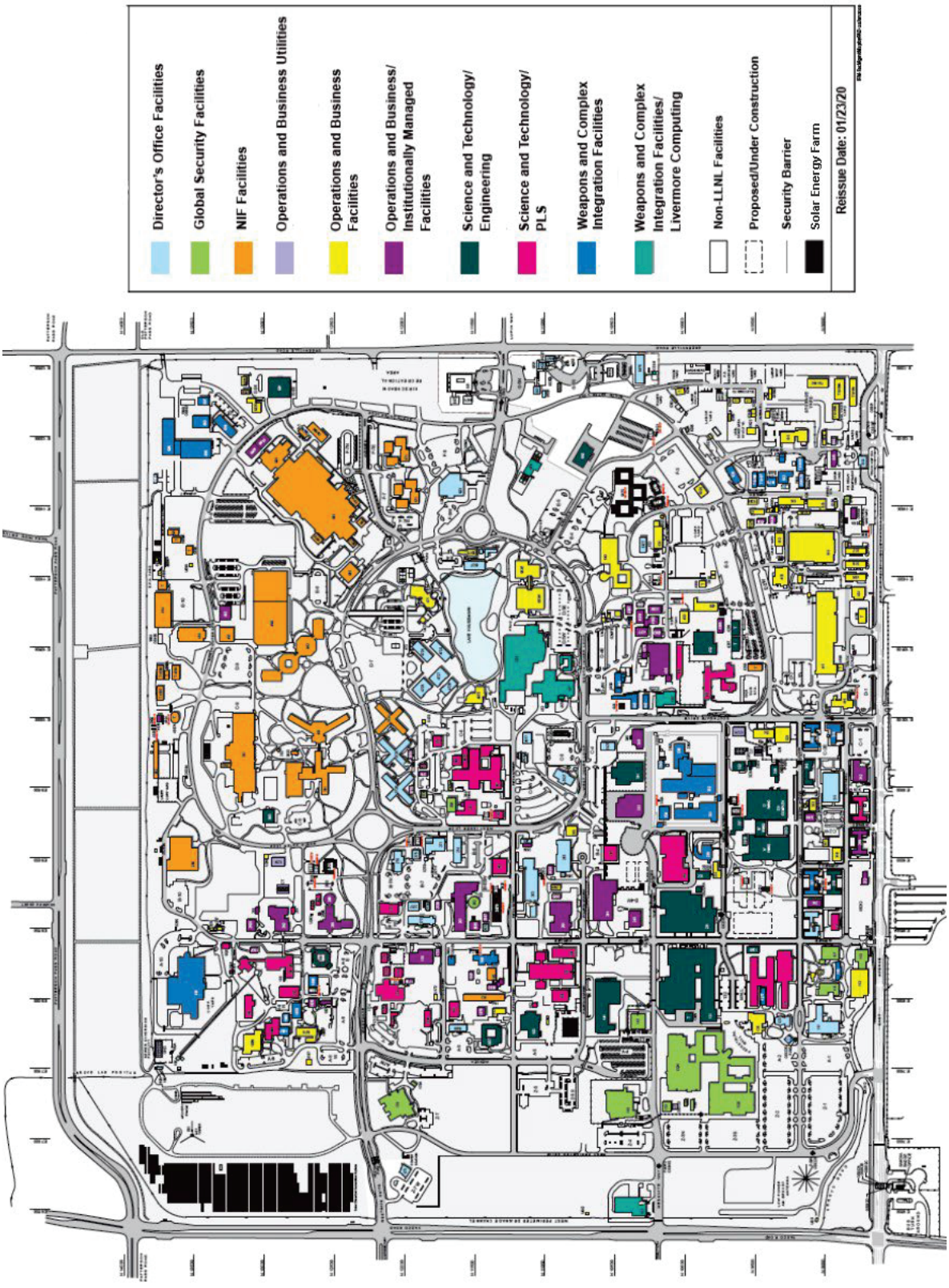


Figure S.2-2. Top View of Existing Facilities at the Livermore Site

Table S.2-2. Overview of Key Facilities at the Livermore Site

Facility Number	Facility Name	Gross Square Feet	NNSA Capability	Lab/ Research	Office/ Service/ Support	Hazards		
						Chemical	Radiological	Other[a]
131	Weapons Engineering	287,192	Design and Certification	Yes	Yes	Yes	Yes	Yes
132N	Defense Programs Research Facility	204,146	Global Security	Yes	Yes	Yes	Yes	Yes
132S	Global Security Research Facility	172,104	Global Security	Yes	Yes	Yes	Yes	Yes
141	Engineering Tech Development	47,342	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
151 & 152	Analytical and Nuclear Chemistry Facility and Storage	96,030 (751)	Design and Certification	Yes	Yes	Yes	Yes	Yes
153	Microfabrication Laboratory	25,976	Non-Nuclear Components	Yes	Yes	Yes	Yes	Yes
154	Analytical and Radiochemistry Laboratory (part of B151 Complex)	9,138	Design and Certification	Yes		Yes	Yes	Yes
162 & 165	Crystal Growth and Optics/Development Labs	29,095	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
166	Development Lab	13,266	Plutonium	Yes		Yes	Yes	Yes
170	National Atmospheric Release Advisory Center	43,760	Strategic Partnership Projects		Yes			
174	Jupiter Laser Facility	19,437	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
190	Center for Accelerator Mass Spectrometry Lab Facility	10,252	Design and Certification	Yes		Yes	Yes	Yes
191	High Explosives Application Facility	121,031	High Explosives	Yes	Yes	Yes	Yes	Yes
194	Accelerator Tunnel Complex	41,544	Design and Certification	Yes	Yes	Yes	Yes	Yes
223	AME New Polymers Capability Facility	13,200	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
225	Manufacturing Sciences Facility	15,900	Tests and Experiments	Yes		Yes		Yes
231	Development and Assembly Eng.	131,454	Weapons Engineering	Yes	Yes	Yes	Yes	Yes
B231V, OS232FA, B233GV	Vaults and Transportation	5,000 1,200 1,800	Weapons Engineering		Yes	Yes	Yes	Yes
235	Materials Science Division Offices and Labs	88,071	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
239	Radiography Facility	12,905	Plutonium	Yes		Yes	Haz Cat 3 Nuclear	Yes
253	HC Dept Offices & Labs	30,932	Enabling Infrastructure	Yes	Yes	Yes	Yes	Yes
254	HC Bio Assay Lab	2,488	Enabling Infrastructure	Yes	Yes	Yes	Yes	Yes
255	HC SPD Labs and Offices	21,855	Enabling Infrastructure	Yes	Yes	Yes	Yes	Yes
262	Radiation Detector Development	10,815	Global Security	Yes		Yes	Yes	Yes
272	Materials Science Laboratory	10,124	Non-Nuclear Components	Yes		Yes	Yes	Yes
298	Target Development	47,987	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
310	Nondestructive Evaluation Building	11,000	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
321A	Materials Fabrication Shop	59,515	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
321C	Materials Fabrication Shop	78,335	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
321G	Manufacturing Building	13,000	Tests and Experiments	Yes	Yes	Yes	Yes	Yes

Facility Number	Facility Name	Gross Square Feet	NNSA Capability	Lab/ Research	Office/ Service/ Support	Hazards		
						Chemical	Radiological	Other[a]
322	Plating Shop	5,704	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
327	Radiography	19,101	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
331	Tritium Facility	30,484	Tritium	Yes	Yes	Yes	Haz Cat 3 Nuclear	Yes
332	Plutonium Facility	104,787	Plutonium	Yes	Yes	Yes	Haz Cat 2 Nuclear	Yes
334	Hardened Engineering Test Building	10,688	Plutonium	Yes		Yes	Haz Cat 2 Nuclear	Yes
335	Support Facility	11,988	Plutonium	Yes	Yes	Yes		Yes
341	Engineering Mechanical Testing	44,184	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
361 & 362	Bio Research Cornerstone Facility	68,889	Global Security	Yes	Yes	Yes	Yes	Yes
364	Bio Research Support Facility	9,372	Global Security	Yes	Yes	Yes	Yes	Yes
365	Biosafety Level 2 Laboratory	8,972	Strategic Partnership Projects	Yes		Yes		Yes
368	Biosafety Level 3 Laboratory	1,590	Strategic Partnership Projects	Yes		Yes	No	Yes
381	Target Fabrication and Offices	95,478	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
391	NIF Optics and Diagnostic Labs	197,842	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
392	Optics Laboratory Facility	8,413	Tests and Experiments	Yes		Yes	Yes	Yes
431	Beam Research Labs	54,790	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
432	NIF Target Fabrication Machining	33,575	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
453	Livermore Computing Facility	253,000	Livermore Computing	Yes	Yes	Yes		Yes
490	NIF Engineering and Diagnostic Lab	216,789	Tests and Experiment	Yes	Yes	Yes	Yes	Yes
491	Development Lab	13,883	Tests and Experiment	Yes	Yes	Yes	Yes	Yes
511	Craft Shop	77,141	Tests and Experiment	Yes		Yes	Yes	Yes
581/582/681	NIF/Vacuum Systems Building, and Optics Assembly Building	700,907 2,927 46,818	Tests and Experiments	Yes	Yes	Yes	Yes	Yes
Area 612	RHWM Waste TSDF (B612, B614, B624, B624A/B, OS612A, Tent 6197B)	12,426	Plutonium		Yes	Yes	Yes	Yes
655	Advanced Manufacturing Laboratory	13,993	Strategic Partnership Projects	Yes		Yes		Yes
663	Health Services	24,786	Enabling Infrastructure		Yes	Yes		Yes
Area 625, 693 Yard, Area 696R	RHWM Radioactive Waste Storage Facilities	19,247 12,000 9,600	Plutonium			Yes	Haz Cat 2 Nuclear	Yes
695, 696S 697	RHWM Liquid Waste Processing/ Decontamination and Waste Treatment Facility	46,504 11,781 4,118	Plutonium	Yes	Yes	Yes	Yes	Yes

Haz Cat 2 Nuclear = Hazard Category 2 facility (as defined by DOE-STD-1027); Haz Cat 3 Nuclear = Hazard Category 3 facility—all radionuclides below Cat 2 thresholds; hazard analysis shows potential for only significant localized consequences (10 CFR Part 830); NIF = National Ignition Facility; RHWM = radioactive and hazardous waste management; TSDF = Treatment, Storage, and Disposal Facility;

a. Other hazards include biological materials, explosives, accelerators, x-ray machines, lasers, nuclear magnetic resonance, electrical, and collection and storage of compressed gas cylinders.

Table S.2-3. Overview of Key Buildings and Facilities at Site 300

Facility Number	Facility Name	Gross Square Feet	NNSA Capability	Lab/ Research	Office Service/ Support	Hazards		
						Chemical	Radiological	Other[a]
801A/B/C	Contained Firing Facility	46,848	Design and Certification	Yes	Yes	Yes	Yes	Yes
805	Inert Machining/Explosives Waste	6,830	High Explosives	Yes	Yes	Yes	Yes	Yes
806A/B	HE Machining	7,505	High Explosives	Yes	Yes	Yes	Yes	Yes
807	HE Machining	1,575	High Explosives	Yes	Yes	Yes	Yes	Yes
809A/B/C	HE Pressing and Oven Facility	3,794	High Explosives	Yes	Yes	Yes	Yes	Yes
810A/B/C	HE Assembly and Storage	5,200	Design and Certification	Yes	Yes	Yes	Yes	Yes
816, M2-5	Explosives Waste Storage Facility	1,223	High Explosives		Yes	Yes	Yes	Yes
817A/B/C/E/ F/G/H	HE Pressing and Oven Facility	3,102	High Explosives	Yes	Yes	Yes	Yes	Yes
823A/B	LINAC Radiography	2,748	Design and Certification	Yes	Yes	Yes	Yes	Yes
825	Chemistry	1,547	High Explosives	Yes	Yes	Yes	Yes	Yes
826	Chemistry	1,547	High Explosives	Yes	Yes	Yes	Yes	Yes
827A/B/C/D/ E	Chemistry Control and Process Facility	18,709	High Explosives	Yes	Yes	Yes	Yes	Yes
832A/C/E, OSM832B/D	Storage Facilities	2,456	High Explosives		Yes	Yes	Yes (A, E)	Yes
834A/B/C/D E/F/H/M	Thermal Test Facilities HE Storage	11,199	Enabling Infrastructure, Tests and Experiments	Yes	Yes	Yes	Yes	Yes
834L	HE Additive Manufacturing	1,000	High Explosives	Yes	Yes	Yes	Yes	Yes
836A/B/C/D	Dynamic Test Facility	13,023	Tests and Experiments	Yes	Yes	Yes	Yes (B, C, D)	Yes
845A/B	Explosives Waste Treatment Facility	722	High Explosives		Yes	Yes	Yes	Yes
850	Firing Facility	5,095	Enabling Infrastructure	Yes	Yes	Yes		Yes
851A	Outdoor Firing Facility	13,176	Design and Certification	Yes	Yes	Yes	Yes	Yes
855A/B/C	HE Machining	1,700	High Explosives	Yes	Yes	Yes	Yes	Yes

a. Other hazards include biological materials, explosives, accelerators, x-ray machines, lasers, nuclear magnetic resonance, electrical, and collection and storage of compressed gas cylinders.
HE = high explosives; LINAC = Linear Accelerator; EWSF = Explosives Waste Storage Facility; EWTF = Explosives Waste Treatment Facility.

Figure S.2-3. Notable Facilities at the Livermore Site

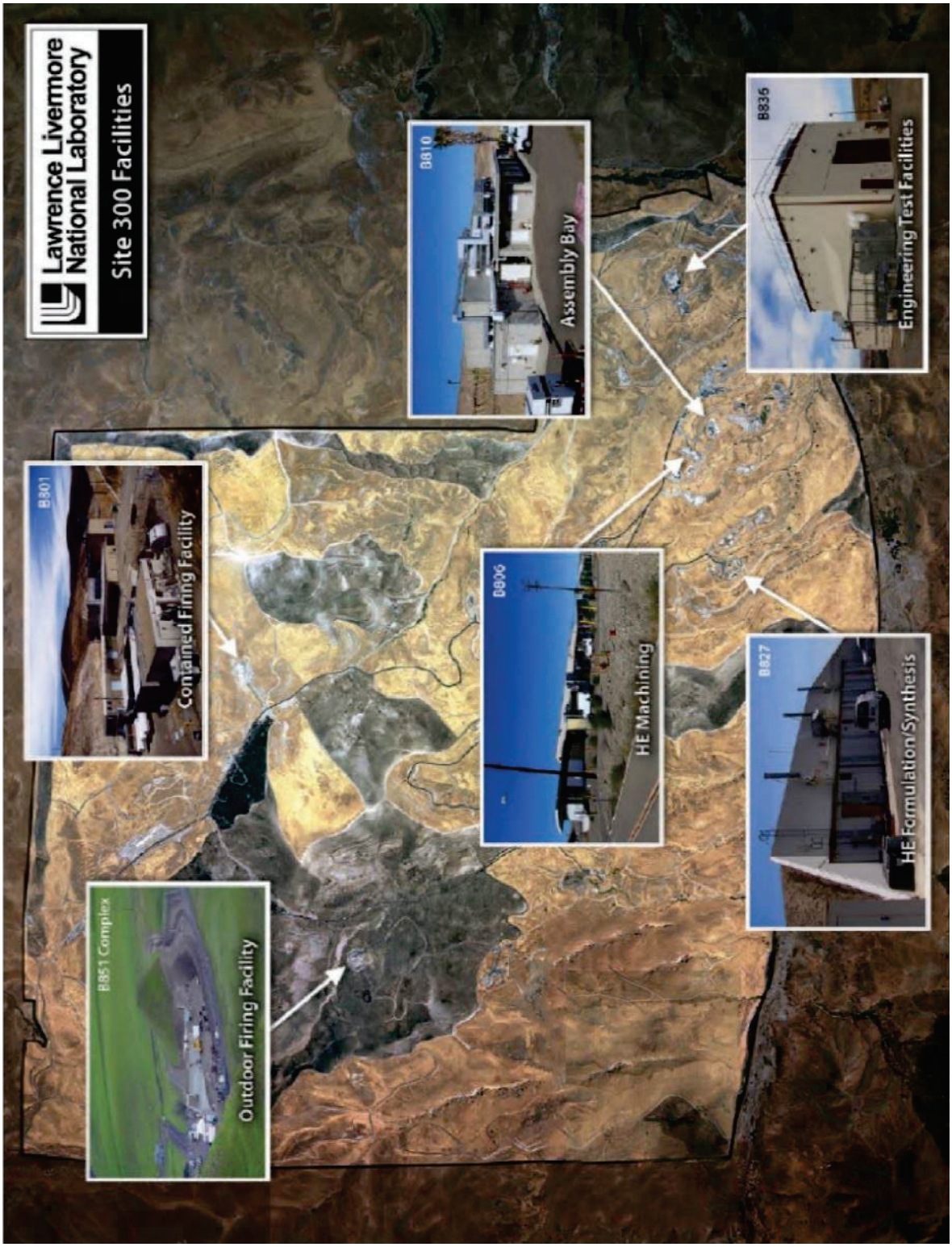


Figure S.2-4. Notable Facilities at Site 300

S.3 PROPOSED ACTION AND ALTERNATIVES

S.3.1 INTRODUCTION

This section describes the two alternatives that NNSA is evaluating for continued operation of LLNL: (1) the No-Action Alternative, described in Section S.3.2; and (2) the Proposed Action, described in Section S.3.3. To evaluate the potential environmental impacts, NNSA developed construction and operational parameters for both the No-Action Alternative and the Proposed Action, as described in Section S.3.4. This chapter also discusses alternatives that were considered but eliminated from detailed study (Section S.3.5); and identifies NNSA's preferred alternative (Section S.3.6).

The No-Action Alternative reflects the use of existing facilities to continue operations at levels consistent with those experienced since 2005, as well as those anticipated by NEPA analyses and agency decisions that have been made since 2005. As described in Section S.3.2, the No-Action Alternative includes the construction of new facilities, modernization/ upgrade/utility projects, and DD&D of excess and aging facilities through 2022. The Proposed Action includes the actions described for the No-Action Alternative, as well as the additional actions through 2035, which are described in detail in Section S.3.3. Figure S.3-1 provides a high-level illustration of the level of operations under both the No-Action Alternative and the Proposed Action.

The analysis in this LLNL SWEIS considers ongoing activities and proposed projects that could occur over approximately the next 15 years (2020-2035). It is important to note that the data and information developed in support of this document is based on the best available data at the end of calendar year 2019. Therefore, it is expected that many of the No-Action Alternative projects will have been completed by the time the Draft SWEIS is issued for public comment and certainly by the time the ROD is issued. This is a complex SWEIS with many projects and supporting infrastructure capabilities and has required a detailed environmental analysis requiring over two years to complete. To assess the potential environmental impacts that could occur as a result of the alternatives, NNSA developed site-wide estimates of construction and operational parameters, such as the potential area of land disturbance or the amount of new utilities that may be required. NNSA incorporated these site-wide estimates, along with information on ongoing and future activities, into the analysis of impacts (Chapters 5 and 6). For example, estimated areas of land disturbance for proposed activities were used in determining impacts on resources such as soils (area of disturbance and erosion), cultural resources (number of sites potentially affected), and biological resources (vegetation/habitat loss).

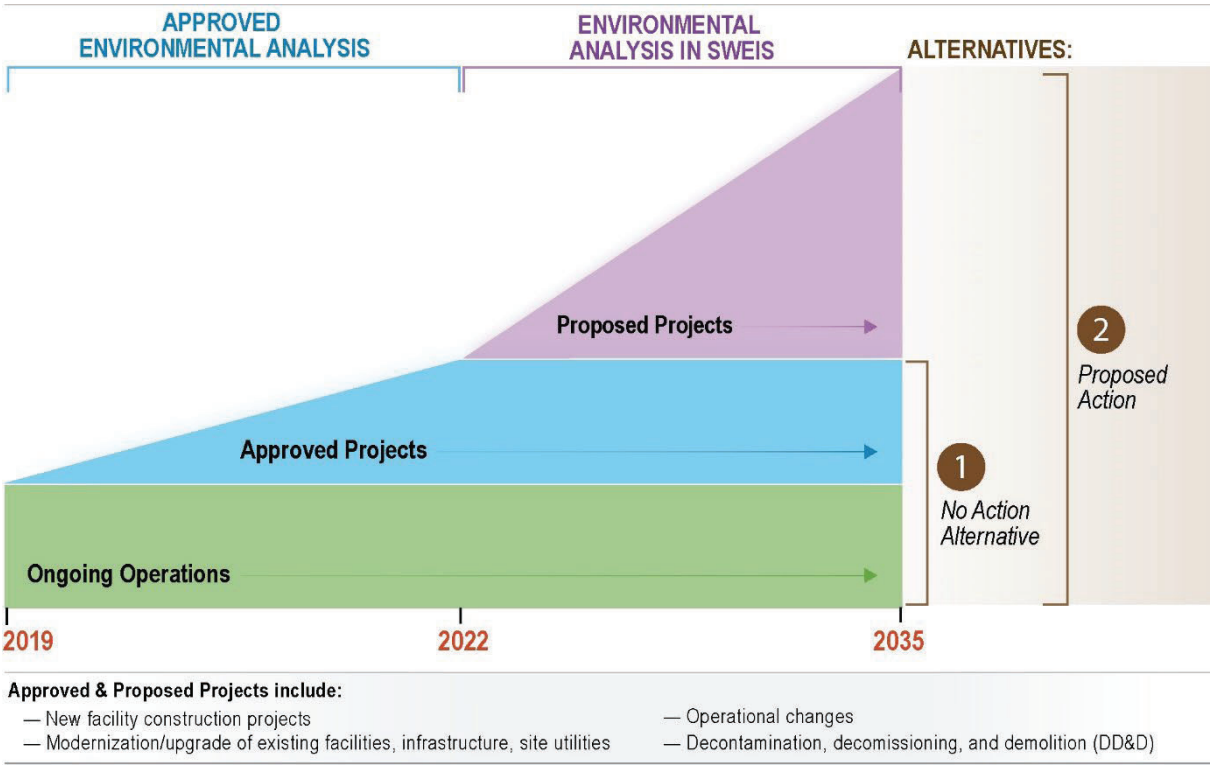


Figure S.3-1. Level of Operations for the No-Action Alternative and the Proposed Action

S.3.2 NO-ACTION ALTERNATIVE

NNSA analyzed the No-Action Alternative to comply with the CEQ's NEPA implementing regulations (40 CFR Parts 1500–1508), and to provide a baseline against which the impacts of the Proposed Action can be compared. The No-Action Alternative reflects implementation of decisions NNSA made based on the 2005 LLNL SWEIS and its 2011 Supplement Analysis (SA), and implementation of decisions made on actions evaluated in other relevant NEPA documents completed since 2005. For example, the removal of Security Category I/II special nuclear materials (SNM)[4] from LLNL, which was completed in 2012, LLNL would continue with Security Category III quantities of materials under the No-Action Alternative. The No-Action Alternative also includes projects/actions through 2022, for which NEPA has or will be completed by 2022. These projects are identified in the most recent 2021 LLNL Site Development Plan, which was published in January 2021 (LLNL 2021b).

The projects identified in this section define the No-Action Alternative projects that are expected to be implemented at the Livermore Site and Site 300 over the next several years. Implementation

[4] Per DOE Order 474.2, "Nuclear Material Control and Accountability," quantities of SNM stored at each DOE site are categorized into Security Categories I, II, III, and IV, with the greatest quantities included under Security Category I and lesser quantities included in descending order under Security Categories II through IV. Types and compositions of SNM are further categorized by their "attractiveness" to saboteurs, alphabetically, with the most attractive materials for conversion of such materials into nuclear explosive devices being identified by the letter "A" and less-attractive materials being designated progressively by the letters "B" through "E."

of these projects would result in changes to some of the environmental parameters at the Laboratory. Table S.3-8, which is located at the end of this chapter, identifies the operational parameters for the No-Action Alternative. As discussed earlier, all of the No-Action Alternative projects have either completed their separate NEPA documentation or would complete their documentation before their startup through 2022.

Under the No-Action Alternative, LLNL would use existing and enhanced capabilities through 2022 to continue to support major DOE/NNSA capabilities/programs described in Chapter 2 of this LLNL SWEIS. This would involve projects that have been approved, or are in the process of being approved, for implementation. As defined in this SWEIS, the No-Action Alternative reflects the use of existing facilities and ongoing projects to meet national security and other laboratory mission requirements. The No-Action Alternative also includes: (1) construction of new facilities; (2) modernization/upgrade of existing facilities and infrastructure projects (includes utility projects); and (3) DD&D of excess and aging facilities for which NEPA analysis/documentation already exists or would be completed by 2022. For example, as a result of continued operation at LLNL, NNSA has issued categorical exclusions for activities that would not result in significant impacts (e.g., routine maintenance, remediation actions, and a broad range of R&D activities performed within existing LLNL facilities) (see Appendix A, Section A.3). Therefore, as shown on Figure S.3-1, the No-Action Alternative includes a level of operation for LLNL greater than ongoing operations. Under the No-Action Alternative, operations would continue at a steady-state into the future, but at a lower level than would be needed to support overall NNSA growing mission requirements.

The major capabilities, key facilities, and operations included in the No-Action Alternative are described in Chapter 2 of this SWEIS. In addition, Table S.3-1, Table S.3-2, and Table S.3-3 identify new facilities, modernization/upgrade/utility projects, and DD&D projects associated with the No-Action Alternative. Figure S.3-2 provides a map for locating the new facilities for the No-Action Alternative at the Livermore Site.[5] Under the No-Action Alternative, only one new facility, the Small Firearms Training Facility (SFTF), would occur at Site 300, at the Small Arms Training Area (*see* Figure S.3-3 for the relevant facilities at Site 300 for the SWEIS). Baseline impacts associated with the No-Action Alternative were estimated based on historical operations since 2005, such as the number of experiments performed at the NIF and the number of HE tests at Site 300, as well as any notable changes in operations resulting from the actions identified in Table S.3-1, Table S.3-2, and Table S.3-3. Baseline data for all environmental resource areas was collected for 2019 as part of the Existing Environment (Chapter 4).

[5] Figure S.3-2 can be used to find the approximate location of new facilities for the No-Action Alternative using the grid coordinates in Table S.3-1.

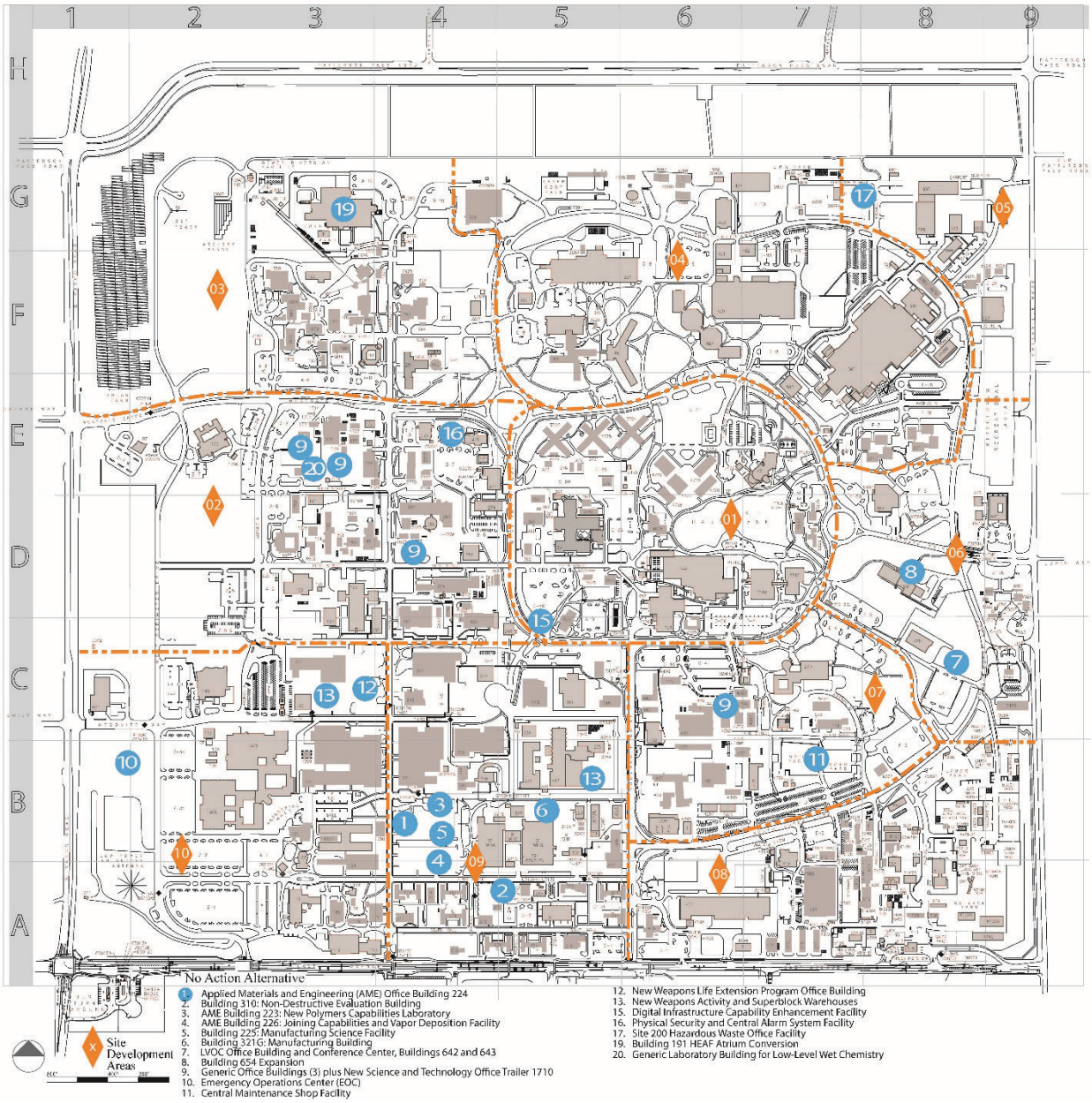


Figure S.3-2. No-Action Alternative Projects at the Livermore Site

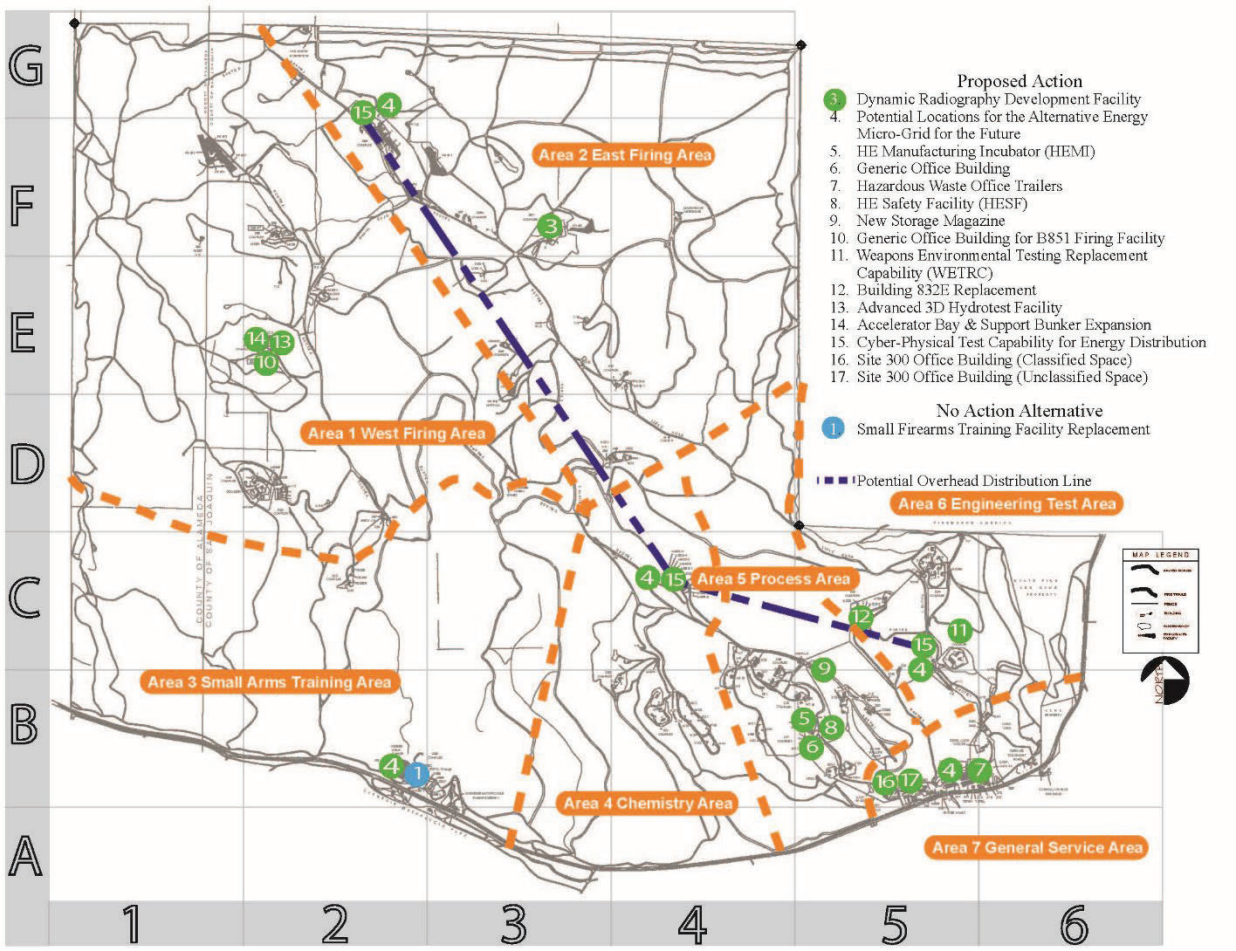


Figure S.3-3. Map for No-Action Alternative and Proposed Action Projects at Site 300

Table S.3-1. No-Action Alternative: New Facilities (2020–2022)

Map ID #	Name[a]	Site; Grid Location[b]	Size (ft^2)/ Facility Type	Year	NNSA Capability[d]
1	**Applied Materials and Engineering (AME) Office Building 224[c]**	Livermore Site; B-4	22,000 Office	2020	Tests and Experiments; Enabling Infrastructure;
2	**Building 310: Non-Destructive Evaluation Building**	Livermore Site; A-5	11,000 Lab	2020	Tests and Experiments
3	**AME Building 223: New Polymers Capabilities Laboratory**	Livermore Site; B-4	13,200 Lab	2020	Tests and Experiments
4	**AME Building 226: Joining Capabilities and Vapor Deposition Facility**	Livermore Site; B-4	15,400 Lab	2021	Tests and Experiments
5	**AME Building 225: Manufacturing Science Facility**	Livermore Site; B-4	15,400 Lab	2020	Tests and Experiment
6	**Building 321G: Manufacturing Building**	Livermore Site; B-5	13,000 Lab	2020	Tests and Experiments
7	**LVOC Office Building and Conference Center, Buildings 642 and 643**	Livermore Site; C-8	25,000 Office	2020	Strategic Partnership Projects
8	Building 654 Expansion	Livermore Site; D-8	18,000 Office	2020	Simulation
9	**Generic Office Buildings (3) plus New Science and Technology Office Trailer 1710**	Livermore Site; E-3; D-4	72,000 Office	2020-2022	Enabling Infrastructure; Tests and Experiments
Fig 3-3: 1	**Building 899 Small Firearms Training Facility (SFTF) Replacement**	Site 300; Figure 3-3, B-2	4,000 Support	2020	Security/Enabling Infrastructure
10	**Emergency Operations Center (EOC)**	Livermore Site; B-1	20,000 Support	2021	Enabling Infrastructure
11	**Central Maintenance Shop Facility**	Livermore Site; B-7	60,000 Support	2021	Enabling Infrastructure
12	New Weapons Life Extension Program Office Building	Livermore Site; C-3	35,000 Office	2021	Design and Certification
13	New Weapons Activity and Superblock Warehouses	Livermore Site; A-6, B-5	25,000 Support	2022	Enabling Infrastructure; Plutonium
15	Digital Infrastructure Capability Enhancement Facility	Livermore Site; C-5	7,000 Support	2022	Communications/ Enabling Infrastructure
16	**Physical Security and Central Alarm System Facility**	Livermore Site; E-4	22,000 Lab	2022	Security/ Enabling Infrastructure
17	Livermore Site Hazardous Waste Office Facility	Livermore Site; F-9	16,000 Office	2022	Plutonium
19	**Building 191 HEAF Atrium Conversion**	Livermore Site; G-3	2,300 Lab	2022	Tests and Experiments
20	**New Generic Laboratory Building for Low-Level Wet Chemistry**	Livermore Site; E-3	20,000 Lab	2022	Design and Certification
Total			**416,300**		

a. Throughout this SWEIS, NNSA acknowledges that facility names are subject to change in the future.
b. In general, for each new facility at the Livermore Site, alphabetical-numerical grid coordinates are provided to aid in locating the facility on Figure S.3-2. For Site 300, Figure S.3-3 shows the locations of any new facilities.
c. **Bolded** projects in this table and Table S.3.2 are described in Section S.3.2.1.
d. NNSA Infrastructure capabilities as defined in Chapter 2.
Sources: LLNL 2021b, 2021c, 2021d.

Table S.3-2. No-Action Alternative: Modernization/Upgrade/Utility Projects (2020–2022)[a]

Name	Site	Building Number(s)	NNSA Capability[b]
Exascale Computing Facility Modernization (Project ID 4169)	Livermore Site	453	Simulation
Livermore Site Miscellaneous Facility/Laboratory Repairs, Replacements, and Upgrades (Project ID 446, 472, 3044, 4000, 5735, 6096, 225, 3789, 4574, 458, 3061, 3913, 3993, 4394, 4412, 5006, 5731, 5733, 5744, 6638, 6684, 6686, 6753)	Livermore Site	131, 132N, 151, 170, 174, 197, 232, 235, 239, 253, 254, 256, 321, 321A, 327, 361, 391, 411, 439, 442, 453, 490, 581, 681, Block 1300 LEP Offices, 15SWCS	Design and Certification; Global Security; Tests and Experiments
Utility Replacements and Upgrades (valves, control systems, piping, etc.) (Project ID 5911, 5649, 4757)	Livermore Site	Not applicable	Enabling Infrastructure
Arroyo Mocho Pump Station Upgrades (control center, pumps, etc.) (Project ID 6859, 6795)	Arroyo Mocho	Not applicable	Enabling Infrastructure
Livermore Site Storm Drain Upgrades (Project ID 3920)	Livermore Site	Not applicable	Enabling Infrastructure
Generator Replacements and Fuel Tank (underground and above ground) Replacements	Livermore Site, Site 300	132, 241, 251, 291, 313, 325, 331, 332, 431, 432, 435, 611, 834A, 836, 875	Global Security; Enabling Infrastructure; Plutonium
Low Pressure Air System Upgrade (Project ID 4745)	Livermore Site, Site 300	Not applicable	Enabling Infrastructure
Seismic Risk Reduction (Project ID 5006, 5728, 6066)	Livermore Site, Site 300	235, 321A, 411	Tests and Experiments
Site 300 Miscellaneous Facility/Laboratory Repairs, Replacements, and Upgrades (Project ID 5727, 6685)	Site 300	836, 865	Enabling Infrastructure
Site 300 Utility Replacements and Installations (transformers, water supply piping, valves, wells) (Project ID 4751, 4746, 6792)	Site 300	Not applicable	Enabling Infrastructure
Site 300 Limited Area Fence Replacements (Project ID 3930)	Site 300	Not applicable	Enabling Infrastructure
3D Flash Computed Tomography (CT) System upgrades	Livermore Site, Site 300	310, 327, 810, 823	Tests and Experiments
Building 850 Revitalization Project (Project ID 6798)	Site 300	850	Global Security; Tests and Experiments

a. Modernization/Upgrades list only comprises of large projects greater than $1million; there are many hundreds of smaller upgrade projects less than $1 million that are not included in this list.
b. NNSA Infrastructure capabilities as defined in Chapter 2.
Sources: LLNL 2021b, 2021c, 2021d.

Table S.3-3. No-Action Alternative: DD&D Projects (2020–2022)

Buildings to Undergo DD&D	Site	Size (ft^2)	Year
1736, 175, 280, 4302, 4377, 4378, 4382, 4383, 4384, 4385, 4387 (11 facilities)	Livermore Site	~60,000	2020
2632, 616 (2 facilities)	Livermore Site	~2,000	2021
194A, 1601, 1602, 1678, 182, 1927, 241, 243, 251, 2525, 2552, 2554, 2728, 2806, 280A, 281A, 292, 2925, 293, 312A, 406, 532, 343, 3526, 3555, 3751, 3775, 4926 (28 facilities), plus Legacy Slabs 212, 377, and 412	Livermore Site	~165,000	2022
8806	Site 300	~1,000	2022
Total		**~228,000**	

Sources: LLNL 2021b, 2021c, 2021d.

Brief descriptions of new facilities and modernization/upgrade/utility projects (Section S.3.2.1), DD&D projects (Section S.3.2.2), and operational changes (Section S.3.2.3) are presented below for the No-Action Alternative.

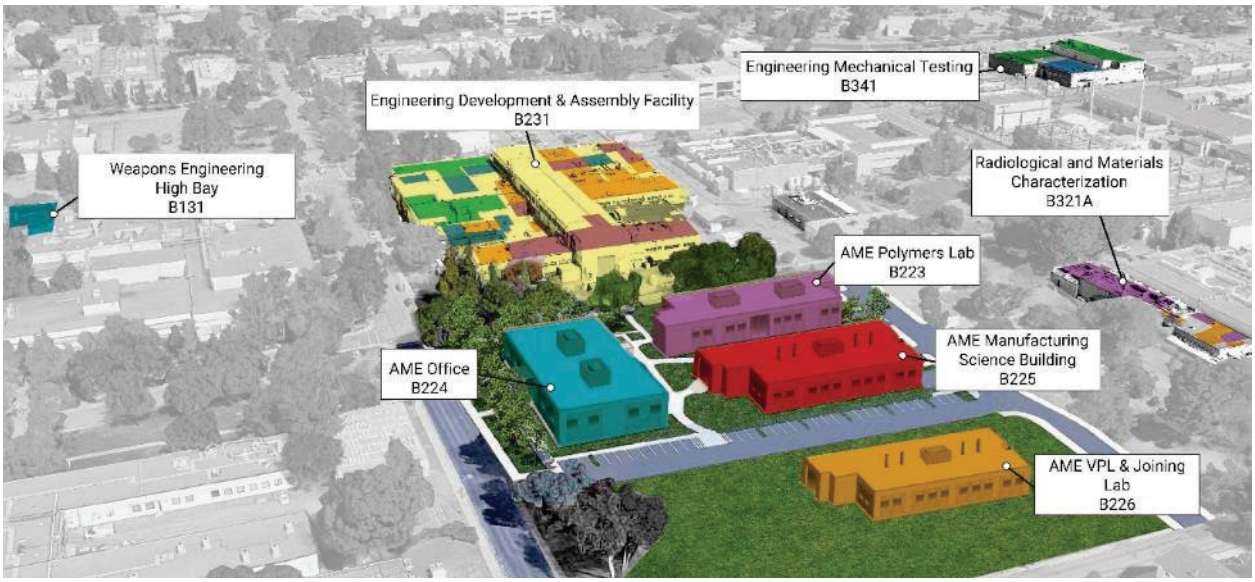
S.3.2.1 No-Action Alternative Project Descriptions: New Facilities and Modernization/ Upgrade/Utility Projects

As shown on Table S.3-1, approximately 19 new projects, totaling about 416,300 square feet, would begin construction through 2022. All but one of those projects would be located at the Livermore Site. The only facility to be constructed at Site 300 is the 4,000-square-foot SFTF. In addition, as shown in Table S.3-2, there would be approximately 13 categories of modernization/upgrade/utility projects, many involving multiple facilities. With regard to NNSA missions, most of the projects are related to Tests and Experiments or Enabling Infrastructure. Brief descriptions of notable new facilities and modernization/upgrade/utility projects for the No-Action Alternative are presented below.

S.3.2.1.1 *Tests and Experiments Projects*

The Tests and Experiments infrastructure houses the activities that provide data to determine weapon performance characteristics, understand material properties under extreme conditions, and contribute to formation and validation of models. For Tests and Experimentation, NNSA would implement the following notable projects:

- **Applied Materials and Engineering (AME) Buildings 223, 224, and 226.** AME capabilities are vital to the certification, design, and testing of stockpile systems under the LEPs and Mods and other programs. To ensure long-term support for nuclear stockpile stewardship and LEPs and Mods, NNSA has developed a multi-year area plan that will replace and upgrade the existing AME facilities, increase operational efficiency, and reduce the area's footprint by 40 percent (LLNL 2019b). As shown on Figure S.3-4, the new facilities would be Building 224 (Office building), Building 223 (Polymers Laboratory), and Building 226 (Vapor Deposition and Joining Lab). Because operations would be similar to the operations in Building 231, there would be no change in wastes, emissions, hazards, or accidents (LLNL 2017b).



Note: Relocation of Building 231 activities shown in different colors; Building 231 would undergo DD&D.
Source: LLNL 2019b.

Figure S.3-4. Applied Materials and Engineering Consolidation

- **AME Building 225 Manufacturing Science Building**. The new AME Manufacturing Science Facility would conduct process development work to modernize and improve production methods and efficiencies for classified parts containing mostly plastic (polymer) materials. These modernized manufacturing techniques would support modernization (LEPs and Mods) programs by improving current manufacturing methods at the production agency.

- **Building 321G Manufacturing Building.** The new Building 321G would add institutional high bay manufacturing space (from 7,000 to 10,000 square feet) in support of NNSA's growing national security programs and Strategic Partnership Projects (SPP), including DoD and DHS projects (LLNL 2019).

- **Building 310 Non-Destructive Evaluation Building.** This project would relocate the primary low-energy operations of the Non-Destructive Evaluation (NDE) group, currently housed in Building 327, to a new 11,000-square-foot above-ground facility (LLNL 2019d).

- **Building 191 HEAF Atrium Conversion to Shot-Ready Workspace Project.** The purpose of the proposed project is to convert the existing first floor 2,000 square feet atrium at HEAF, Building 191, into experimental space (LLNL 2020d).

S.3.2.1.2 *Design and Certification Projects*

As a design agency for NNSA, LLNL is responsible for maintaining three of the seven active stockpile weapon systems through the annual weapon assessment process and for enabling the future stockpile. Weapons issues that could lead to future degradation, such as aging effects, include parts that may need to be replaced or refurbished as part of LEPs and Mods to meet safety, security, and reliability requirements. In this way, LEPs and Mods extend the lifetime of the

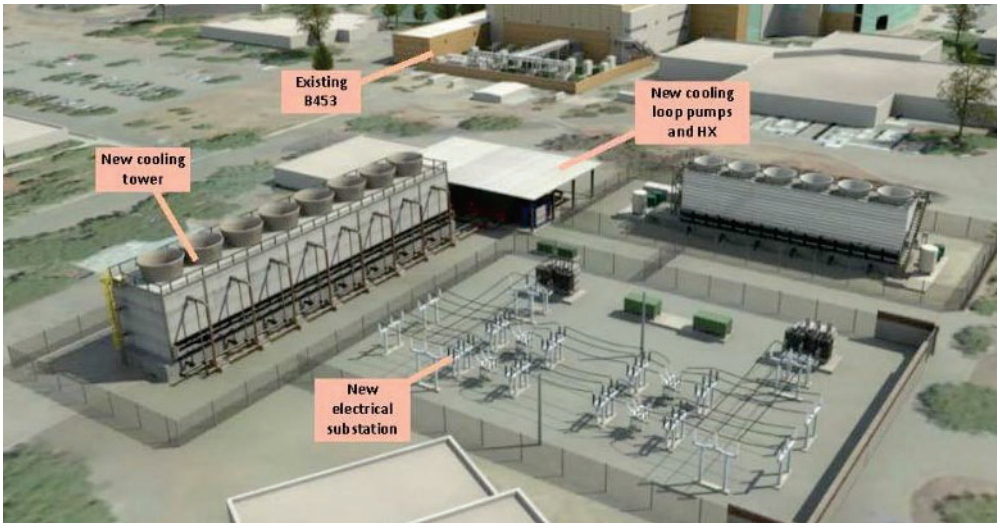
weapons by an additional 20 to 30 years and are carried out without conducting underground nuclear tests.

- **New Generic Laboratory Building for Low-Level Wet Chemistry.** This facility would replace Building 197, which provides small-scale laboratory space for the Center for Accelerator Mass Spectrometry (CAMS), Building 190 (LLNL 2021c).

S.3.2.1.3 *Simulation Projects*

Simulation capability and infrastructure at LLNL support activities for computer modeling and the prediction of weapon performance and material properties not accessible through experimentation. Under the No-Action Alternative, NNSA would implement the Exascale Complex Facility Modernization (ECFM).

- **Exascale Complex Facility Modernization (ECFM).** The ECFM project would provide capable facilities and infrastructure to site an exascale-class system in 2022, with full operations initiating in 2023 (LLNL 2017a). To implement the ECFM, NNSA would modify Building 453 by strengthening the facility foundation, increase electrical power service to 85-110 megawatts by constructing a new electrical substation, and install new cooling towers and cooling loop pumps to accommodate an additional 18,000 to 28,000 tons of cooling (Figure S.3-5) (LLNL 2019b).



Source: LLNL 2019b.

Figure S.3-5. ECFM Project

S.3.2.1.4 *Strategic Partnership Projects*

Strategic Partnership Projects (SPP) capabilities support federal and non-federal entities that are outside of DOE and NNSA, and involve broader national security, energy security, and scientific development missions.

- **LVOC Office Building and Conference Center, Buildings 642 and 643.** This project involves the construction of approximately 28,000 square feet to provide modern office and meeting space for LLNL researchers in predictive biology, materials and manufacturing, the Laboratory's Innovation & Partnerships Office and High Performance Computing Innovation Center.

S.3.2.1.5 *Global Security Projects*

Global Security R&D at LLNL supports a broad range of national security missions for a wide sponsor base, which includes DOE/NNSA, as well as other federal, state, local agencies, private industry and academia. This includes capabilities for counterterrorism, nonproliferation, intelligence, and energy security.

- **Building 850 Revitalization Project.** This project would revitalize Building 850 at Site 300 and would mainly involve utility upgrades/replacements, including the electrical, water, sanitary, and septic systems. The project started in 2021. The work involves reconnecting the electrical, water, and sanitary septic systems in year one of the construction changes (LLNL 2021c).

S.3.2.1.6 *Enabling Infrastructure Projects*

Mission-enabling infrastructure supports all Laboratory programmatic needs, and is foundational to making sites habitable, including assets for communications, power, water, emergency services, offices, site roads and parking, storage, maintenance shops, and waste management. NNSA would implement several new projects related to Enabling Infrastructure, including the following notable projects:

- **Emergency Operations Center.** NNSA is in the process of constructing a building of approximately 20,000 square feet to house emergency management and response capabilities. The permanent facility (Figure S.3-6) would be in an area that is part of the previously undisturbed west buffer zone in the southwest quadrant of the Livermore Site, south of Mesquite Way and west of West Perimeter Drive (LLNL 2017c).

Source: LLNL 2017a.

Figure S.3-6. Conceptual View of the New Emergency Operations Center

- **Small Firearms Training Facility Replacement.** This project involves construction of a new facility at Site 300, Small Arms Training Area. The new facility would replace the 35-year-old classroom that concurrently operates as an office, kitchen, and classroom, which limits and obstructs training.

- **Physical Security and Central Alarm System (CAS) Facility**. This project would involve construction of a new 2-story facility totaling 22,000 square feet in an existing developed area of the Livermore Site. The proposed facility would house multiple security groups including the CAS facility that operates 24 hours a day and seven days a week (LLNL 2021c).

- **Central Maintenance Shop Facility.** A new 60,000-square-foot facility would be constructed in the southeast portion of the Livermore Site to replace the current seismically deficient maintenance shop, Building 511 (LLNL 2021c).

- **Replacement of Existing Office Buildings/Laboratory Facilities.** The No-Action Alternative includes the construction of three generic office buildings, as well as modernization/upgrade to facilities at the Livermore Site and Site 300.

- **Seismic Risk Reduction.** LLNL has many enduring facilities that are in need of a seismic retrofit. This will be accomplished through the Seismic Risk Reduction Project (LLNL 2017a). Figure S.3-7 depicts LLNL facilities that still have seismic deficiencies. As indicated on that figure, four facilities are rated as having poor to extremely poor seismic performance. Of those four, Buildings 231, 511, and 431 are proposed for DD&D, and the fourth facility (Building 411) would be seismically upgraded**.**

- **Utility Projects.** LLNL's utilities infrastructure must be fully reliable 24/7 to ensure NNSA meets its programmatic mission requirements. Many of LLNL's utility systems are the original systems installed when LLNL was a Naval Air Station over 65 years ago and are well beyond useful life (LLNL 2019b). Some projects, such as replacing over 100 of LLNL's most critical utility system valves, are ongoing and nearing completion. Other projects include storm drain upgrades at the Livermore Site, generator and generator fuel tank replacements, upgrades to the low-pressure air system, Site 300 replacements and installations of transformers, water supply piping, valves, and wells (LNL 2019b).

- **Ongoing Remediation Activities.** Groundwater and soils at both the Livermore Site and Site 300 are contaminated from historical operations; the contamination is mostly confined to within the boundaries of each site. Ongoing remedial investigations and cleanup activities for legacy contamination of environmental media at LLNL fall under the *Comprehensive Environmental Response, Compensation, and Liability Act*. Chapter 4, Section 4.15, of this SWEIS discusses ongoing pending remediation efforts. Those remediation efforts would continue under both the No-Action Alternative and the Proposed Action.

- **Arroyo Mocho Utility Upgrades.** The primary source of domestic water for the Livermore Site is the City of San Francisco's Hetch Hetchy Regional Water System. The

Source: LLNL 2020o.
Note: Buildings 231, 511, and 431 are proposed for DD&D in approximately 2027, 2030, and 2032, respectively. Seismic upgrades are planned for Buildings 235, 321A and 411 as part of the No-Action Alternative. Seismic upgrades for Buildings 490, 391B, 271, 381B, 431, and 298 are planned as part of the Proposed Action.

Figure S.3-7. LLNL Facilities with Seismic Deficiencies

Hetch Hetchy water is pumped to aboveground tanks at Arroyo Mocho Pump Station and then feeds via a pipeline to the Livermore Site, about seven miles from the Arroyo Mocho Pump Station (Figure 4-1 in Chapter 4 shows the location of Arroyo Mocho Pump Station in relation to LLNL sites). NNSA owns and operates three wells, each with a pump to pull the water from the tunnel to aboveground tanks, which then gravity feeds to the LLNL supply tanks located at Sandia National Laboratories/California (SNL/CA). This then becomes the source of water for the Livermore Site and SNL/CA. Two of the three pumps are more than 40 years old, and a third is 28 years old, well past their expected service life. Under the No-Action Alternative, NNSA would replace these pumps at the Arroyo Mocho Pump Station (LLNL 2021c).

S.3.2.2 No-Action Alternative: DD&D Projects

As shown in Table S.3-3, over the period 2020–2022, NNSA expects to DD&D approximately 42 excess facilities, totaling approximately 228,000 square feet. All but one of the facilities scheduled for DD&D are at the Livermore Site (41 facilities, totaling approximately 227,000 square feet). The only facility at Site 300 that would undergo DD&D is Building 8806 (1,000 square feet). Figure S.3-8 shows notable contaminated facilities at the Livermore Site that would undergo DD&D under the No-Action Alternative.

S.3.2.3 No-Action Alternative: Operational Changes

There are no new operational changes under the No-Action Alternative. The prior operational changes described in the 2011 SA (NNSA 2011) examined changes in programs, projects, or operations since the 2005 SWEIS; new and modified plans, projects, and operations for the period 2010–2015; and new information that was not available for consideration when the 2005 SWEIS was prepared. The 2010–2015 projections for each resource area included consideration of the proposed new and modified projects and modifications in site operations at LLNL that were likely to be implemented through the year 2015. For most environmental resources, the 2010–2015 projections remained consistent with impacts analyzed in the 2005 SWEIS (*see* Table A-8 in Appendix A). For the few instances where the 2010–2015 projections differed from the 2005 SWEIS analysis, the changes in environmental impact were not significant (NNSA 2011). A notable operational change that has occurred since 2011 is the de-inventory of Security Category I/II SNM, which was completed in 2012. Another operational change– a proposed increase in weights of explosives detonated at the Building 851 firing table–has not been implemented during the writing of this SWEIS.[6]

[6] Detonation of explosives is currently limited to less than 100 pounds per day and less than1,000 pounds per year.

Source: LLNL 2015a.

Figure S.3-8. No-Action Alternative: Notable Facilities to Undergo DD&D

S.3.3 PROPOSED ACTION

In January 2021, LLNL published the 2021 Site Development Plan (LLNL 2021b), which provides a framework for future development at both the Livermore Site and Site 300. The Plan was undertaken to guide planning for the facilities and infrastructure needed to best support the NNSA mission at LLNL. The Plan, which identifies critical needs and articulates a vision to meet those needs, is guided by the following principal goals:

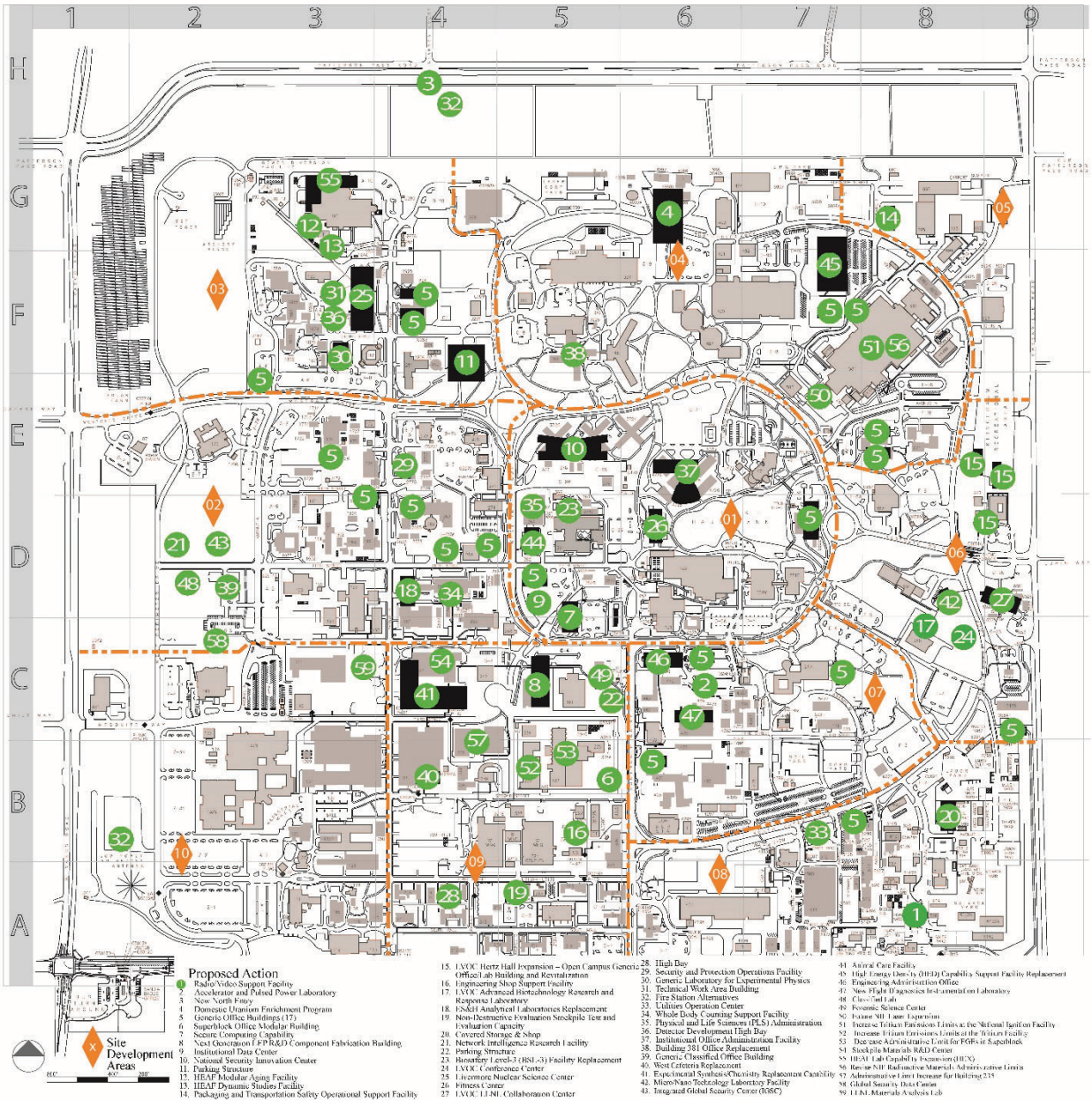
- Create an approach for physical development of the Laboratory over time;
- Confirm the phasing of projects with mission needs and priorities; and
- Support future project requests for direct and indirect funding.

The Proposed Action described in this section embraces the framework, principles, goals, and vision expressed in the 2021 Site Development Plan. The Proposed Action supports the need to replace many aged facilities with consolidated new construction that offers conservation of resources with closer connection in an identifiable "Campus Center." The Proposed Action also promotes pedestrian scale development, creates public space, and is intended to enhance environmental quality, improve connections across the Lab, and create a strong, collaborative center. With regard to Site 300, the 2021 Site Development Plan and this SWEIS recognize decentralization as a prevailing condition and the roadway system that connects the Site 300 operational areas. As such, the Proposed Actions for Site 300 focuses on improving the infrastructure and operations within the seven operational areas identified in Figure S.3-3.

Under the Proposed Action, NNSA would continue to support national security and the other laboratory mission requirements described in Chapter 2 of this LLNL SWEIS. As defined in this SWEIS, the Proposed Action reflects the use of existing facilities and ongoing projects described for the No-Action Alternative, as well as additional new facility construction, modification/upgrade/utility projects, DD&D of excess/aging facilities, and operational changes. Therefore, the Proposed Action includes a level of operation at LLNL that is greater than both current operations and under the No-Action Alternative (*see* Figure S.3-1 for a graphical representation of the operational difference between the Proposed Action and the No-Action Alternative).

Table S.3-4, Table S.3-5, and Table S.3-6 identify new facilities, modernization/upgrade/utility projects, DD&D projects, and operational changes associated with the Proposed Action. Figure S.3-9 provides a map for locating the new facilities for the Proposed Action at the Livermore Site.[7] For new facilities at Site 300 under the Proposed Action, refer to Figure S.3-3 above. The tables below list all the Proposed Actions by category. Those highlighted in bold are described in more detail in the following sections. Section S.4 presents the environmental impacts associated with the Proposed Action.

[7] Figure S.3-9 can be used to find the approximate location of new facilities for the Proposed Action using the grid coordinates in Table S.3-4.



Note: Some project locations have been approximated pending detailed design requirements.

Figure S.3-9. Proposed Action Projects at the Livermore Site

Table S.3-4. Proposed Action: New Facilities/Operational Changes (2023–2035)

Map ID #	Name[a]	Site; Grid Locations[b]	Size (ft^2)/ Facility Type	Year	NNSA Capability[d]
1	Radio/Video Support Facility	Livermore Site; A-8	8,000 Support	2023	Enabling Infrastructure
2	**Accelerator and Pulsed Power Laboratory[c]**	Livermore Site; C-6	50,000 Lab	2023	Tests and Experiments. Strategic Partnerships
5	**Generic Office Buildings (17)**	Livermore Site; Various	404,000 Office	2023-2035	Enabling Infrastructure
Figure S.3-14	**Extend City of Livermore Reclaimed Water Distribution System for Cooling Tower Use**	Livermore Site; Figure S.3-14	Not applicable	2023-2024	Enabling Infrastructure
Figure S.3-3: 4	**Alternative Energy Micro-Grid for the Future**	Site 300; Figure S.3-3	Not applicable	2023	Global Security
6	Superblock Office Modular Building	Livermore Site; B-5	6,000 Lab	2024	Global Security
7	Secure Computing Capability	Livermore Site; C-5	40,000 Office	2024	IT and Communications
8	**Next Generation LEP R&D Component Fabrication Building**	Livermore Site; C-5	60,000 Lab	2024	Tests and Experiments
9	Institutional Data Center	Livermore Site; D-5	10,000 Office	2024	IT and Communications
10	**National Security Innovation Center**	Livermore Site; F-4	225,000 Office	2024	Design and Certification
11	**Parking Structure**	Livermore Site; F-4	90,000	2024	Enabling Infrastructure
12	**HEAF Modular Aging Facility**	Livermore Site; G-3	2,000 Lab	2024	Tests and Experiments
13	**HEAF Dynamic Studies Facility**	Livermore Site; G-3	2,000 Lab	2024	Tests and Experiments
14	**Packaging and Transportation Safety Operational Support Facility**	Livermore Site; G-8	11,000 – 14,000 Office and Support	2024	Enabling Infrastructure, Plutonium
54	**Stockpile Materials R&D Center**	Livermore Site; C-4	50,000 Lab	2024	Non-Nuclear Components
15	**Hertz Hall Expansion – Open Campus Generic Office/Lab Building and Revitalization**	Livermore Site; C-9, D-8, E-8, E-9	20,000 Office, Lab	2024-2028	Strategic Partnership Projects
Figure S.3-3: 5	**HE Manufacturing Incubator (HEMI)**	Site 300; Figure S.3-3, B-5	10,000 Lab	2024	High Explosives
Fig S.3-3: 15	**Cyber-Physical Test Capability for Energy Distribution**	Site 300; Figure S.3-3, various	NA	2024	Global Security
Figure S.3-3: 6	**Generic Office Building**	Site 300; Figure S.3-3, B-5	14,000 Office	2024	Enabling Infrastructure
Figure S.3-3: 7	Hazardous Waste Office Trailers	Site 300; Figure S.3-3, B-5	5,000 Office	2024	Enabling Infrastructure
Figure S.3-3:17	**Site 300 Office Building (unclassified space)**	Site 300; Fig. 3-3	24,000 (unclassified)	2024	Enabling Infrastructure
Figure S.3-3:16	**Site 300 Office Building (classified space)**	S300; Fig. 3-3	50,000 (classified)	2024	Enabling Infrastructure
16	Engineering Shop Support Facility	Livermore Site; B-5	10,000 Support	2025	Tests and Experiments
17	**LVOC Advanced Biotechnology Research and Response Laboratory**	Livermore Site; C-8	Up to 13,000 Lab	2025	Strategic Partnership Projects

Map ID #	Name[a]	Site; Grid Locations[b]	Size (ft^2)/ Facility Type	Year	NNSA Capability[d]
18	**ES&H Analytical Laboratories Replacement**	Livermore Site; D-4	40,000 Lab	2025	Enabling Infrastructure
55	**HEAF Lab Capability Expansion (HEX)**	Livermore Site; G-3	40,000 Lab; 10,000 Office	2025	Tests and Experiments
3	**New North Entry**	Livermore Site; H-4	N/A	2025	Enabling Infrastructure
Figure S.3-3: 8	**HE Safety Facility (HESF)**	Site 300; Figure S.3-3, B-5	10,000 Lab	2025	High Explosives
Figure S.3-3: 9	New Storage Magazine	Site 300; Figure S.3-3, B-5	400 Support	2025	High Explosives
19	**Non-Destructive Evaluation Stockpile Test and Evaluation Capacity**	Livermore Site; A-5	11,000 Lab	2026	Tests and Experiments, Global Security, Strategic Partnerships
20	Covered Storage & Shop	Livermore Site; B-8	20,000 Support	2026	Enabling Infrastructure
21	**Network Intelligence Research Facility**	Livermore Site; C-2	80,000 Office	2026	Global Security
22	Parking Structure	Livermore Site; C-5	250,000	2026	Enabling Infrastructure
23	**Biosafety Level-3 (BSL-3) Facility Replacement**	Livermore Site; D-5	5,000 Lab	2026	Strategic Partnership Projects; Global Security
24	**LVOC Conference Center**	Livermore Site; D-8	20,000 Office	2026	Strategic Partnership Projects
25	**Livermore Nuclear Science Center**	Livermore Site; F-3	100,000 Lab	2026	Design and Certification
Figure S.3-3: 10	**Generic Office** (for Building 851 Firing Facility)	Site 300; Figure S.3-3, E-2	10,000 Office	2026	Enabling Infrastructure
26	Fitness Center	Livermore Site; D-6	22,000 Support	2027	Enabling Infrastructure
27	**LVOC LLNL Collaboration Center**	Livermore Site; D-9	111,000 Office	2027	Strategic Partnership Projects
59	**Materials Analysis Laboratory**	Livermore Site	20,000	2027	Global Security
28	**High Bay**	Livermore Site; A-4	100,000	2028	Design and Certification
29	Security and Protection Operations Facility	Livermore Site; E-4	22,000 Lab	2028	Security
30	**Generic Laboratory for Experimental Physics**	Livermore Site; F-3	15,000 Lab	2028	Tests and Experiments
31	Technical Work Area Building	Livermore Site; F-3	4,000 Lab	2028	Enabling Infrastructure
32	**Fire Station Facility**	Livermore Site; H-4	30,000 Support	2028	Enabling Infrastructure
39	**Generic Classified Office Building**	Livermore Site	15,000	2028	Global Security
Figure S.3-3: 3	**Dynamic Radiography Development Facility**[c]	Site 300; Fig. S.3-3, F-3	60,000-Lab 60,000 to 80,000-Shed	2028-2032	High Explosives
33	Utilities Operation Center	Livermore Site; B-7	10,000 Office	2029	Enabling Infrastructure
Figure S.3-3: 11	**Weapons Environmental Testing Replacement Capability (WETRC)**	Site 300; Figure S.3-3, C-5	40,000 Lab	2029	Tests and Experiments
Figure S.3-3: 12	**Building 832E Replacement**	Site 300; C-5	2,000 Office/ Storage	2029	Enabling Infrastructure
34	**Whole Body Counting Support Facility**	Livermore Site; D-4	2,000 Lab	2030	Enabling Infrastructure

Map ID #	Name[a]	Site; Grid Locations[b]	Size (ft^2)/ Facility Type	Year	NNSA Capability[d]
35	Physical and Life Sciences (PLS) Administration	Livermore Site; D-5	22,000 Office	2031	Simulation
36	**Detector Development High Bay**	Livermore Site; F-3	15,000 Lab	2031	Test and Experiments
4	**Domestic Uranium Enrichment Program**	Livermore Site; G-6	150,000 Lab	2031	Global Security
37	Institutional Office Administration Facility	Livermore Site; E-6	110,000 Office	2032	Enabling Infrastructure
38	Building 381 Office Replacement	Livermore Site; F-5	70,000 Office	2032	Test and Experiments. HED Experiments
Figure S.3-3: 13	**Advanced 3D Hydrotest Facility**	Site 300; Figure S.3-3, E-2	75,000 Lab	2032	High Explosives
39	Secure Training and Communications Center	Livermore Site; D-2	8,000 Support	2033	Global Security
Figure S.3-3: 14	**Accelerator Bay & Support Bunker Expansion**	Site 300; Figure S.3-3, E-2	10,000 Lab	2033	High Explosives
40	West Cafeteria Replacement	Livermore Site; B-4	15,000 Support	2034	Enabling Infrastructure
41	**Experimental Synthesis/Chemistry Replacement Capability**	Livermore Site; C-4	160,000 Lab	2034	Tests and Experiments. Global Security, Strategic Partnerships
42	**Micro/Nano Technology Laboratory Facility**	Livermore Site; C-6	20,000 Lab	2034	Non-Nuclear Components
43	Integrated Global Security Center (IGSC)	Livermore Site; D-2	75,000 Office	2034	Global Security
44	**Animal Care Facility**	Livermore Site; D-5	20,000 Lab	2034	Strategic Partnership Projects. Global Security
45	**High Energy Density (HED) Capability Support Facility Replacement**	Livermore Site; F-7	145,000 Lab	2034	Tests and Experiments
46	Engineering Administration Office	Livermore Site; C-6	50,000 Office	2035	Design and Certification
47	**Flight Diagnostics Instrumentation Laboratory**	Livermore Site; C-6	22,000 Lab	2035	Tests and Experiments
48	**Classified Lab**	Livermore Site; D-2	15,000 Lab	2035	Global Security
49	**Forensic Science Center**	Livermore Site; C-5	60,000 Lab	By 2035	Global Security
Figure S.3-13	**Rebalance Site-wide Parking**	Livermore Site; Figure S.3-13	Not applicable	By 2035	Enabling Infrastructure
Figure S.3-15	**Remove Limited Area Fencing**	Livermore Site; Figure S.3-15	Not applicable	By 2035	Enabling Infrastructure
Figure S.3-16	**Expand Pedestrian Walkways**	Livermore Site; Figure S.3-16	Not applicable	By 2035	Enabling Infrastructure
Figure S.3-17	**Expand Bicycle Circulation**	Livermore Site; Figure S.3-17	Not applicable	By 2035	Enabling Infrastructure
50	**Future NIF Laser Expansion**	Livermore Site; E-7	50,000	Unknown	Tests and Experiments; High Energy Density Physics
N/A	**Lake Haussmann Enhancements**	Livermore Site; D-6	Not applicable	By 2035	Enabling Infrastructure
Total			**3,328,400**		
Operational Changes					
51	**Increase Tritium Emissions Limits at the National Ignition Facility**	Livermore Site; F-8	N/A	2023	Tests and Experiments
52	**Increase Tritium Emissions Limits at the Tritium Facility**	Livermore Site; B-5	N/A	2023	Tritium

Map ID #	Name[a]	Site; Grid Locations[b]	Size (ft^2)/ Facility Type	Year	NNSA Capability[d]
53	**Decrease Administrative Limit for Fuels-Grade Equivalent Plutonium, Enriched Uranium, and Depleted Uranium Radioisotopes in Superblock**	Livermore Site; B-5	N/A	2023	Plutonium
56	**Revise National Ignition Facility Radioactive Materials Administrative Limits**	Livermore Site; F-8	N/A	2023	Tests and Experiments
57	**Increase Administrative Limit for Building 235**	Livermore Site; C-6	N/A	2024	Tests and Experiments; Plutonium

a. Throughout this SWEIS, NNSA acknowledges that facility names are subject to change in the future.
b. In general, for each new facility at the Livermore Site, alphabetical-numerical grid coordinates are provided to aid in locating the facility on Figure S.3-9. For Site 300, Figure S.3-3 shows designated areas to aid in locating any new Site 300 facility.
c. **Bolded** projects in this table and Table S.3-5 are described in Section S.3.3.1.
d. NNSA Infrastructure capabilities as defined in Chapter 2.
Sources: LLNL 2021b, 2021c, 2021d.

Table S.3-5. Proposed Action: Modernization/Upgrade/Utility Projects (2023–2035)[a]

Name[b]	Site	Building Number(s)	NNSA Capability[c]
NIF Upgrades and Infrastructure Modernization (Project ID 4368, 460, 5644, 6622, 4761, 4798, 385, 3047, 3060, 3066, 4390, 3983, 4097, 4590, 5561, 6623, 433, 3078, 3936, 4107, 4184, 4582, 4583, 4584, 4587, 4593, 5724, 593, 3036, 3056, 3059, 4586, 4588, 4589, 4595, 4596, 4597, 4598, 6132, 6131, 6130, 6129, 6136, 6128)	Livermore Site	298, 391, 392, 490, 581, 582, 684	Tests and Experiments
Enhanced Capability at NIF	Livermore Site	581	Tests and Experiments
132N Complex Revitalization (Project ID 4576, 5650, 5652, 4793, 4794, 457, 5576, 6971, 5575)	Livermore Site	132N	Global Security
132S Complex Revitalization (Project ID 4393, 5657, 5583, 484, 4408, 3897, 6970, 6972)	Livermore Site	132S	Global Security
Building 151 Laboratory Upgrades and Revitalization (Project ID 3976, 5528, 6071, 6077, 6068, 6072, 6078, 3776, 6079)	Livermore Site	151	Design and Certification
Superblock Upgrades (Glovebox System, Support Systems) (Project ID 3045, 4156, 540, 3046, 3049, 5648, 545, 6137, 6168, 6847, 6848, 387, 3054, 6139, 6138)	Livermore Site	239, 331, 332, 334, 3340, 335	Tritium, Plutonium
Livermore Site Miscellaneous Facility/Laboratory Upgrades (Project ID 3989, 5522, 2823, 3019, 4267, 4756, 5519, 6111, 3052, 3350, 4085, 4158, 6109, 4046, 4157, 4172, 5627, 374, 384, 3895, 3928, 4066, 4090, 4189, 5517, 6030, 6075, 425, 3345, 4007, 4045, 4407, 5536, 5549, 5552, 5554, 5624, 6073, 3058, 4330, 5620, 6027, 6074, 6076, 6087, 6100, 6112, 6093, 6097, 6106, 6033, 6107, 6089, 6094, 6101, 6113, 6110, 6812).	Livermore Site	131, 140, 141, 170, 191, 194, 197, 231, 233, 235, 253, 255, 262, 282, 321C, 327, 341, 361, 381, 391, 439, 443, 451, 453, 551W, 654, 663, 681, 695, 696	Design and Certification; High Explosives; Tests and Experiments; Enabling Infrastructure

Name[b]	Site	Building Number(s)	NNSA Capability[c]
Includes industrial gas (i.e., liquid nitrogen) centralization for site facilities.			
Seismic Risk Reduction (Project ID 6790, 6791, 3349)	Livermore Site	490, 391B, 271, 381B, 431, 298	Enabling Infrastructure
Miscellaneous Office and Computing Building Revitalization (Project ID 4072, 4105, 5977, 246, 4766, 5970, 4402, 4071, 5511, 6163, 597)	Livermore Site, Site 300	111, 112, 113, 123, 1677, 271, 324, T4727, 490, 651	Enabling Infrastructure
High Explosives Process Area Revitalization (Project ID 537, 500, 594, 596)	Site 300	805, 806, 807, 809, 810, 817, 823, 855	High Explosives
Site 300 Firing Control System Modernization/Upgrade (Project ID 445, 732, 6034)	Site 300	851	Design and Certification
Site 300 Miscellaneous Facility/Laboratory Upgrades (Project ID 3901, 4754, 5651, 4074, 6028, 6029, 6635, 556, 509, 590, 6032, 526, 542, 562, 532). Includes industrial gas (i.e., liquid nitrogen) centralization for site facilities	Site 300	801, 807, 810, 823, 825, 826, 827, 834, 836, 850, 851, 865	Design and Certification; High Explosives
Running Track Installation	Livermore Site	Not applicable	Enabling Infrastructure
Site 300 Erosion Control Projects	Site 300	Not applicable	Enabling Infrastructure
Site 300 Road Upgrades	Site 300	Not applicable	Enabling Infrastructure
Domestic Water/Low Conductivity Water Supply and Distribution System Upgrades, including Cooling Tower Replacements/Upgrades	Livermore Site, Site 300	Includes U291, OS454, and other upgrades at both sites	Enabling Infrastructure
Sanitary Sewer, Septic and Stormwater System Upgrades and Replacements, including Wastewater Reuse Projects	Livermore Site, Site 300	Not applicable	Enabling Infrastructure
Security Fencing and Security Upgrades	Livermore Site, Site 300	Not applicable	Enabling Infrastructure
Arroyo Mocho Water Pumping Facility and Associated Pipelines Refurbishment and Upgrades	Livermore Site, Site300, Arroyo Mocho	Not applicable	Enabling Infrastructure
Mechanical and Electrical System (including High Voltage and Emergency System) Replacements and Upgrades, including upgrades and expansion for Electric Vehicle Charging[d]	Livermore Site, Site 300	Not applicable	Enabling Infrastructure

a. Modernization/Upgrades list only comprises of large projects greater than $1 million; there are many hundreds of smaller upgrade projects less than $1million are not included in this list.
b. Actions identified in Table S.3-5 have been combined and summarized.
c. NNSA Infrastructure capabilities as defined in Chapter 2.
d. Electric Vehicle charging capabilities would be increased such that fleet acquisitions for light-duty vehicles approach 100% zero emissions by 2025. Charging capability for employee personal vehicles would also be expanded.

Sources: LLNL 2021b, 2021c, 2021d.

Table S.3-6. Proposed Action: DD&D Projects (2023–2035)

Buildings to Undergo DD&D	Site	Size (ft^2)	Year
1726, 2632, 2685, 2687, 3180, 343, 345, 3724, 3725, 3726, 373, 376, 379, 3982, 5125, 5225 (16 facilities)	Livermore Site	~ 37,000	2023
1739, 2726, 2727, 2775, 312A, 446, 4475, 6127, 6178, 6179 (10 facilities)	Livermore Site	~ 95,000	2024
8724, 8726	Site 300	~ 1,300	2024
231, 261, 263, 3203, 3204, 321F, 322A, 3527, 435 (9 facilities)	Livermore Site	~ 196,000	2025
802A, 828A/B/C (4 facilities)	Site 300	~ 4,000	2025
4675, 510, 6475, 6501, 651, 652, 6525, 6526, 6527, 653, 6575 (11 facilities)	Livermore Site	~ 35,000	2026
830	Site 300	~ 1,800	2026
1714, 1730, 1735, 231A, 3427, 378, 4525, 6206 (8 facilities)	Livermore Site	~ 24,000	2027
856	Site 300	~ 1,600	2027
1277, 1280, 197, 198, 294, 327, 5626, 5627, 5675 (9 facilities)	Livermore Site	~ 60,000	2028
848	Site 300	1,300	2028
115, 116, 117, 118, 2580, 314, 315, 362, 571 (9 facilities)	Livermore Site	~ 119,000	2029
Other Structure (OS) 858B Drop Tower Storage	Site 300	N/A	2029
1878, 1886, 1887, 1888, 1925, 214, 217, 218, 317, 318, 319, 404, 405, 418, 5105, 511, 514A, 515, 516, 519, 520, 522, 5226, 523, 525, 5299, 622, 6325, 6925, 6926 (30 facilities), plus LS431	Livermore Site	~ 260,000	2030
812A, 812D, OS812B, OS812C (4 facilities)	Site 300	~ 4,000	2030
1826, 1884, 1885, 252, 4725, 4726, 4727, 4728, 4729, 473, 512 (11 facilities)	Livermore Site	~ 65,000	2031
834B, 834C, 834G, 834J (4 facilities)	Site 300	~ 3,000	2031
253, 365, 423, 431, 509, 517, 517A (7 facilities)	Livermore Site	~ 110,000	2032
1632, 254, 671 (3 facilities)	Livermore Site	~ 49,000	2033
255	Livermore Site	~ 22,000	2034
1677, 1680, 216, 316, 366, 6929, 6930 (7 facilities), plus OS394	Livermore Site	~ 81,000	2035
Total		**~ 1,170,000**	

Sources: LLNL 2021b, 2021c, 2021d.

S.3.3.1 Proposed Action Project Descriptions: New Facilities and Modernization/Upgrade/Utility Projects

As shown on Table S.3-4, approximately 75 new projects, totaling approximately 3.3 million square feet, are proposed over the period 2023–2035. Of this, 61 projects, totaling approximately 2.9 million square feet, are proposed at the Livermore Site; 14 projects, totaling approximately 385,000 square feet, are proposed at Site 300. The proposed locations for new facilities are primarily based on land availability and synergies/efficiencies with respect to existing facilities/operations. The proposed locations would also support NNSA's vision for the Proposed Action end state (*see* Section S.3.3.4). In addition to new projects, as shown in Table S.3-5, NNSA proposes 20 modernization/upgrade/utility projects, many involving multiple facilities. The following sections provide brief descriptions of the notable new facilities/projects and modernization/upgrade/utility projects proposed.

S.3.3.1.1 *Design and Certification and LEPs and Mods Support Projects*

To accomplish the annual weapon assessment process and LEPs and Mods certification, NNSA is proposing to construct several new facilities, including the following notable facilities: (1)

National Security Innovation Center; (2) Next Generation LEP R&D Component Fabrication Building; (3) Livermore Nuclear Science Center; and (4) High Bay. Each of these proposed new facilities is discussed below.

- **National Security Innovation Center.** This project involves construction and operation of a three-story building (or four separate smaller buildings) of approximately 225,000 square feet to co-locate the Weapons Program offices currently spread out in several facilities into one central campus and optimize the mix of classified and unclassified space. Approximately 1,100 personnel from Buildings 132N, 131, 111, and 381 would relocate to this facility (LLNL 2020g, 2021c).

- **Next Generation LEP R&D Component Fabrication Building.** The scope of this project is the construction and operation of a 60,000-square-foot R&D complex for increasing capacity and capability in support of current and future LEPs and Mods. The new facility would provide the precision required in manufacturing weapons parts and assemblies while increasing efficiencies and safety by adding automation and advanced technologies (LLNL 2020h, 2021c).

- **Livermore Nuclear Science Center.** The Nuclear Science Center is a centerpiece of NNSA's strategy at LLNL to centralize and improve the existing capabilities for (1) generating nuclear data used as input to the design community's computer simulations; (2) acquiring and interpreting data from nuclear explosion debris to enable decisions about historic nuclear explosion tests; and (3) providing a platform where new experimental techniques, such as neutron interrogation and diagnostics, can be developed. The facility would be about 100,000 square feet over multiple floors, with laboratories making up half of the total building area (LLNL 2020j, 2021c).

- **High Bay.** The new High Bay would replace the existing Building 131 High Bay, which is now experiencing seismic issues due to its 60+ year-old age. The new High Bay would be a 100,000-square-foot industrial shop-type building that would provide workshop, machine shop, and storage capabilities for experiments and operations in engineering evaluations, primarily in support of the Stockpile Stewardship and Management Program, although other programs are supported as well. It would be classified as a low-hazard radiological facility (LLNL 2021c).

S.3.3.1.2 *High Explosives Infrastructure Revitalization Projects*

This NNSA program relies on high explosives (HE) devices and advanced manufacturing process development capabilities currently at Site 300 and in the HEAF (at the Livermore Site) to complete mission activities. The HE enterprise across NNSA is aging as the mission areas are increasing. Capabilities and capacities are inadequate to meet current stockpile research, development, test, and evaluation (RDT&E) demands. NNSA is proposing investments to sustain and modernize the equipment and utilities at HEAF and existing facilities at Site 300. Laboratory-specific projects proposed for the HE Infrastructure Revitalization are described below.

- **Dynamic Radiography Development Facility (DRDF).** This 60,000-square-foot facility (plus a 60,000 to 80,000-square-foot shed-like structure) would be used to conduct

radiography of HE targets using Dense Plasma Focus (DPF), Linear Induction Accelerator (LIA), and/or NIF-like laser-based application technologies (LLNL 2021c).

- **HE Manufacturing Incubator (HEMI).** This proposed 10,000-square-foot facility would allow the manufacturing processes for HE developed by the Design Agency to be seamlessly passed to the Pantex Production Agency. To accomplish this, the facility would conduct process development work for new manufacturing techniques (proof of concept) in collaboration with the Pantex Production Agency (LLNL 2021c).

- **High Explosives Application Facility (HEAF) Laboratory Capability Expansion (HEX).** This project includes construction of a 30,000 - 40,000-square-foot laboratory at the Livermore Site for scientific and laboratory space for HE R&D, as well as 5,000-10,000 square feet of office space on the second floor. The proposed approach would leverage an existing, large NNSA investment by adding the HEX to HEAF to capitalize on the existing structure, equipment, and workforce. This facility could double the work currently conducted at HEAF (LLNL 2020c, 2021c).

- **HE Safety Facility (HESF).** This facility would allow the life-cycle evaluation of HE process safety and would focus on formulation, transportation, assembly, disassembly, and final disposition of HE. NNSA does not have a dedicated facility to study the safety of HE processes. The facility would perform studies to define science-based HE processes safety limits, specifically for use at Pantex in assembly and disassembly activities (LLNL 2021c).

- **HEAF Modular Aging Facility.** This would be a thermal aging laboratory that would use modified transport containers for construction. Pressed HE parts (with an average mass of approximately one gram) would be put in ovens for approximately three to six months for aging studies (LLNL 2021c).

- **HEAF Dynamic Studies Facility.** This would be another Environmental Testing Facility for HE. It would be constructed in the courtyard of Building 191 and would be of a modular structure consisting of two shipping containers joined together (LLNL 2021c).

- **Advanced 3D Hydrotest Facility.** The proposed 75,000-square-foot Advanced 3D Hydrotest Facility would deliver a unique cinematographic capability for understanding vital weapons physics and validating an array of high-fidelity simulations. This testbed would serve as a basis for future upgrades to other hydrotest facilities, such as the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility at LANL and Flash X-ray (FXR) at Building 801 (LLNL 2021c).

- **Building 832E Replacement.** This 2,000-square-foot facility would replace existing materials management functions from Building 832E at Site 300, to be conducted safely and efficiently into a modern facility (LLNL 2021c).

- **Accelerator Bay and Support Bunker Expansion.** This 10,000-square-foot facility, which would be a variation of the LIA for HE diagnostics, would generate flash x-rays videos for diagnostics of HE (LLNL 2021c).

S.3.3.1.3 *Tests and Experiments Projects*

For Tests and Experimentation, NNSA is proposing to construct many new projects, including the following notable projects: (1) Generic Laboratory for Experimental Physics; (2) Weapons Environmental Testing Replacement Capability (WETRC); (3) Accelerator and Pulsed Power Laboratory; (4) HED Capability Support Facility Replacement; (5) Micro/Nano Technology Laboratory Facility; (6) Experimental Synthesis/Chemistry Replacement Capability; (7) Detector Development High Bay; (8) Flight Diagnostics Instrumentation Laboratory; (9) Stockpile Materials R&D Center; and (10) NIF Expansion and Upgrades. Each of these proposed projects is discussed below.

- **Generic Laboratory for Experimental Physics**. This would be a 15,000 square-foot generic physics dry laboratory, including a high-pressure lab that supports the two-stage gas gun facility at JASPER at the Nevada National Security Site (NNSS) (LLNL 2021c).

- **Weapons Environmental Testing Replacement Capability (WETRC).** This project would construct up to 40,000 square feet of new facilities to consolidate activities that are currently housed in Buildings 834, 836, and the OS858 Complexes at Site 300. The existing prefabricated facilities are old (1960s-era) and unable to address new environments for future stockpile LEPs and Mods with new delivery platforms (LLNL 2021c).

- **Accelerator and Pulsed Power Laboratory**. The proposed Pulsed Power Laboratory would replace existing capabilities in Buildings 423 and 431. The facility would be approximately 50,000 square feet, and would have two bays, one for accelerator testing and the other for pulse power testing (LLNL 2021c).

- **HED Capability Support Facility Replacement.** This new 145,000 square-foot facility would house fabrication of targets, target diagnostics, and optics. The facility would consolidate operations currently conducted in Buildings 298, 381, 391, 490, and at several vendor locations. The new facility would provide advanced clean room and laboratory facilities for the next generations of targets and diagnostics for HED physics (LLNL 2020k, LLNL 2021c).

- **Micro/Nano Technology Laboratory Facility.** This proposed facility would duplicate the micro/nano electronic technology work conducted in Building 153 (LLNL 2021c).

- **Experimental Synthesis/Chemistry Replacement Capability.** This project would replace Building 235 with a modern 160,000 square-foot facility to conduct metallography on small samples of radiological and hazardous materials (LLNL 2021c).

- **Detector Development High Bay.** This 15,000 square-foot high bay facility would replace the high bay in Building 432 and would be used for building detectors for physics experiments.

- **Flight Diagnostics Instrumentation Laboratory.** The new 22,000 square-foot facility would replace Building 442 and 443 to provide light laboratories, secure video teleconferencing, and some office space.

- **Stockpile Materials R&D Center (SMRDC).** NNSA is developing a number of new materials and pilot manufacturing processes for several active stockpile weapon systems. The proposed SMRDC, at approximately 50,000 square feet, would be a nonradiological facility with large open laboratory space (LLNL 2020i, 2021c).

- **NIF Upgrades, Infrastructure Modernization, and Enhanced Capability.** NIF is approaching 20 years of operation and some of its infrastructure will need to be replaced or upgraded. Additionally, improving NIF's laser energy and power could enable higher-yield experiments that further increase the fidelity of weapons physics experiments and enable the continued progress in support of ignition (LLNL 2020l, LLNL 2021c). Enhanced capability at NIF would include 4 major actions:

    (1) Sustain NIF operations for the next 3 decades: This would include refurbishment and upgrades to conventional facility infrastructure such as boilers, chillers, and transformers as well as systems supporting main laser operations, such as control, alignment, and optical systems.

    (2) Increase Capability at NIF: The power and energy delivery could increase by 50 percent to support increased yield and to potentially achieve ignition.

    (3) Step towards doing direct drive experiments: This would be polar direct drive with smooth laser beam to target (as opposed to current indirect drive experiments where the laser beam shines inside of the hohlraum to create x-rays). This will involve beam smoothing technology and modifications to the two ends of the laser systems.

    (4) Increase the rate of experiments from 400 shots per year to 600 shots per year. There would be no change in NIF limits as described in the operational changes under the Proposed Action. Increases in the number of shots would increase LLW by two transportainers per year. Total yearly shot yield would remain at 1,245 megajoules; therefore, the skyshine estimates from the 2005 SWEIS/2011 SA would not increase.

- **Future NIF Laser Expansion.** NIF has the potential for adding a second Switchyard/Target Bay/Target Chamber to conduct experiments using the NIF beam lines. Among other things, this expansion would allow for shielding design to support higher yields, the division of yield/non-yield experiments, direct-drive architecture, and enhanced shot rate. The expansion would be approximately 50,000 square feet as shown on Figure S.3-10and could disturb approximately 3 acres of land located southwest adjacent to the NIF. A new target chamber would require excavation to approximately 50-feet-deep. If the currently defined operational envelope for NIF is insufficient to support operations envisioned for the second target chamber, appropriate NEPA actions would be initiated at a later date (LLNL 2021b, LLNL 2021c).

Source: LLNL 2021b.

Figure S.3-10. Potential Expansion of the NIF

S.3.3.1.4 *Strategic Partnership Projects*

NNSA is proposing to construct several new SPP facilities, including the following notable facilities: (1) Hertz Hall Expansion – Open Campus Generic Office/Lab Building and Revitalization and other Proposed New Facilities; (2) LVOC Advanced Biotechnology Research and Response Facility; (3) LVOC LLNL Collaboration Center; (4) Biosafety Level-3 (BSL-3) Facility Replacement; and (5) Animal Care Facility (includes Forensic Science Center interface and R&D activities previously described in 3.3.1.5). Each of these proposed facilities is discussed below.

- **Hertz Hall Expansion – Open Campus Generic Office/Lab Building and Revitalization and other Proposed New Facilities.** The Hertz Hall expansion would be a UC funded project, and would consist of light laboratories, offices, and guest house facilities for visitors from UC campuses (LLNL 2019e, 2021c).

- **LVOC Advanced Biotechnology Research and Response Facility**. This project involves construction and operation of a 13,000 square-foot laboratory building adjacent to the Advanced Manufacturing Laboratory (AML). The facility would be designed with reconfigurable biological wet lab space for state-of-the-art bioscience, and flexible dry-lab space devoted to building engineering platform prototypes and measurement instrumentation. There is currently a gap in DOE/NNSA capabilities at LLNL to address future pandemics, and this facility would fill those gaps. The operations would use Risk Group 2 agents and below that can be handled at the BSL-2 level (LLNL 2020e, 2020f).

- **LVOC LLNL Collaboration Center**. This project involves construction and operation of a 111,000 square-foot 4-story office and conference center with approximately 350 offices.

- **Animal/Biosafety Level-3 Facility Replacement.** LLNL's BSL-3 Facility, Building 368, is the only such laboratory within the DOE complex. The facility is experiencing an increased demand for many DOE laboratory collaborators and other government and industry strategic partners as well as ongoing and expanding programs. Additionally, there is a need for modern approaches to enhance safety, but these require additional space to implement The facility supports new work in medical countermeasures (medical prophylactics [e.g., vaccines] and therapeutics [e.g., antibody therapy, antibiotics, drugs]) and is specific to providing risk reduction for public health-related incidents (i.e., COVID-19). The Proposed Action involves construction of a new modernized replacement facility, with upgraded safety systems and enhanced laboratory capabilities, which would be approximately 5,000 square feet with laboratory, equipment, and small animal preparation and holding space. Some procedures with the new instrumentation would benefit from the addition of a Class III biosafety cabinet for which space is a current limitation (LLNL 2020m, 2020n, 2021c).

- **Animal Care Facility.** The Proposed Action would involve construction of a modern 20,000-square-foot replacement Animal Care Facility with state-of-the-art air-handling units and other safety and environmental features. Animals are humanely used in these research protocols and tissues are harvested for molecular analysis. Other chemicals and some radionuclides are also used in this research. The proposed facility would also house secure labs to conduct forensic science work with classified materials in the animal care facility (LLNL 2020m, 2020n, 2021c).

S.3.3.1.5 *Global Security*

In support of this mission, NNSA is proposing the following new facilities:

- **Domestic Uranium Enrichment Program.** NNSA has a need for domestic uranium enrichment using U.S.-developed technologies in support of the Stockpile Stewardship and Management Program and advanced civilian and defense reactor systems. As experts in the previous uranium-atomic vapor laser isotope separation (Uranium-AVLIS) work at LLNL, the laboratory is well-suited to conduct pilot-scale laser-based technology development work and to use these systems to enrich depleted uranium inventories. Once selected and successfully developed, this LLNL technology would then be transferred to one of the NNSA production agencies where it can be scaled up to support NNSA uranium enrichment programs. The facility would be a radiological facility and would remain below Hazard Category (HC)-3 thresholds.[8] Less than HC-3 facilities are classified in accordance

[8] Under 10 CFR Part 830, DOE assigns hazard categories to nuclear and radiological facilities in accordance with the potential consequences of a radiological accident. The HC is based on the quantities of hazardous radiological materials, per DOE-STD-1027. An HC-3 nuclear facility would only have the potential for localized consequences.

with DOE-STD-1027. The proposed project would require an approximately 150,000 square feet laboratory facility in the north-central portion of the Livermore Site.

- **Classified Lab**. This 15,000-square-foot classified laboratory would be used to conduct electromechanical work, as well as work involving test assembly, clean room activities (optics), and small wet and dry chemical capability (LLNL 2021c).

- **Forensic Science Center.** This 60,000-square-foot facility would replace Forensic Science laboratory spaces in Building 132N with a new state-of-the-art classified laboratory space, including 30 new chemistry and biology laboratories and 80 offices. The biological laboratories would be at BSL-2 or below. The facility would support U.S. compliance with the Chemical Weapons Convention, as well as the ongoing and expanding work for the U.S. Federal Bureau of Investigation, the intelligence community, and other U.S. government organizations (LLNL 2021c).

- **Network Intelligence Research Facility.** There is a need to expand support for emergency response, forensics, nuclear counterterrorism, and other intelligence-related projects. The proposed action would construct an 80,000 square foot facility encompassing offices, light electrical laboratories, server rooms, communications rooms and other support space focused on international threats and corresponding countermeasures.

- **Cyber-Physical Test Capability for Energy Distribution.** The Site 300 Cyber-physical test capability for energy distribution would install renewable power generation and distribution systems at Site 300 to enable cyber-physical testing and demonstration focused on enhancing the resilience of the US energy production and distribution infrastructure. This effort would involve installing electrical generation and storage equipment consisting of ground-mounted solar arrays, battery storage, and diesel generators, as well as power distribution equipment connected by a dedicated overhead distribution line system.

- **Alternative Energy Micro-Grid for the Future.** The Site 300 alternative energy micro-grid for the future will both provide a pilot location for demonstrating resilient power solutions from renewable sources as well as provide some power for Site 300 using primarily renewable sources thereby enhancing LLNL's ability to provide some uninterrupted NNSA mission support even during grid-wide power outages.

- **Materials Analysis Laboratory.** This facility (approximately 20,000 square feet) would support LLNL's expanding nuclear forensics work. In short, this facility would be similar to Building 151 but on a smaller scale. The facility would have the ability to do high sensitivity and high-resolution chemical and nuclear analysis but would remain a low-level radiological facility with similar emissions, hazards, and waste streams as Building 151.

- **Generic Classified Office Building**. LLNL is experiencing a shortage of classified office space. This office building is planned to be near LLNL's proposed Classified Lab Facility and would be approximately 15,000 square feet and house 40-50 staff. There is a need to expand support for emergency response, forensics, nuclear counterterrorism, and other intelligence-related projects.

S.3.3.1.6 *Enabling Infrastructure Projects*

NNSA is proposing to construct many new projects related to Enabling Infrastructure, including the following notable projects: (1) ES&H Analytical Laboratories Replacement; (2) Packaging and Transportation Safety and Operational Support Facility; (3) Whole-Body Counting Support Facility; (4) Non-Destructive Evaluation Stockpile Test and Evaluation Capacity Expansion; (5) Generic Office Buildings/Modernization of Existing Office Buildings/Miscellaneous Laboratory Facilities; (6) New Parking Structures and Rebalance of Site-Wide Parking; (7) Upgrades of Electrical, Mechanical, and Civil Utilities at the Livermore Site and Site 300; (8) Fire Station; (9) New North Entry at Livermore Site; (10) Extend City of Livermore Reclaimed Water Distribution System for Cooling Tower Use; (11) Seismic Risk Reduction Projects; (12) Removal of Limited Area Fencing; (13) Arroyo Mocho Utility Upgrades; (14) Expand Pedestrian Walkways; (15) Expand Bicycle Circulation; and (16) Lake Haussmann Enhancements. Each of these proposed projects is discussed below.

- **ES&H Analytical Laboratories Replacement.** This 40,000-square-foot laboratory is a proposed replacement for ES&H analytical laboratory functions within Buildings 253, 254, and 255, and a small lab in Building 151 at the Livermore Site (LLNL 2021c).

- **Packaging and Transportation Safety and Operational Support Facility.** This new facility would serve as a replacement for office space in Building 234, Building 231 Vault, Building 233 Garage Area and Building 233 Fenced Area. Operations would include shipping, receiving, and storage of controlled materials (LLNL 2021c).

- **Whole-Body Counting Support Facility.** This would be a 2,000-square-foot facility that would be built to provide offices and labs near the whole-body counting facility (LLNL 2021c). This appears to be the most cost-effective solution to providing employee health monitoring capabilities.

- **Non-Destructive Evaluation Stockpile Test and Evaluation Capacity Expansion**. The current non-destructive evaluation facilities would be expanded to support the growing LEPs and Mods work. Building 327 low-energy capabilities would be relocated to this new 11,000 square feet facility with modern, flexible open labs LEP and Mods work (LLNL 2021c).

- **Generic Office Buildings/Modernization of Existing Office Buildings/Miscellaneous Laboratory Facilities.** As previously discussed, LLNL facilities are old and aging. Modernization is critical to long-term goals to support NNSA's national security missions. Per Table S.3-4, approximately 17 new generic office buildings are proposed at the Livermore Site, totaling approximately 374,000 square feet (each generic office building is expected to be approximately 22,000 square feet in size); two new office buildings, totaling approximately 24,000 square feet, are proposed to be located at Site 300. In addition to these generic office buildings, several specific office buildings are proposed, such as the Institutional Office Administration Facility and the Engineering Administration Office (LLNL 2021b, 2021c).

- **New Parking Structures and Rebalance of Site-wide Parking.** Current Livermore Site parking count identifies more than 17,000 spaces overall. Available area, changing programs, and shifts in staff population have resulted in a situation in which the Livermore Site is over-parked by space-count, but poorly balanced by the location of those spaces. Recognizing convenience in access as a reasonable priority, new surface parking is proposed to be located in smaller lots near buildings. This reduced area carries visual benefit, limiting the visual potential for a "sea of parking" with improved opportunities for screening and shading. With this, consolidated parking would be accomplished in a few large lots at the Livermore Site perimeter or in parking structures to support increased worker population near the central portion of the Livermore Site. For the Proposed Action, NNSA is proposing to construct two new parking structures: (1) a two-level 90,000-square-foot garage with 300 parking spaces located close to the National Security Innovation Center; and (2) a multi-level 250,000-square-foot parking structure east of Building 341 (LLNL 2020g, 2021c). The Proposed Action assigns about 1,500 spaces to the two new parking structures, increasing total space count to more than 2,500 spaces in the central portion of the site. Increasing the number of charging stalls in the larger parking lots is included under the Proposed Action. Figure S.3-11 reflects this proposed new parking balance.

Source: LLNL 2021b.

Figure S.3-11. Parking Distribution for the Proposed Action

- **Upgrades of Electrical, Mechanical, and Civil Utilities at the Livermore Site and Site 300.** LLNL is comparable to a small city— it provides utility services to hundreds of buildings, roads, and basic support services for its population. The Livermore Site and Site 300 have their own electric, gas, water, communications, sewage collection systems, security force, and fire stations. Components within LLNL's utility systems are more than 50 years old, have aged to the point of unreliability, and/or can no longer be maintained cost effectively. Leaks and system failures are impacting mission facility availability. Aging of LLNL's utilities and need for reliable, code-compliant systems create gaps that require ongoing investment. Infrastructure projects include utility valves and water distribution piping replacements, domestic water system treatment plant upgrades, Site 300 erosion control systems installation, paving systems replacements, facilities fire protection and life-safety systems replacement, and electrical system upgrades (LLNL 2017a).

- **Fire Station.** A new 30,000-square-foot Fire Station is proposed to be constructed in approximately 2028 (LLNL 2021c). The existing single-story fire station is inadequate for many reasons and no longer meets its goal of providing a fully functional fire station with administrative offices meeting the needs of a modern professional fire department. A replacement for this building is needed to provide the quarters needed for the firefighting crews, provide space for housing fire vehicles, and provide administrative space. The preferred location for the new Fire Station would be south of the EOC in the southwest area of the Livermore Site. In addition, this SWEIS analyzes an alternate location west of the New North Entry in the north buffer zone.

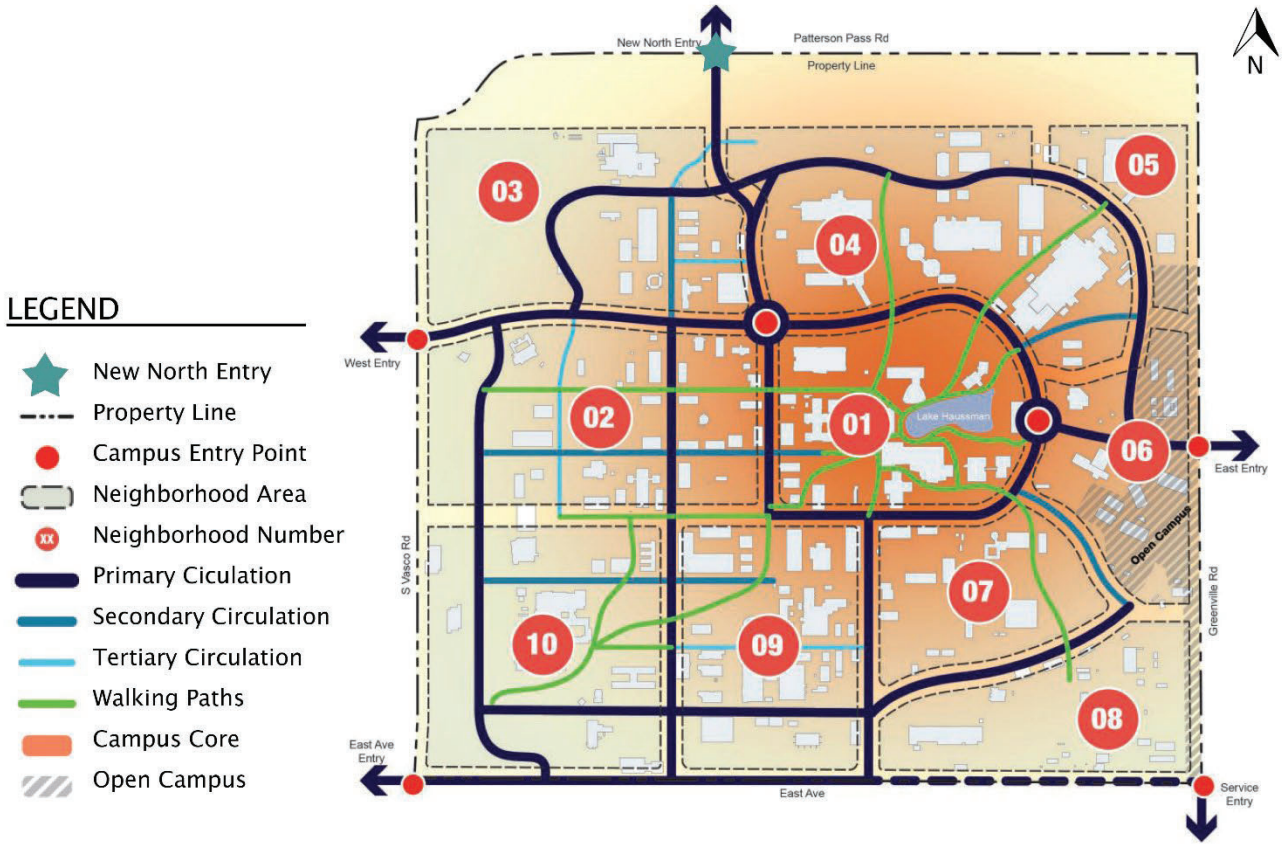
- **New North Entry at Livermore Site.** As shown on Figure S.3-12 and Figure S.3-13, a New North Entry to the Livermore Site is proposed for 2025. This site entry would provide quick employee access to the center of the laboratory where several new facilities and office buildings are being proposed. The New North Entry would alleviate traffic backups and delays/wait times (some up to 15 minutes long) that occur during the morning commute at the West Gate entrance. Approximately 1,500 lineal feet of roadway construction and approximately four acres of land would be disturbed for this project. The roadway would cross the approximately 500-foot-wide north buffer zone, and an approximately 100-foot-long bridge would be constructed across the existing Arroyo Las Positas (LLNL 2021b).

- **Extend City of Livermore Reclaimed Water Distribution System for Cooling Tower Use.** NNSA is proposing to improve LLNL's water resource sustainability practices by working with multiple local water agencies to extending the supply of City of Livermore Water Reclamation Plant (WRP) reclaimed water for use in cooling towers at the Livermore Site. As shown on Figure S.3-14, this proposal would require construction of approximately 6,000 linear feet of 6-inch-diameter piping on the Livermore Site, buried to a depth of approximately 3 feet. Approximately 2.5 acres of land would be disturbed during construction activities, but would be restored after construction. The reclaimed water would be used by existing cooling towers U291 and OS454 and a future cooling tower serving the ECFM project. (Stantec 2019).

- **Seismic Risk Reduction**. The Proposed Action includes seismic upgrades to several facilities, as identified in Table S.3-5. These buildings are Class B Priority or lower. Class B Priority indicates that they would have poor seismic performance in a design basis

earthquake and would potentially receive heavy damage but collapse not likely. Several of these facilities are large (about 200,000 square feet) and routinely occupied. The buildings would be upgraded to meet Life Safety performance objectives.

- **Arroyo Mocho Utility Upgrades**. NNSA proposes the following upgrades to the Arroyo Mocho water supply system: (1) installation of a second telemetry control system; (2) replacement of the pump control systems and associated electrical switchgear; and (3) refurbishment of the seven-mile-long pipeline. These projects would improve the reliability and life of the supply system (LLNL 2021c).

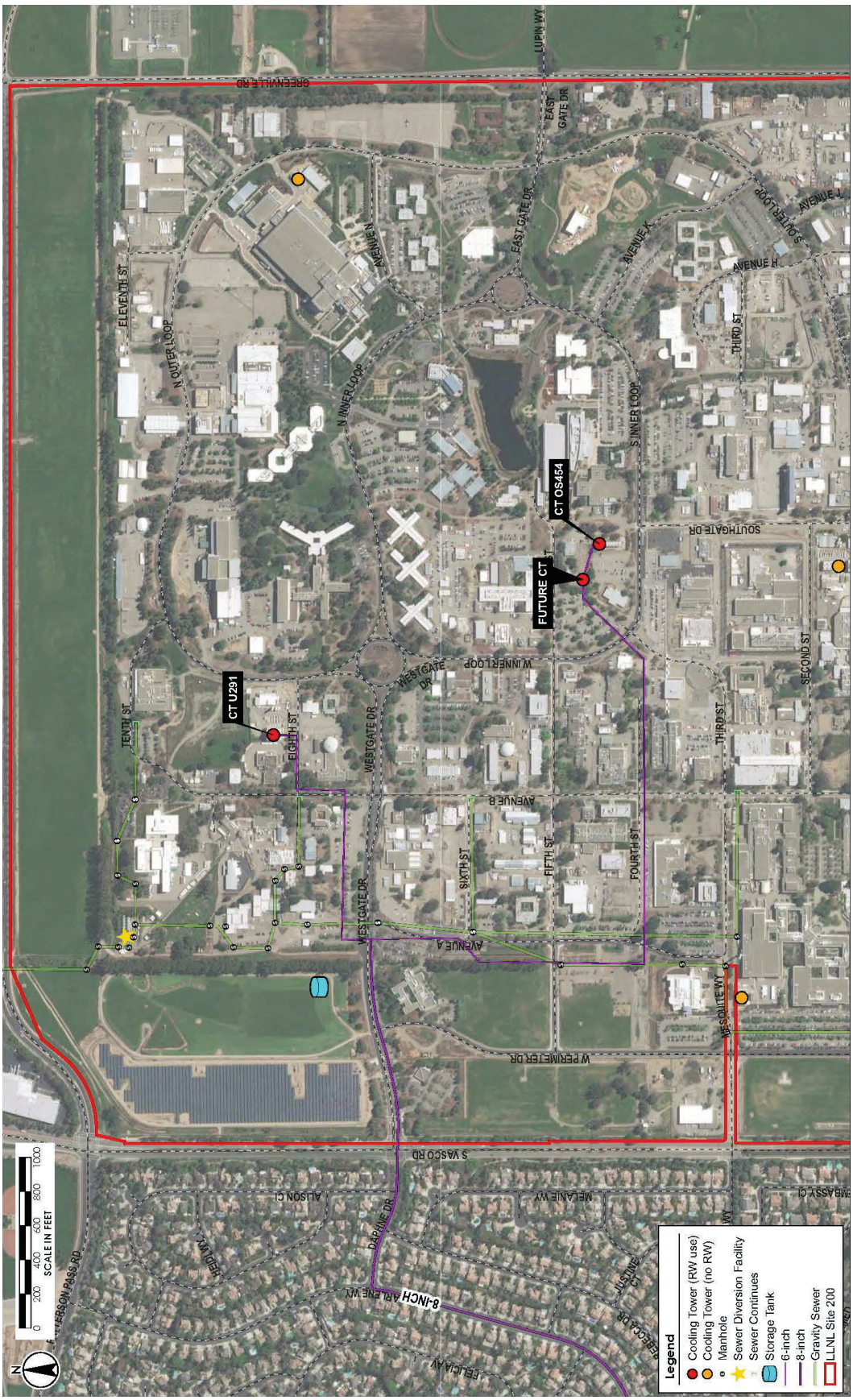


Source: LLNL 2021b.

Figure S.3-12. Location of New North Entry to Livermore Site

Source: LLNL 2021b.

Figure S.3-13. Details of New North Entry to Livermore Site



Note: The purple line shows the pipeline extensions on the Livermore Site and the near vicinity.
Source: Stantec 2019.

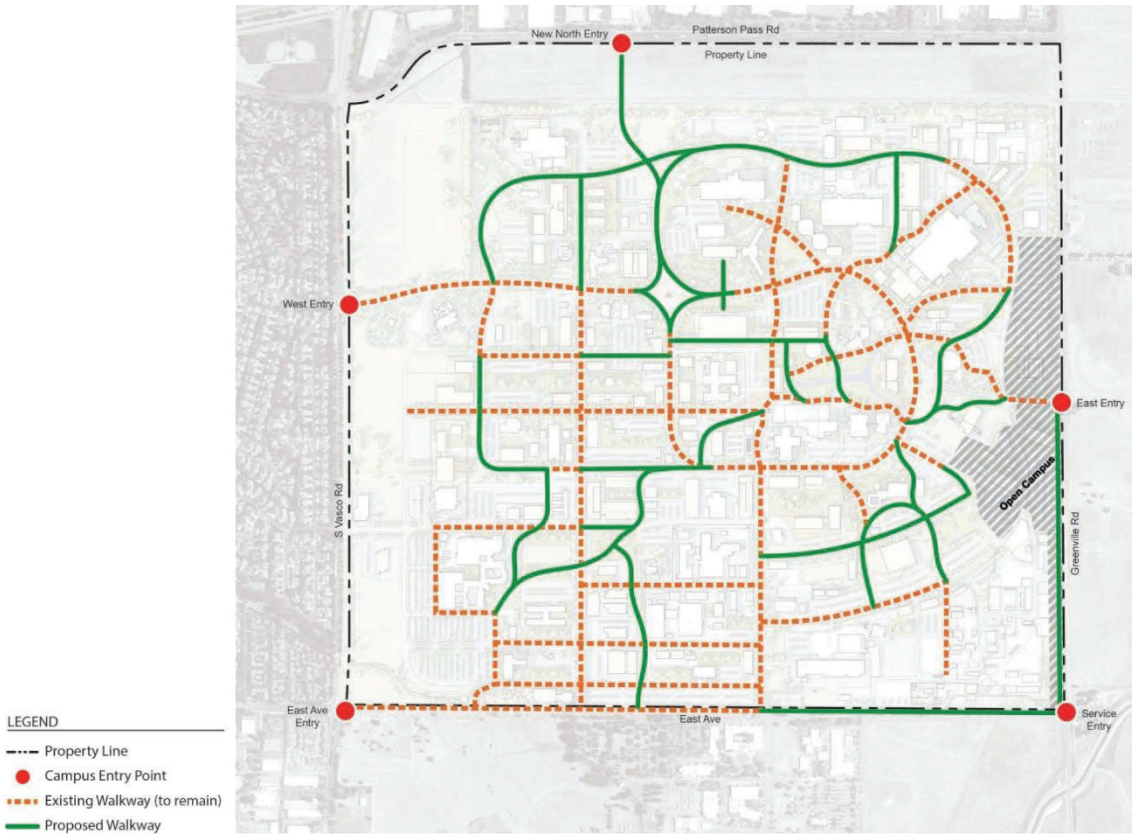
Figure S.3-14. Extend City of Livermore Reclaimed Water Distribution System for Cooling Tower Use

- **Removal of Limited Area Fencing.** The Proposed Action also includes operational Limited Area fencing located throughout the Livermore Site to provide a layer of physical security external to buildings. Gradually removing and relocating Limited Area fencing and the associated legacy posts and turnstiles would allow more fluid pedestrian movement and thereby greater collaborative potential. In addition, general access areas (GAA) around the LVOC and along Vasco Road would be expanded as collaborative projects are built on the edges of the Livermore Site. Figure S.3-15 displays proposals related to removing the Limited Area fencing and expanding the GAA at the Livermore Site.

Source: LLNL 2021b.

Figure S.3-15. Removal of Limited Area Fencing and Expanding General Access Areas

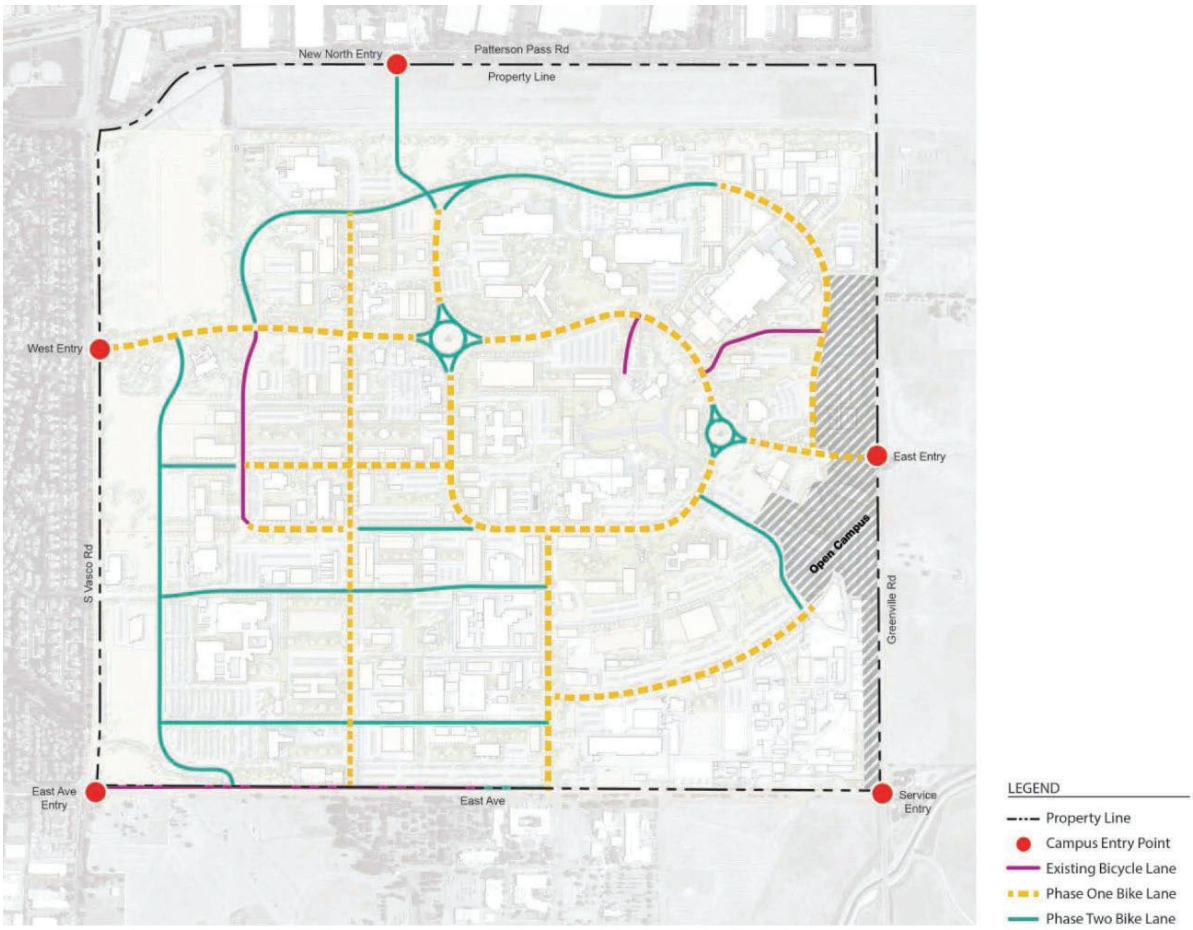
- **Expand Pedestrian Walkways.** Pedestrian routes are typically located adjacent to roadway or parking areas on the Livermore Site. The SWEIS identifies opportunities for dedicated pedestrian circular networks throughout the Livermore Site, as depicted in Figure S.3-16. Approximately six miles of new pedestrian walkways would be constructed, disturbing approximately six acres of land (LLNL 2021b).



Source: LLNL 2021b.

Figure S.3-16. Expanded Pedestrian Walkways at the Livermore Site

- **Expand Bicycle Circulation.** The one-square-mile Livermore Site is easily traveled by bicyclists if there are adequate considerations made for their safety along the vehicle roadways. Consequently, as depicted in Figure S.3-17, NNSA is proposing to stripe 4-foot-wide bike lanes on existing roads that are generous enough in width to provide safe passage for vehicles and bicyclists simultaneously.



Source: LLNL 2021b.

Figure S.3-17. Expanded Bicycle Circulation at the Livermore Site

- **Two Site 300 Office Buildings (unclassified and classified spaces).** LLNL is experiencing a shortage of office space and is planning to lease spaces offsite. Specifically, Site 300 has a critical shortage of office space, particularly in the General Services Area (GSA). Two office buildings are separate projects proposed for this area: the first office building (approximately 24,000 square feet) would house 100 personnel, and the second office building (approximately 50,000 square feet) would house 200 personnel. The buildings would provide modern office space based on Energy STAR initiative floor plans. Both buildings would provide needed space for new hires and serve as a "Site 300 Hub," creating hoteling/short-term office space for LLNL commuters coming from the Central Valley and beyond, while also providing a home base for classified computing and IT. A master planning study is underway to identify the current capacity of the electrical, water, and sewage systems as well as to determine the future utility requirements of the GSA and forward areas. The study would also quantify the classified and unclassified office needs of Site 300. This office space supports programmatic requirements for NNSA.

- **Lake Haussmann Enhancements.** Although not a native or natural water body, Lake Haussmann is a feature element and is located in the geographic center of the Livermore Site. In addition to its aesthetic value, Lake Haussmann is a conveyance channel for both

stormwater runoff and treated groundwater that is discharged off site into Arroyo Las Positas. NNSA is proposing additional landscaping around Lake Haussmann to facilitiate a collaborative environment while retaining a significant water feature. Lake Haussmann would continue to serve as a conveyance channel.

S.3.3.2 Proposed Action: DD&D Projects

Under the Proposed Action, NNSA would DD&D about 150 facilities, totaling approximately 1,170,000 square feet; 98 percent of these facilities are at the Livermore Site (131 facilities, totaling about 1,153,000 square feet) and 2 percent (18 facilities, totaling about 17,000 square feet) are at Site 300. On an annualized basis, NNSA would DD&D approximately 90,000 square feet of excess facilities over the SWEIS Proposed Action planning period (2023–2035).

S.3.3.3 Proposed Action: Operational Changes

NNSA is proposing to increase the tritium emissions limits at the NIF (Building 581) and the Tritium Facility (Building 331). Emissions from the Tritium Facility and NIF may not increase; however, increased reservoir tritium loading (up to 1,500 Curies [Ci]) presents the potential for higher emissions during reservoir handling and associated system operations or maintenance. Engineered solutions to tritium emissions, including the Tritium Processing System, are expected to continue to operate with high efficiency (>99 percent) but some equipment/operations fall out of the control umbrella of these engineered systems. These larger quantities of tritium would be required to fill the larger target gas capsules to higher pressures anticipated in new experimental platforms. The fill systems are complex and operated manually, and could release part or all of the tritium from the target or reservoir to the NIF or Building 331 environmental stacks instead of the intended tritium recovery systems. Additionally, programmatic and maintenance tasks required during tritium processing (e.g., changing fill and source vessels during processing operations and maintenance of valves, pipes, pumps, and molecular sieves may increase the likelihood of incidental tritium emissions. This SWEIS analyzes the potential impacts from increased tritium emissions limits (*see* Section 5.14 of this LLNL SWEIS).

In addition, NNSA is proposing to decrease the administrative limit for fuels-grade-equivalent (FGE) plutonium in the Superblock (Building 332). The 2005 LLNL SWEIS ROD established an administrative limit for all isotopes of plutonium in the Superblock to 1,400 kilograms, enriched uranium to 500 kilograms, and depleted or natural uranium to 3,000 kilograms. In this SWEIS, NNSA is proposing to reduce that administrative limit to 300 kilograms of FGE (see text box below) plutonium; 200 kilograms of enriched uranium (>1 percent enrichment); and 1,000 kilograms of natural or depleted uranium (<1 percent enrichment).

Administrative Limits

Administrative limits are defined as the maximum amount of the referenced material allowed at a facility. The actual inventory for some materials at LLNL for which there is an administrative limit may be classified.

Fuels-Grade-Equivalent (FGE) Plutonium

The Building 332 Documented Safety Analysis (DSA) uses 30-year-old fuels-grade plutonium for material-at-risk (MAR) in accident scenarios. Most of plutonium handled in Building 332 is weapons- or fuels-grade-plutonium, that comprise of a variety of different isotopes. The major difference between the two is the presence of americium-241 (Am-241), which has a higher potential radiological dose than any of the plutonium isotopes. Because the 30-year-old fuels-grade plutonium has approximately three percent Am-241, versus 0.45 percent in weapons-grade, the fuels-grade is used as a standard to compare with all other radionuclides. This is done by the method of Equivalent Mass Multiplier (EMM), where the EMM for fuels-grade is defined as 1.00. The EMM for weapons-grade is 0.47 and for Pu-238 is 80.9. For example, 10 kilograms of fuels-grade plutonium is equivalent to 10 divided by 80.9, or 0.12 kilograms of Pu-238. In other words, 0.12 kilograms of Pu-238 has a FGE of 10 kilograms. This method is used to determine a FGE plutonium value for all other materials used in Building 332 that have different isotopes than the specified 30-year-old fuels-grade plutonium. The FGE value is also used in the inventory control process to ensure that the facility operates within the envelope of analyzed conditions. The FGE values represent the amount of an isotope giving an offsite dose equivalent to 30-year-old fuels-grade plutonium as analyzed in the Building 332 DSA.

Source: LLNL 2016a.

NNSA notes that the Building 334 administrative limits for plutonium, enriched uranium, and natural and depleted uranium are included in the Building 332 administrative limits. After de-inventory of Security Category I and II materials were completed in 2012, LLNL designated material areas would remain below Security Category II material limits. This SWEIS analyzes whether the proposed decrease would impact operations and accidents involving the Superblock (*see* Section 5.16 of this SWEIS).

The National Ignition Facility would revise its radioactive materials administrative limits for all isotopes in accordance with the applicable hazard categorization standard.[9] Under the Proposed Action, the facility would increase the tritium inventory limit from the No-Action Alternative (8,000 Ci) to below the HC-3 limits (16,000 Ci) and would also increase the plutonium-239 administrative limits to below 38.2 grams per DOE-STD-1027-2018 when approved for use at LLNL. These changes would maintain the existing facility characterization of less than HC-3 in accordance with DOE-STD-1027 revisions approved for use at LLNL. These limits are presented in Chapter 4 (*see* Table 4-39) and analyzed in Appendix C and Chapter 5. The bounding radiological impacts from accidents at LLNL are not related to NIF operations; therefore, neither the current nor proposed inventory limits in NIF would change the bounding radiological impacts from accidents.

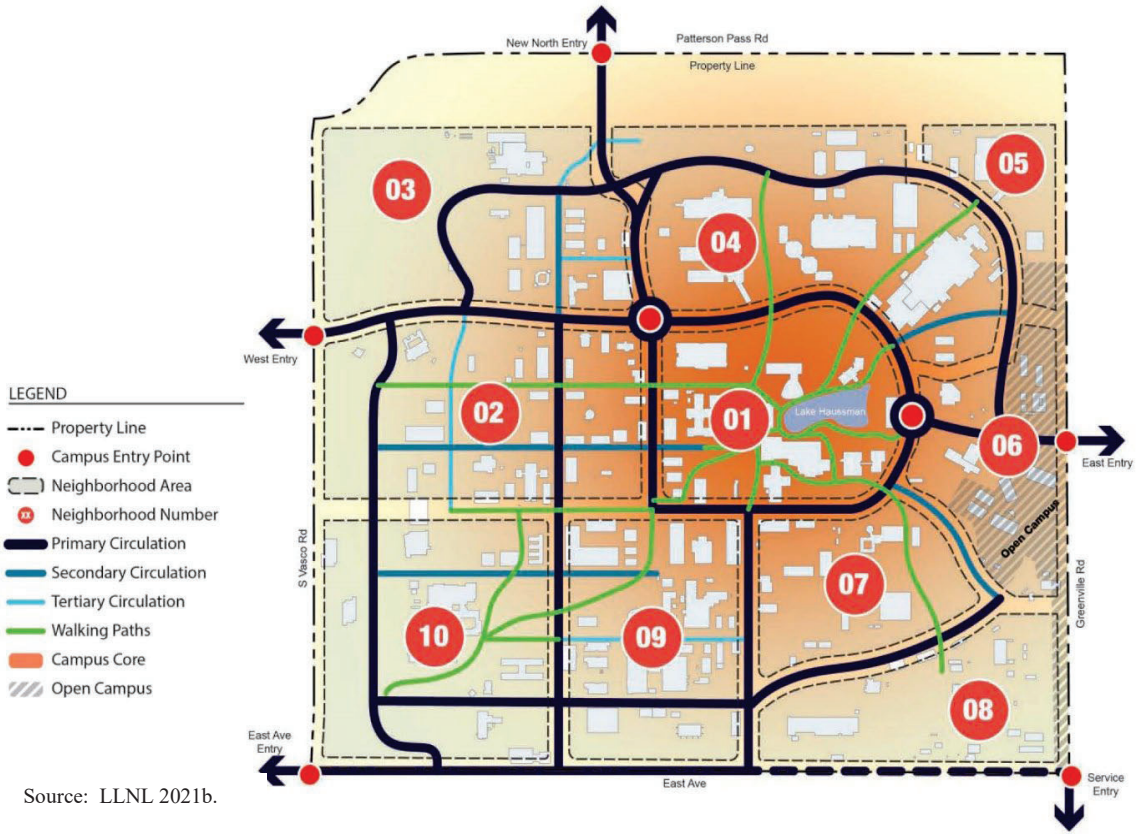
NNSA is also proposing to increase the administrative limits for plutonium mixtures at Building 235 from less than 8.4 grams plutonium-239 under the No-Action Alternative to less than 38.2 grams under the Proposed Action. This increase would maintain the existing facility limit of less than HC-3 in accordance with DOE-STD-1027 revisions approved for use at LLNL. The increased limits in B235 would lead to expanding the laboratory space dedicated to the preparation of plutonium samples for experimental work conducted outside of B235. This would enable the preparation of experimental samples for critical high-pressure experiments at NIF, JASPER facility at the Nevada Nuclear Security Site, HPCAT and DCS facilities at Argonne National

[9] For purposes of this document, radiological hazard categorization primarily uses DOE-STD-1027-92, which is the currently applicable standard at LLNL per the terms of the prime contract. Because the SWEIS is a forward-looking document, some proposed projects will use the more recent revision, DOE-STD-1027-2018 (DOE 2018), which NNSA expects to implement at LLNL in the future. Use of either of these revisions is acceptable by the guidance provided by DOE.

Laboratory, Z Pulsed Power Facility at Sandia National Laboratories, and other facilities. Building 235 would also conduct characterization of aged and newly manufactured actinide materials; small scale benchtop experiments evaluating engineering property changes as a function of age; and new manufacturing processes and methods of mitigating the effects of aging.

S.3.3.4 The Proposed Action End State

The planned removal or replacement of aged facilities creates an opportunity to shift population and intensity of use toward a central location within the Livermore Site. Because Lake Haussmann is a feature element and the geographic center of the Livermore Site, the Proposed Action would consolidate many new facilities near this location to create opportunities for collaboration, introduce employee amenities, and enhance the image of the site. Enhancing the landscaping with additional vegetation and walkways would facilitate this proposed vision. Figure S.3-18 depicts a "heat map" that visually illustrates the concentration of employees in an identifiable central area (Area "01") while reducing the concentration of worker population in the surrounding collaborative loop (Areas "02-10").



Source: LLNL 2021b.

Figure S.3-18. Illustration of the Concentration of Employees in Central Area

The size of the Livermore Site also places a premium on the value of an effective, site-wide network of pedestrian links and bicycle paths. While the loop road system is currently geared to vehicles, the original master planning concept envisioned a pedestrian network, converging on Lake Haussmann. In addition, changing security protocols would allow for removal of significant fencing of Limited Areas, removing additional barriers to cross-site pathways. The Proposed

Action also addresses this approach for pedestrians and leverages the width of the loop road system to introduce dedicated lanes for bicycle travel.

S.3.3.5 New Hybrid Work Environment for the Proposed Action and No-Action Alternative

Although teleworking was not discussed in the scoping meetings, this SWEIS includes analysis of an implementation option in which NNSA would maximize telework at LLNL. This new hybrid work environment is a DOE/NNSA initiative at the Administrator-level involving all NNSA laboratories, including LLNL. The new hybrid work environment would represent a different approach to conducting operations at LLNL but would not change the fundamental NNSA mission requirements or overall facility operations. Under this option, approximately 20 to 30 percent of the LLNL workforce could telework a maximum of 2.5 days per week without detriment to NNSA mission requirements.

Section 5.18 of this SWEIS provides an analysis of the potential environmental impacts associated with a new hybrid work environment at LLNL and quantifies the impacts where possible. The new hybrid work environment could be implemented for both the No-Action Alternative and the Proposed Action. As discussed in Section 5.18 of this LLNL SWEIS:

- Although consolidation of personnel could help accelerate DD&D and construction activities, the number of facilities and offices would not change; potential decreases in office space would be countered by COVID-19 distancing requirements that may be required/accommodated for in the future. Reduced worker commuting and reduced travel would decrease air emissions. However, some of this decrease would be offset by workers using their home heating and air conditioning systems.
- Reduced worker commuting would result in positive impacts on the level-of-service (LOS) of area roads.
- Reduced onsite worker population would reduce onsite vehicle circulation, parking, and domestic water use.
- There would be no net change in safety, health, and waste generation because facility and laboratory personnel would continue to operate facilities and conduct the same types and amounts of experiments and tests.

S.3.4 Analytical Parameters for the Alternatives

As discussed in Sections S.3.2 and S.3.3, both the No-Action Alternative and the Proposed Action encompass a multitude of discreet projects/actions that could give rise to environmental impacts. By addressing all of these projects/actions in a site-wide analysis, NNSA is able to:

- Consolidate impact analyses and public participation activities, which streamlines the NEPA process to make it more efficient and useful.
- Present impact information so decisionmakers and the public have a clear understanding of the totality of impacts from past, present, and reasonably foreseeable future activities at a site.
- Avoid segmentation (division of actions with significant impacts into smaller actions, thereby hiding significance); and

- Effectively and efficiently respond to stakeholders by presenting information on past, present, and future activities at DOE sites in order to better understand the impacts that DOE's activities have had or may have on their health and environmental quality (DOE 1994).

A primary challenge in preparing a site-wide analysis is to address the impacts of the individual projects/actions while also addressing the totality of impacts. To accomplish those dual goals, NNSA defined and accumulated data for each of the projects/actions defined by the No-Action Alternative and the Proposed Action. For each project/action, NNSA consulted with subject matter experts from LLNL to quantify key parameters. The accumulated parameters are shown in Table S.3-7 (for construction) and Table S.3-8 (for operations) for both the No-Action Alternative and the Proposed Action. For example, for both the No-Action Alternative and the Proposed Action, construction activities associated with new facilities (Table S.3-1 and Table S.3-4), modernization/ upgrade/utility projects (Table S.3-2 and Table S.3-4), and DD&D activities (Table S.3-3 and Table S.3-5) have the potential to result in land disturbance. Table S.3-7 shows the results of accumulating those land disturbances for all of the projects/actions.

This same process was utilized to develop parameters such as workforce, water use, and waste generation, as examples. In some instances, the accumulated parameters presented in Table S.3-7 and Table S.3-8 are largely driven by the contribution of one or two projects/actions. For example, as shown in Table S.3-8, increased water usage at the Livermore Site after 2023 would be primarily associated with cooling water usage for Exascale computing. As these examples illustrate, in developing the key parameters for the SWEIS analysis, NNSA is able to account for projects/actions both individually and in totality, and the analysis in this SWEIS addresses each of these aspects.

As shown in Table S.3-7, for most construction parameters associated with the Proposed Action, NNSA developed estimates for both the average year and the peak year of construction/DD&D.[10] The analysis in Chapter 5 of this LLNL SWEIS addresses the potential impacts associated with peak year of construction/DD&D. This approach acknowledges the non-linear characteristics of construction/DD&D (i.e., unlike steady-state operations, construction/DD&D projects often ramp up to a peak level of effort) and provides a conservative analysis to account for future uncertainties. This approach also affords NNSA flexibility with respect to scheduling and conducting future construction/DD&D projects. For example, if NNSA decides to conduct a greater amount of DD&D in a given year than currently planned, the peak year analysis would be expected to bound those potential impacts.

Because operations are based on steady-state conditions, most parameters in Table S.3-8 were estimated to reflect operations at a given level. One exception to this is waste generation, which includes construction/DD&D wastes in Table S.3-8 as "nonroutine" wastes. Once the key construction and operational parameters were developed, resource experts utilized those parameters to conduct the impact analysis presented in Chapter 5 of this SWEIS.

[10] Because construction associated with the No-Action Alternative is more well defined, less uncertain, and has occurred/is occurring over a relatively short period (i.e., 2019–2022), a peak-year analysis is less meaningful and was not developed.

Table S.3-7. Key Construction Parameters for the No-Action Alternative and the Proposed Action

Resources	Baseline Data (2019)	No-Action Alternative (3 years: 2020–2022)	Proposed Action (13 years: 2023–2035)
Land disturbance[a]	**Livermore Site:** 821 acres in size; approximately 80-90% developed	**Livermore Site** • 13.6 acres total (9.6 acres for new projects, 2 acres for ECFM, and 2 acres of laydown areas); • average of 4.5 acres/yr	**Livermore Site** • 85.5 acres total (69 acres for new projects, 4 acres for New North entry, 2.5 acres for cooling tower pipeline, 6 acres for sidewalks, and 4 acres of laydown areas); • average of 6.4 acres/yr; peak year: 12.8 acres
	Site 300: 7,000 acres in size; less than 5% developed	**Site 300** • 0.6 acres total including 0.5-acre laydown area; • average of 0.2 acres/yr	**Site 300** • 36 acres total (12.3 acres for new facilities, 2.3 acres for Cyber-physical test capability for energy distribution, 20.4 acres for alternative energy micro-grid for the future, and 1 acre of laydown areas); • average of 2.4 acres/yr; peak year: 4.8 acres
Land restored by DD&D	As of 2019, approximately 481,166 square feet of facilities (11 acres total, 0.8 acre/yr) have undergone DD&D at LLNL since completion of 2005 SWEIS	**Livermore Site** • 5.2 acres total; average of 1.7 acres/yr	**Livermore Site** • 26.5 acres total; average of 2.0 acres/yr; peak year: 4.0 acres
		Site 300 • 0.02 acres total; average of 0.007 acre/yr	**Site 300** • 0.4-acre total; average of 0.03 acre/yr; peak year: 0.06 acre
Net land	Not applicable	**Livermore Site** • 6.4 acres disturbed (assumes DD&D land is reclaimed and laydown areas are restored)	**Livermore Site** • 52.5 acres disturbed (assumes DD&D land is reclaimed and cooling tower pipeline and laydown areas are restored)
		Site 300 • 0.1 acre disturbed (assumes DD&D land is reclaimed and laydown areas are restored)	**Site 300** • 34.6 acres disturbed (assumes DD&D land is reclaimed and laydown areas are restored)
Workforce	Total LLNL employment: 7,909, consisting of 7,208 employees at Livermore Site, 477 supplemental workers, and 224 workers at Site 300	210 construction workers/yr	Average: 350 construction workers/yr; peak year: 700 construction workers

Resources	Baseline Data (2019)	No-Action Alternative (3 years: 2020–2022)	Proposed Action (13 years: 2023–2035)
Electricity use	**Livermore Site**: 402.4 million kilowatt-hours/year **Site 300**: 12.2 million kilowatt-hours/year	No notable change associated with construction	No notable change associated with construction
Natural gas use	**Livermore Site and Site 300**: 12,361 therms/day	No notable change associated with construction	No notable change associated with construction
Fuel	**Livermore Site and Site 300**: 102,000 gallons/yr of petroleum	No notable change associated with construction	No notable change associated with construction
Concrete	Not applicable	25,000 yd^3	250,000 yd^3 (of this, approximately 50,000 yd^3 could be associated with future NIF expansion)
Water use	**Livermore Site and Site 300**: 267 million gallons/yr	Increase of 3.7 million gallons/yr	Increase of 3.9 million gallons/yr; increase of 6.8 million gallons in peak year
Wastewater	**Livermore Site and Site 300**: 328,000 gallons/day	Increase of 5,250 gallons/day (based on 25 gallons/day per construction worker)	Increase of 8,250 gallons/day; increase of 16,500 gallons/day in peak year (based on 25 gallons/day per construction worker)

a. Land disturbance includes new parking lots associated with rebalancing parking on the Livermore Site.
Sources: LLNL 2021c, LLNL 2021d.

Table S.3-8. Key Operational Parameters for the No-Action Alternative and the Proposed Action

Resources	Baseline Data (2019)	No-Action Alternative (Operations After 2022)		Proposed Action (Operations by 2035)	
Land occupied by new projects after restoration of laydown areas and other project areas	**Livermore Site:** 821 acres in size; approximately 80-90% developed	**Livermore Site** • 11.6 acres total		**Livermore Site** • 79 acres total	
	Site 300: 7,000 acres in size; less than 5% developed	**Site 300** • 0.1acre total		**Site 300** • 35 acres total	
Land no longer occupied as a result of DD&D	As of 2019, approximately 481,166 square feet of facilities (11 acres total, 0.8 acre/yr) have undergone DD&D at LLNL since completion of 2005 SWEIS	**Livermore Site** • 5.2 acres total		**Livermore Site** • 26.5 acres total	
		Site 300 • 0.02acre total		**Site 300** • 0.4 acres total	
Net change in land use	Not applicable	**Livermore Site** • 6.4 acres disturbed		**Livermore Site** • 52.5 acres disturbed	
		Site 300 • 0.1 acre disturbed		**Site 300** • 34.6 acres disturbed	
Operational workforce	**Total LLNL employment**: 7,909, consisting of 7,208 employees at Livermore Site, 477 supplemental workers, and 224 workers at Site 300	**Livermore Site** • 8,810 workers	Total: 9,130 workers (increase of 1,221 workers over 2019 baseline of 7,909 workers)	**Livermore Site** • 9,654 workers	Total: 10,060 workers (increase of 2,151 workers over No-Action Alternative 9,130 workers)
		Site 300 • 320 workers		**Site 300** • 406 workers	
Electricity	**Livermore Site**: 402.4 million kilowatt-hours/year	**Livermore Site** • 475 million kilowatt-hours/year • 65.5 MW/month (peak)		**Livermore Site** • 535 million kilowatt-hours/year • 81.9 MW/month (peak)	
	Site 300: 12.2 million kilowatt-hours/year	**Site 300** • 12.6 million kilowatt-hours/year • 2 MW/month (peak)		**Site 300** • 24.7 million kilowatt-hours/year • 5 MW/month (peak)	
Natural gas usage	**Livermore Site and Site 300**: 12,361 therms/day	12,750 therms/day		13,500 therms/day	
Fuel (oil, gasoline) usage[a]	**Livermore Site and Site 300**: 102,000 gallons/yr of petroleum	96,000 gallons/yr. by 2022 75,300 gallons/yr. by 2035		85,000 gallons/yr. by 2035	
Water use[b]	**Livermore Site and Site 300**: 281 million gallons/yr	Increases to 447 million gallons/yr in 2030; 400 million gallons/yr by 2035		503 million gallons/yr	

Resources	Baseline Data (2019)	No-Action Alternative (Operations After 2022)	Proposed Action (Operations by 2035)
Wastewater	**Livermore Site and Site 300**: 328,000 gallons/day	358,000 gallons/day (based on 25 gallons/day per additional worker)	412,000 gallons/day (based on 25 gallons/day per additional worker)
Radiological air emissions (curies/year)	**Livermore Site** • Tritium Facility: 126.4 Ci tritium • NIF: 2.8 Ci tritium Miscellaneous other diffuse emissions	**Livermore Site** • Tritium Facility limit: 210 Ci tritium • NIF limit: 80 Ci tritium • Building 298: 10 Ci tritium • Miscellaneous other diffuse emissions	**Livermore Site** • Tritium Facility limit: 2,000 Ci tritium[c] • NIF limit: 1,600 Ci tritium[c] • HED Capability Support Facility Replacement (replacement for Building 298): 10 Ci tritium • Miscellaneous other diffuse emissions
	Site 300 • CFF: 1.2×10^{-7} U-234; 1.7×10^{-8} U-235; 9.2×10^{-7} U-238	**Site 300** • CFF: 1.2×10^{-7} U-234; 1.1×10^{-8} U-235; 8.9×10^{-7} U-238	**Site 300** • CFF: 1.2×10^{-7} U-234; 1.1×10^{-8} U-235; 8.9×10^{-7} U-238
Radiation workers[h]	123	575	615
Average dose to radiation worker	69.6 mrem/yr	180 mrem/yr	173.5 mrem/yr
Waste Projections[d]			
Hazardous waste	Routine: 510 metric tons/yr Nonroutine: 1,700 tons/yr	Routine: 510 metric tons/yr Nonroutine: 1,700 metric tons/yr	Routine: 510 metric tons/yr Nonroutine: 1,700 metric tons/yr
Nonhazardous solid waste	Routine: 2,780 metric tons/yr Nonroutine: 2,570 metric tons/yr	Routine: 3,050 metric tons/yr Nonroutine: 900-5,500 metric tons/yr	Routine: 3,400 metric tons/yr Nonroutine: 5,500 metric tons/yr
LLW	Routine: 850 m^3/yr Nonroutine: 710 m^3/yr[e]	Routine: 850 m^3/yr Nonroutine: 4,000-8,000 m^3/yr[e]	Routine: 1,000 m^3/yr Nonroutine: 7,000 m^3/yr[e]
MLLW	Routine: 88 m^3/yr Nonroutine: 725 m^3/yr	Routine: 88 m^3/yr Nonroutine: 725 m^3/yr[e]	Routine: 88 m^3/yr Nonroutine: 3,170 m^3/yr[e]
TRU and mixed TRU wastes	Routine: 52.8 m^3/yr Nonroutine: 60 m^3/yr	Routine TRU: 50 m^3/yr Nonroutine TRU: 60 m^3/yr[e] Routine Mixed TRU: 2.8 m^3/yr Nonroutine Mixed TRU: 0 m^3/yr[e]	Routine TRU: 50 m^3/yr Nonroutine TRU: 60-120 m^3/yr[e] Routine Mixed TRU: 2.8 m^3/yr Nonroutine Mixed TRU: 0-2.8 m^3/yr[e]
LLW/MLLW shipments	40-50 annually of LLW 10-15 annually of MLLW	Routine shipments: 120/yr (85% to NNSS, 15% to Energy*Solutions*)[f] Nonroutine shipments: 160/yr (10% to NNSS, 90% to Energy*Solutions*)[f]	Routine shipments: 120/yr (85% to NNSS, 15% to Energy*Solutions*)[f] Nonroutine shipments: 160-384/yr (10% to NNSS, 90% to Energy*Solutions*)[f]
TRU waste shipments to WIPP	2-4 annually[g]	Up to 8 annually[g]	Up to 8 annually[g]

a. In 2019, LLNL used 102,000 gal/yr of petroleum. NNSA has a goal to reduce petroleum usage at LLNL by approximately 2 percent year-over-year. By the end of 2022, petroleum usage is expected to be 96,000 gal/yr and LLNL would strive to continue reducing usage by 2 percent year-over-year going forward. For the Proposed Action, NNSA has assumed that the goal to reduce petroleum usage by 2 percent annually would continue and by 2035 petroleum usage would decline to 85,000 gal/yr.

b. In 2019, LLNL used approximately 261 million gallons/yr of water. Increased usage until 2023 would be primarily associated with increased personnel. Increased water usage after 2023 would be primarily associated with cooling water usage for Exascale computing. Under the No-Action Alternative, water usage is expected to peak in 2030, when approximately 447 million gallons/yr would be used. Steady-state water usage of approximately 400 million gallons/yr would occur under the No-Action Alternative. Water use for the Proposed Action would increase to approximately 503 million gallons/year as new facilities become operational.
c. Emissions from the Tritium Facility and NIF may not increase; however, increased reservoir tritium loading (up to 1,500 Ci) presents the potential for higher emissions during reservoir handling and associated system operations or maintenance. Engineered solutions to tritium emissions, including the Tritium Processing System, are expected to continue to operate with high efficiency (>99 percent) but some equipment/operations fall out of the control umbrella of these engineered systems.
d. In general, English units are used throughout this SWEIS. However, for most waste types, metric units are used as that is the normal convention used by LLNL in measuring and reporting these wastes.
e. Estimates for nonroutine radiological wastes (i.e., LLW, MLLW, TRU waste) are not intended to reflect annual occurrences. Nonroutine radiological wastes would not be generated in all years.
f. Small quantities of shipments could also be made to other commercial facilities (see Section 5.11.3).
g. Past shipments to the WIPP were done through "Campaigns," in which several years of generated waste drums/boxes were stored onsite until a campaign was initiated to move these drums to WIPP. In the future, NNSA intends to develop an enduring program to make annual shipments from LLNL to WIPP. This would result in less waste drum storage onsite, thereby reducing any accident scenarios involving multiple stored drums.
h. Number of radiation workers receiving a measurable dose.

Sources: LLNL 20201c, LLNL 2021d.

S.3.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

NNSA considered public input and comments received during the scoping process in determining the range of alternatives in this Draft LLNL SWEIS. NNSA only considered reasonable alternatives that would meet the purpose and need described in Chapter 1 of this SWEIS. The following alternatives were considered in developing this Draft SWEIS, but were eliminated from detailed analysis because they did not allow LLNL to fulfill the NNSA mission requirements. The specific reasons for elimination are detailed below.

Complete Closure of LLNL (Livermore Site and/or Site 300). This alternative is inconsistent with the LLNL mission defined by NNSA. Such a possibility was considered as recently as 2008 when NNSA prepared the Complex Transformation SPEIS (NNSA 2008). In that document, NNSA concluded that, "as a result of the continuing challenges of certification [of nuclear weapons] without underground nuclear testing, the need for robust peer review, benefits of intellectual diversity from competing physics design laboratories, and uncertainty over the details [of] future stockpiles, NNSA does not consider it reasonable to evaluate laboratory consolidation [or elimination] at this time" (NNSA 2008). That conclusion has not changed today. In addition, as one of only three nuclear weapons laboratories, LLNL contributes significantly to the core intellectual and technical competencies of the U.S. related to nuclear weapons. These competencies embody more than 50 years of weapons knowledge and experience. The laboratories perform the basic research, design, system engineering, development testing, reliability and assessment, and certification of nuclear weapon safety, reliability, and performance. From a broader national security perspective, the core intellectual and technical competencies of LLNL (as well as LANL and SNL, NNSA's other nuclear weapons laboratories) provide the technical basis for the pursuit of U.S. arms control and nuclear nonproliferation objectives.

Transfer of Current Missions/Operations from LLNL to Other Sites. The Complex Transformation SPEIS also considered and evaluated the transfer of missions/operations to and/or from LLNL, and NNSA has implemented, as appropriate, decisions that followed preparation of that document. NNSA has not identified any new proposals for current missions/operations that are reasonable for transfer to and/or from LLNL (NNSA 2008; 85 FR 47362).

Conversion of LLNL to an Academic Laboratory and/or an Environmental Research Laboratory. Under this alternative, LLNL would cease nuclear weapons-related work and instead perform academic/environmental research work. Under this alternative, NNSA would remove nuclear materials from LLNL and remove all waste. LLNL would use existing facilities and staff for academic research and/or environmental research. Such an alternative would not allow NNSA to meet the purpose and need discussed in Chapter 1, Section 1.3, of this SWEIS (85 FR 47362).

Relocation of All Nuclear Materials and Nuclear Research to Another Site. Under this alternative, LLNL would cease its work involving nuclear materials and would relocate all nuclear materials to another DOE/NNSA site. Such an alternative would not allow NNSA to meet the purpose and need discussed in Chapter 1, Section 1.3, of this SWEIS (85 FR 47362).

Reduced Operations at LLNL. Under this alternative, LLNL would reduce operations to a level below the operations defined under the No-Action Alternative. Such an alternative would not

allow NNSA to meet the purpose and need discussed in Chapter 1, Section 1.3, of this LLNL SWEIS.

Shift Funding from Weapons Work to Environmental Cleanup. Such an alternative would not allow NNSA to meet the purpose and need discussed in Chapter 1, Section 1.3, of this SWEIS (85 FR 47362).

Analyze Alternatives for Elimination of Outdoor Detonations with Hazardous Materials at Site 300. During the scoping period, a commenter stated that NNSA should analyze an alternative to eliminate outdoor detonations with hazardous materials at Site 300. As discussed in Section 2.2.5, LLNL's HE R&D program is an integral element of the NNSA's design and development effort that supports nuclear weapons stewardship and broad national security missions. The infrastructure at Site 300 consists of more than 50 facilities and storage magazines supporting HE work. These HE capabilities provide core competencies for the weapons program's annual assessment of energetic materials, components, and subassemblies (LLNL 2017a). Outdoor testing at Site 300 with hazardous material such as HE is important for formulation development and testing. If that testing were eliminated, NNSA would not be able to meet the purpose and need discussed in Chapter 1, Section 1.3, of this LLNL SWEIS.

No W87-1 Warhead Development. During the scoping period, a commenter stated that NNSA should analyze an alternative that did not include development of the W87-1 warhead. Decisions concerning whether the U.S. should possess nuclear weapons and the type and number of those weapons are made by Congress and the President. As discussed in Section 1.3.3, over the next 15 years, one of LLNL's primary responsibilities will be to continue to support LEPs and Mods, which modify the existing weapons packages for new delivery systems and extend the service life and enhance the safety, security, and reliability of nuclear weapons. One specific such project is the W87-1 LEP and Mods. The alternative requested by the commenter would not allow NNSA to meet the purpose and need discussed in Chapter 1, Section 1.3, of this LLNL SWEIS (85 FR 47362).

S.3.6 PREFERRED ALTERNATIVE

CEQ NEPA regulations require that an agency identify its preferred alternative, if one or more exists, in a Draft EIS and identify such an alternative in the Final EIS (40 CFR 1502.14 [e]). The preferred alternative is the alternative that NNSA believes would fulfill its statutory missions and responsibilities, considering economic, environmental, technical, and other factors. This LLNL SWEIS provides information on the potential environmental impacts under the No-Action Alternative and the Proposed Action. NNSA prepares cost, schedule, and technical analyses separately, and NNSA will consider all relevant factors in preparation of its ROD. NNSA has determined that LLNL is critical to its Stockpile Stewardship and Management Program, which is best supported by the Proposed Action. Therefore, NNSA has identified the Proposed Action as the preferred alternative for the continuing operations of LLNL.

S.3.7 POTENTIAL CONSEQUENCES OF THE ALTERNATIVES

A summary comparison of the environmental consequences for the continued operation of LLNL is provided in Table S.3-9 (note: Table S.3-10 and Table S.3-11 provide additional details regarding infrastructure and accidents, respectively). The table compares the potential impacts to environmental resources associated with the continued operation of LLNL under the No-Action Alternative and the Proposed Action. The information in Table S.3-9 includes data for both construction and operations. Detailed analyses supporting the summary comparisons in Table S.3-9 are contained in Chapter 5 of this SWEIS. Table S.3-12 provides information regarding the new hybrid work environment.

Table S.3-9. Summary Comparison of Environmental Impacts of the Alternatives

Baseline Data (2019)	No-Action Alternative (2020-2022)	Proposed Action (2023-2035)
Land Use		
Both Sites: The Livermore Site is 821 acres in size and is approximately 85 percent developed. Site 300 is approximately 7,000 acres in size and less than 5 percent developed. Activities at both sites continue to be compatible with existing land uses, approved land-use designations surrounding the site, and open space policies applicable to areas near the site. Since 2005, approximately 166,741 square-feet of new facilities have been added to LLNL and 659,755 square-feet of facilities have undergone DD&D.	Both Sites: Operations would be consistent with current land use designations and historic uses of LLNL land. Livermore Site: Land disturbance of 13.6 acres; 5.2 acres of land reclaimed as a result of DD&D; and 2 acres of laydown areas restored. Net change in land use would be disturbance of 6.4 acres. Site 300: Land disturbance of 0.6 acres; 0.02 acres of land reclaimed as a result of DD&D; and 0.5 acre of laydown areas restored. Net change in land use would be disturbance of 0.1 acres.	Both Sites: Operations would be consistent with current land use designations and historic uses of LLNL land. Livermore Site: Land disturbance of 85.5 acres; 26.5 acres of land reclaimed as a result of DD&D; 2.5 acres restored for cooling tower pipeline; and 4 acres of laydown areas restored. Net change in land use would be disturbance of 52.5 acres. Removal of limited area fencing, expanded bicycle network, expanded pedestrian walkways, rebalanced vehicle parking, and Lake Haussmann enhancements would create an end state with more green space. Site 300: Land disturbance of 36 acres; 0.4 acres of land reclaimed as a result of DD&D; and 1 acre of laydown areas restored. Net change in land use would be disturbance of 34.6 acres.
Aesthetics and Scenic Resources		
Both Sites: The Livermore Site has a campus-like setting with buildings, internal roadways, pathways, and open space. Portions of the Livermore Site along the western and northern boundaries are largely undeveloped and serve as buffer zones between the laboratory and adjacent industrial and residential development. Site 300 is predominately grasslands and low shrubs in areas ranging in topography from gently rolling hills to steeply sloping ridges and valleys. Viewsheds in the area around Site 300 are severely constrained by topography.	Both Sites: Construction activities would result in temporary changes to the visual appearance of both sites due to the presence of cranes, construction equipment, demolition, facilities in various stages of construction/DD&D, and possibly increased dust. Livermore Site: Replacing some aging facilities would improve the overall visual appearance, but site would remain highly developed with a campus-style or business park appearance. Site 300: Due to site boundary distances and intervening topography, minimal visual impacts expected.	Both Sites: Construction activities would result in temporary changes to the visual appearance of both sites due to the presence of cranes, construction equipment, demolition, facilities in various stages of construction/DD&D, and possibly increased dust. Livermore Site: Net land disturbance for new projects would be 52.5 acres, but modernizations and land use initiatives would add green space and improve visual appeal. Site would remain highly developed with a campus-style or business park appearance. The New North Entry and Fire Station (alternate location) in the north buffer zone would be the most notable visual change. Site 300: Net land disturbance for new projects would be 34.6 acres. Changes would occur in the site interior and would be consistent with existing visual character of the site.

Baseline Data (2019)	No-Action Alternative (2020-2022)	Proposed Action (2023-2035)
Geology and Soils		
Both Sites: There is no prime farmland at either the Livermore Site or Site 300. Ongoing remediation efforts would continue to improve soil conditions at both sites. The Livermore Site and Site 300 are located near the boundary between the North American and Pacific tectonic plates, and the structural geology of the area is the result of the interaction between these two plates. The structural conditions of the region around Livermore are largely defined by the major active faults within the region. Potential impacts from geologic hazards (i.e., seismic events) are discussed under "accidents."	Both Sites: Soil disturbances would be minimal; no prime farmland exists. Ongoing remediation efforts would continue to improve soil conditions at both sites. Major regional faults exist, but no active faults underlie the sites. No historical record of surface rupturing or faulting, although there is potential for surface faulting at Site 300. Any new facility would be designed and constructed to meet seismic design criteria commensurate with the risk category requirements. Potential impacts from geologic hazards (i.e., seismic events) are discussed under "accidents."	Both Sites: Soil disturbances would be minimal; no prime farmland exists. Ongoing remediation efforts would continue to improve soil conditions at both sites. Major regional faults exist, but no active faults underlie the sites. No historical record of surface rupturing or faulting, although there is potential for surface faulting at Site 300. Any new facility would be designed and constructed to meet seismic design criteria commensurate with the risk category requirements. Potential impacts from geologic hazards (i.e., seismic events) are discussed under "accidents."
Water Resources		
Both Sites: Groundwater quality has improved because of ongoing remediation at treatment facilities. Water use at LLNL is approximately 267 million gallons per year. Livermore Site: Surface drainage and natural surface infiltration at the Livermore Site are generally good, but drainage decreases locally with increasing clay content in surface soils. Arroyo Las Positas is an intermittent stream that drains from the hills directly east of the Livermore Site with a watershed area of approximately 3,300 acres. The arroyo enters the Livermore Site from the east, is diverted to a storm ditch along the northern edge of the site, and exits at the northwest corner. Nearly all of the surface-water runoff at the Livermore Site is discharged into Arroyo Las Positas. There are a total of 25.9 acres of floodplain on the Livermore Site. Floodplains are associated with the Arroyo Las Positas (23.5 acres) and the Arroyo Seco (2.4 acres). Wetlands at the Livermore Site include seasonal wetlands and freshwater marsh wetlands in intermittent streams which total 1.85 acres and 4,332 linear feet.	Both Sites: New facilities would increase impervious surfaces, which could increase stormwater runoff. LLNL meets stormwater compliance monitoring requirements and implementation of a Stormwater Pollution Prevention Plan (SWPPP) would minimize any pollution that might leave the site by stormwater. Ongoing remediation efforts would continue to improve groundwater conditions at both sites. There are no construction and operations projects under the No-Action Alternative that would affect the floodplains at the Livermore Site or Site 300. Water use is addressed in "Infrastructure."	Both Sites: New facilities would increase impervious surfaces, which could increase stormwater runoff. LLNL meets stormwater compliance monitoring requirements and implementation of a SWPPP would minimize any pollution that might leave the site by stormwater. Ongoing remediation efforts would continue to improve groundwater conditions at both sites. Livermore Site: New North Entry would cross approximately 0.9 acres (approximately 2 percent) of the 500-year floodplain (critical action floodplain) in the north buffer zone and approximately 0.1 acres (approximately 0.4 percent) of the 100-year floodplain (base floodplain) along Arroyo Las Positas. New Fire Station (alternate location) could disturb approximately 0.7 acres (approximately 1.6 percent) of the 500-year floodplain (critical action floodplain) but would not disturb any acres of the 100-year floodplain (base floodplain). The enhancements in Lake Haussmann would not involve wetlands or affect impoundment-waters. Even with enhancements, Lake Haussmann would continue to serve as a conveyance channel. Water use is addressed in "Infrastructure." However,

Baseline Data (2019)	No-Action Alternative (2020-2022)	Proposed Action (2023-2035)
Site 300: Surface water at Site 300 consists of seasonal runoff, seeps, and natural and man-made ponds. There are no perennial streams at or near Site 300. The floodplain associated with the Corral Hollow intermittent stream in the southeast corner is 9.6 acres. Perennial and seasonal wetlands total 8.4 acres. Waters include intermittent and ephemeral streams which total 10.54 acres and 108,066 linear feet.		implementation of City of Livermore wastewater reclamation plant (LWRP) would enable LLNL to use approximately 200 million gallons per year of treated wastewater from the LWRP for cooling tower cooling water instead of using Hetch Hetchy or Zone 7 waters, and effectively would reduce potable water usage at LLNL by 200 million gallons per year.
Air Quality		
Both Sites: Based on actual emission data for the past five years (2015-2019), the Livermore Site has emitted approximately 38.7-41.4 tons/year of pollutants. The Livermore Site's nonradioactive air emissions have been approximately: • 16.9 tons/year of carbon monoxide • 14.7 tons/year of nitrogen oxides • 1.8 tons/year of particulate matter • 0.7 tons/year of sulfur oxides • 6.1 tons/year of precursor organic compounds. Air pollutants are much lower at Site 300 than the Livermore Site. Emissions estimates are well below the applicable conformity thresholds for air quality; therefore, the SWEIS projected air emissions and the actual emissions are still in conformance with Clean Air Act requirements. In 2019, LLNL emitted approximately 147,332 metric tons of carbon dioxide equivalent. The Livermore Site has reduced Scope 1 and 2 Greenhouse gas (GHG) emissions by 32 percent since 2008. Radiological air emissions of tritium at the Livermore Site are approximately 129.2 curies. Site	Both Sites: Fugitive dust would be generated during clearing, grading, and other earth-moving operations. Construction and operational emissions would not: (1) result in a considerable net increase (i.e., greater than the *de minimis* thresholds) of any criteria pollutant for which the project region is non-attainment; (2) expose sensitive receptors to substantial pollutant concentrations; (3) conflict with or obstruct implementation of the applicable air quality plan; or (4) violate any air quality standard or contribute substantially to an existing or projected air quality violation. contribute to an exceedance of an ambient air quality standard. GHG emissions would increase by approximately 5,237 metric tons annually compared to 2019 levels. The GHG emissions associated with the No-Action Alternative would represent 0.03 percent of the State of California GHG emissions. Radiological air emissions of tritium at the Livermore Site were estimated to be 300 curies based on emissions limits. There would be minimal radiological air emissions at Site 300. Impacts associated with radiological air emissions are addressed in "Human Health and Safety."	Both Sites: Fugitive dust would be generated during clearing, grading, and other earth-moving operations. Construction and operational emissions would not: (1) result in a considerable net increase (i.e., greater than the *de minimis* thresholds) of any criteria pollutant for which the project region is non-attainment; (2) expose sensitive receptors to substantial pollutant concentrations; (3) conflict with or obstruct implementation of the applicable air quality plan; or (4) violate any air quality standard or contribute substantially to an existing or projected air quality violation. GHG emissions would increase by approximately 5,239 metric tons annually compared to the No-Action Alternative. This GHG emissions associated with the Proposed Action would represent 0.03 percent of the State of California GHG emissions. Radiological air emissions of tritium at the Livermore Site were estimated to be 3,610 curies based on emissions limits. There would be minimal radiological air emissions at Site 300. Impacts associated with radiological air emissions are addressed in "Human Health and Safety."

Baseline Data (2019)	No-Action Alternative (2020-2022)	Proposed Action (2023-2035)
300 emits small quantities of depleted uranium.		
Noise		
Livermore Site: Existing sources of noise at the Livermore Site are common to any industrial/commercial setting, although on a somewhat larger scale. Sources include various industrial facilities, equipment, and machines, vehicles, as well as the use of small arms and demolitions. Noise sources from industrial facilities and operations at the Livermore site are predominantly inaudible at the property boundary. Site 300: NNSA conducts explosive testing at the CFF and on open firing tables. The overall average sound levels are completely compatible with all land uses outside of the Site 300 property boundary.	Livermore Site: Although construction and DD&D activities would cause temporary noise impacts, almost all activities would be confined to areas more than 500 feet from the Livermore Site property boundaries. Including the EOC, there would be five projects constructed within a distance of approximately 800 feet of the Livermore Site boundary. Site 300: The SFTF would be located within 500 feet of the southern site boundary. However, because there are no residences or other noise receptors within several miles of this facility, there would be no offsite noise impacts. Explosive testing conducted at the CFF and on open firing tables at Site 300 would be unchanged when compared to current operations. . The 57-dBC, 62-dBC, and 70-dBC CDNL contours would remain completely contained within the Site 300 property boundary, and the testing activities would continue to be neither loud enough nor frequent enough to generate areas of incompatible land use. LLNL continues to monitor testing activities to ensure that noise levels remain below its self-imposed limit of 126 dB in nearby residential areas. LLNL would continue to monitor during testing to limit noise levels in nearby residential areas.	Livermore Site: Although construction and DD&D activities would cause temporary noise impacts, most activities would be confined to areas more than 500 feet from the Livermore Site property boundaries. There would be 15 projects constructed within a distance of approximately 800 feet of the Livermore Site boundary. Six of the new projects would be constructed within approximately 500 feet of a site boundary. Site 300: Four facilities would be located within 500 feet of the southern site boundary. However, because there are few residences/businesses, but no schools, within several miles of this facility, offsite noise impacts would be minimal. Explosive testing noise impacts would be the same as discussed for the No-Action Alternative. LLNL would maintain its self-imposed 126 dB limits for offsite populated areas.
Biological Resources		
Both Sites: There are 10 protected and sensitive species known or expected to occur in the vicinity of the Livermore Site and 11 at Site 300. Through monitoring and compliance activities, NNSA has been able to avoid significant impacts on special status wildlife and plants. Habitat enhancement, avian protection, and invasive species control efforts resulted in benefits to protected and sensitive species. NNSA continues to monitor and maintain several restoration sites, habitat enhancements, and	Both Sites: The net land disturbance would be 6.4 acres at the Livermore Site and net disturbance of 0.1 acres at Site 300. Construction would have no appreciable impact on native vegetation, plant species of concern, wetlands or waters of the U.S. viability of federally or state-listed species, or modification of USFWS-designated critical habitat. Operations would be consistent with current activities and would have no appreciable impact on biological resources.	Both Sites: The net land disturbance would be 52.5 acres (Livermore Site) and 34.6 acres (Site 300). Construction would have no appreciable impact on native vegetation, plant species of concern, wetlands or waters of the U.S. viability of federally or state-listed species, or modification of USFWS-designated critical habitat. The roadway for the New North Entry would not be expected to impact biological resources. Operations would be consistent with current activities and would have no appreciable impact on biological resources.

Baseline Data (2019)	No-Action Alternative (2020-2022)	Proposed Action (2023-2035)
conservation set asides that are beneficial to native plants and animals at the Livermore Site or Site 300 and ensures the protection of protected and sensitive species. Surveys and monitoring activities through 2019 show no indications of substantial changes in general site conditions, ecology, and species compositions at the Livermore Site and Site 300 since the 2005 LLNL SWEIS was completed.		
Cultural and Paleontological Resources		
Livermore Site: No archaeological resources have been previously recorded at the Livermore Site. No cultural resources of religious or cultural significance to Native American tribes have been identified on the Livermore Site. Fossil resources within the area include fragmented fossils of mammoth, extinct bison, horses, camels, boney fish, rodent, turtle, and bird. Four late Pleistocene vertebrate fossils were discovered in the peripheral parts of the excavation for the NIF. No facilities at the Livermore Site retain National Register eligibility. Site 300: Archaeological surveys undertaken at Site 300 over the past 40 years inventoried all accessible areas of Site 300 and resulted in the recordation of 31 prehistoric and historic archaeological sites and isolated artifacts. It is likely that currently unknown, intact archaeological deposits exist at Site 300 because such resources have been recorded at the site and approximately 95 percent of the site's 7,000 acres is undeveloped. There have been no recorded paleontological finds on Site 300. However, several vertebrate fossil deposits have been found on Site 300 in the vicinity of Corral Hollow.	Both Sites: The probability of impacting archaeological resources would be low because field and archival research have not identified any such resources. Because fossils and/or fossil remains have been discovered at both sites, any excavations have the potential to impact similar fossils/fossil remains. Both sites have undergone a comprehensive review to identify significant historic buildings, structures, and objects, and those that were determined eligible for the National Register have already been mitigated and are no longer eligible.	Both Sites: The probability of impacting archaeological resources would be low because field and archival research have not identified any such resources. Because fossils and/or fossil remains have been discovered at both sites, any excavations have the potential to impact similar fossils/fossil remains. Both sites have undergone a comprehensive review to identify significant historic buildings, structures, and objects, and those that were determined eligible for the National Register have already been mitigated and are no longer eligible. Because there would be much more construction and associated excavation under the Proposed Action, the likelihood for discoveries of fossils/fossil remains would be greater than under the No-Action Alternative. Livermore Site: Construction planned in the vicinity of the 1997-1998 fossil discoveries, which includes the NIF Laser Expansion, HED Capability Support Facility Replacement, and some generic office buildings, would have higher potential for such discoveries if excavation extends to those depths. Of note is the planned addition to the southwestern end of the NIF for the laser expansion, as many of the original fossil discoveries occurred in this area during construction of the NIF; thus, the probability for further discoveries during the expansion of the facility is high. Site 300: For the DRDF, excavation of the hill north or south of Building 801 could be as deep as 50 feet, which would have a higher potential to impact cultural resources.

<table>
<tr><th>Baseline Data (2019)</th><th>No-Action Alternative (2020-2022)</th><th>Proposed Action (2023-2035)</th></tr>
<tr><td colspan="3">Socioeconomic Characteristics</td></tr>
<tr><td>Both Sites: As of 2019, there were 7,909 full-time employees at LLNL consisting of 7,208 employees at the Livermore Site, 477 supplemental workers, and 224 workers at Site 300. (Note: at any given time there are also additional construction workers at LLNL. Due to fluctuations, those workers are assumed to be within the accuracy of the estimated total employment). The 2019 labor force in the region of influence (ROI) is 1,976,800 persons. Direct onsite employment at LLNL accounts for approximately 0.4 percent of employment in the four-county ROI.</td><td>Key socioeconomic impacts are presented in the table below.
<table><tr><th>Resource/Metric</th><th>Construction</th><th>Operations</th></tr><tr><td>Additional direct employment</td><td>210</td><td>1,221</td></tr><tr><td>Additional indirect employment</td><td>81</td><td>1,016</td></tr><tr><td>Additional direct earnings (millions of dollars)</td><td>18.6</td><td>206.0</td></tr><tr><td>Additional value added from LLNL (millions of dollars)</td><td>31.6</td><td>376.1</td></tr></table>
Socioeconomic impacts associated with construction would be minimal/temporary and much lower than operational impacts. Once steady-state operations are reached in 2023, employment at LLNL is projected to increase to 9,340 workers (9,020 workers at the Livermore Site and 320 workers at Site 300). This would represent an increase of 1,431 workers over the 2019 workforce, resulting in an estimated 1,097 indirect jobs in the four-county ROI.

Due to the low potential for impacts on the ROI population, steady-state operations would not affect fire protection, police protection services, or medical services. The number of school-age children associated with the additional workforce potentially migrating into the ROI would be 1,011 children. The increase in school enrollment would represent 0.4 percent of the projected 2021-2022 school enrollment for the ROI. This minimal increase in school enrollment would have a negligible effect on school services in the ROI.</td><td>Key socioeconomic impacts are presented in the table below.
<table><tr><th>Resource/Metric</th><th>Construction</th><th>Operations</th></tr><tr><td>Additional direct employment</td><td>700</td><td>710</td></tr><tr><td>Additional indirect employment</td><td>270</td><td>590</td></tr><tr><td>Additional direct earnings (millions of dollars)</td><td>62.1</td><td>119.8</td></tr><tr><td>Additional value added from LLNL (millions of dollars)</td><td>104.4</td><td>218.7</td></tr></table>
Socioeconomic impacts associated with construction would be minimal/temporary and much lower than operational impacts. Once steady-state operations are reached in 2035, employment at LLNL is projected to increase to 10,750 workers (10,344 workers at the Livermore Site and 406 workers at Site 300). This would represent an increase of 1,410 workers over the No-Action Alternative workforce, resulting in an estimated 860 indirect jobs in the four-county ROI workforce.

Due to the low potential for impacts on the ROI population, operations by 2035 would not affect fire protection, police protection services, or medical services. The number of school-age children associated with the additional workforce potentially migrating into the ROI would be 908 children. The increase in school enrollment would represent 0.1 percent of the projected 2034-2035 school enrollment for the ROI. This minimal increase in school enrollment would have a negligible effect on school services in the ROI.</td></tr>
<tr><td colspan="3">Environmental Justice</td></tr>
<tr><td>Both Sites: The average minority population percentage of the counties surrounding the Livermore Site and Site 300 is approximately 59.6 percent The low-income population percentage of the counties surrounding the Livermore Site and Site 300 is 10.8 percent. LLNL operations have</td><td>No high and adverse impacts from construction and operation activities at LLNL are expected. Consequently, there would be no disproportionately high and adverse impacts to minority or low-income populations.</td><td>No high and adverse impacts from construction and operation activities at LLNL are expected. Consequently, there would be no disproportionately high and adverse impacts to minority or low-income populations.</td></tr>
</table>

Baseline Data (2019)	No-Action Alternative (2020-2022)	Proposed Action (2023-2035)
continued to result in minimal impacts, including human health effects to offsite residents and onsite workers, and there are no disproportionately high and adverse impacts to minority or low-income populations.		
Traffic and Transportation		
Both Sites: LLNL is surrounded by a system of freeways, major streets, and collector streets. The freeways and major streets in the vicinity of the Livermore Site include I-580, South Vasco Road, Greenville Road, East Avenue, and Patterson Pass Road, most of which are primarily located within the city limits of Livermore. Recent traffic studies in the vicinity of the Livermore Site indicate that the standards on roads and intersections in the vicinity of the Livermore Site vary between level-of-service (LOS) C and LOS D, which is not considered deficient.	Both Sites: By 2023, employment at LLNL is projected to increase by 1,431 over the current 2019 baseline of 7,909 workers. If all 1,431workers were to commute to the Livermore Site (which is a bounding assumption for the transportation analysis), local traffic would increase by an average of approximately 2.4 percent (note: traffic on specific roads in the vicinity of the Livermore Site would increase by 1.6 – 3.4 percent). The increase in traffic would not affect the LOS on roads in the vicinity of LLNL.	Both Sites: By 2035, employment at LLNL is projected to increase by 1,410 workers over the No-Action Alternative workforce. If all 1,410 workers were to commute to the Livermore Site (which is a bounding assumption for the transportation analysis), local traffic would increase by an average of approximately 2.3 percent (note: traffic on specific roads in the vicinity of the Livermore Site would increase by 1.6 – 3.2 percent). The increase in traffic would not affect the LOS on roads in the vicinity of LLNL. The New North Entry to the Livermore Site is expected to be operational in approximately 2025. This site entry would reduce the ADT volumes on Vasco Road and Greenville Road, and increase the ADT volume on Patterson Pass Road in the vicinity of the Livermore Site. The net effect would be a reduction in traffic backups and delays in the mornings on Vasco Road at the West Gate entrance.
Radiological and Hazardous Material Transportation		
Both Sites: LLNL transports the following hazardous and radiological materials: LLW/MLLW shipments: 40-50 annually. TRU shipments: 2-4 annually. Radiological Material shipments: about 600 shipments annually. In 2019, there were approximately 11 shipments of special nuclear material (primarily plutonium and uranium), about 84 shipments of small quantities of highly enriched uranium, about 5 shipments of tritium, and about 470 shipments of sealed sources and miscellaneous isotopes. Explosive's shipments: 730 annually. Hazardous waste shipments: about 80 to 240	Both Sites: No radiological or hazardous waste materials/shipments are expected to be performed in support of construction activities. During operations, LLNL would regularly transport radiological waste, SNM, and other radiological materials to and from the LLNL site (which includes Site 300). Modeling all 645 potential offsite shipments resulted in the following impacts: Dose to transport-crews: 61.6 person-rem per year; LCF Risk to transport crews: 0.037 LCFs; Incident-free dose to general public: 21.6 person-rem; LCF Risk to Public: 0.013 LCFs; Accident Risk to Public: 1.9 x 10^{-6} LCFs;	Both Sites: As a result of increased nonroutine shipments of LLW/MLLW associated with DD&D, there could be more total shipments of radiological materials for the Proposed Action compared to the No-Action Alternative. However, potential impacts would not be notable higher because the LLW/MLLW shipments only account for a small fraction of the total impacts. Modeling all 873 potential offsite shipments resulted in the following impacts: Dose to transport-crews: 69.2 person-rem per year; LCF Risk to transport crews: 0.042 LCFs; Incident-free dose to general public: 24.7 person-rem; LCF Risk to Public: 0.015 LCFs; Accident Risk to Public: 2.9 x 10^{-6} LCFs;

<table>
<tr><th>Baseline Data (2019)</th><th>No-Action Alternative (2020-2022)</th><th>Proposed Action (2023-2035)</th></tr>
<tr><td>annually.</td><td>Number of Traffic Fatalities from Accidents: 0.025.</td><td>Number of Traffic Fatalities from Accidents: 0.038.</td></tr>
<tr><td colspan="3">Infrastructure</td></tr>
<tr><td>See Table S.3-10 for a discussion of total capacity and available capacity.</td><td>Both Sites: Existing infrastructure would be adequate to meet all requirements (see Table S.3-10).</td><td>Both Sites: Existing infrastructure would be adequate to meet all requirements (see Table S.3-10).</td></tr>
<tr><td colspan="3">Waste Management and Materials Management</td></tr>
<tr><td>Both Sites: Operations (including construction and DD&D) generate the following annual quantities of waste (higher numbers are projections):
LLW (cubic meters/year): 1,022-1,560
MLLW (cubic meters/year): 206-813
TRU/mixed TRU waste (cubic meter/year): 8-112.8
Hazardous (metric tons/year): 269-2,210
Nonhazardous (metric tons/year): 5,360</td><td>Operations (including construction and DD&D) would generate the following projected annual quantities of waste:
LLW (cubic meters/year): 4,850 – 8,850
MLLW (cubic meters/year): 813
TRU/mixed TRU waste (cubic meter/year): 112.8
Hazardous (metric tons/year): 2,210
Nonhazardous (metric tons/year): 3,950-8,550</td><td>Operations (including construction and DD&D) would generate the following projected annual quantities of waste:
LLW (cubic meters/year): 8,000
MLLW (cubic meters/year): 3,258
TRU/mixed TRU waste (cubic meters/year): 112.8-175.6
Hazardous (metric tons/year): 2,210
Nonhazardous (metric tons/year): 8,900</td></tr>
<tr><td colspan="3">Human Health and Safety</td></tr>
<tr><td>Both Sites:
Lost days due to injury/illness per year: 65
Number of occupational fatalities per year: 0.13
Radiological Impacts:
<table>
<tr><th>Receptor/Dose/Risk</th><th>Livermore Site</th><th>Site 300</th></tr>
<tr><td>Public</td><td></td><td></td></tr>
<tr><td>Collective dose to 50-mile population (person-rem)</td><td>0.26</td><td>3.7×10^{-5}</td></tr>
<tr><td>Population LCFs</td><td>1.6×10^{-4}</td><td>2.0×10^{-8}</td></tr>
<tr><td>Offsite MEI dose (millirem)</td><td>4.004[a]</td><td>1.7×10^{-4}</td></tr>
<tr><td>MEI LCF risk</td><td>2.4×10^{-6}</td><td>1.0×10^{-10}</td></tr>
<tr><td>Workers</td><td></td><td></td></tr>
<tr><td>Number of radiological workers receiving measurable dose</td><td colspan="2">123</td></tr>
<tr><td>Average annual dose to radiological worker (millirem)</td><td colspan="2">69.6</td></tr>
<tr><td>Average annual radiological worker risk (LCFs)</td><td colspan="2">4.2×10^{-5}</td></tr>
<tr><td>Collective annual dose to radiological workers (person-rem)</td><td colspan="2">8.45</td></tr>
<tr><td>Total Annual Radiological Worker Risk (LCFs)</td><td colspan="2">0.005</td></tr>
</table>
a. Modelled doses as reported in the 2020 Annual Site Environmental Report (LLNL 2020r). Also includes maximum of 4 mrem/year in skyshine dose from NIF operations.</td><td>Both Sites:
Lost days due to injury/illness per year: 77.5
Number of occupational fatalities per year: 0.15
Radiological Impacts:
<table>
<tr><th>Receptor/Dose/Risk</th><th>Livermore Site</th><th>Site 300</th></tr>
<tr><td>Public</td><td></td><td></td></tr>
<tr><td>Collective dose to 50-mile population (person-rem)</td><td>0.60</td><td>5.0×10^{-5}</td></tr>
<tr><td>Population LCFs</td><td>3.6×10^{-4}</td><td>3.0×10^{-8}</td></tr>
<tr><td>Offsite MEI dose (millirem)</td><td>4.01[a]</td><td>1.7×10^{-4}</td></tr>
<tr><td>MEI LCF risk</td><td>2.4×10^{-6}</td><td>1.0×10^{-10}</td></tr>
<tr><td>Workers</td><td></td><td></td></tr>
<tr><td>Number of radiological workers receiving measurable dose</td><td colspan="2">575</td></tr>
<tr><td>Average annual dose to radiological worker (millirem)</td><td colspan="2">180</td></tr>
<tr><td>Average annual radiological worker risk (LCFs)</td><td colspan="2">1.1×10^{-4}</td></tr>
<tr><td>Collective annual dose to radiological workers (person-rem)</td><td colspan="2">103.5</td></tr>
<tr><td>Total Annual Radiological Worker Risk (LCFs)</td><td colspan="2">0.06</td></tr>
</table>
Modelled doses from radiological air emissions. Includes maximum of 4 mrem/year in skyshine dose from NIF operations.</td><td>Both Sites:
Lost days due to injury/illness per year: 92.5
Number of occupational fatalities per year: 0.18
Radiological Impacts:
<table>
<tr><th>Receptor/Dose/Risk</th><th>Livermore Site</th><th>Site 300</th></tr>
<tr><td>Public</td><td></td><td></td></tr>
<tr><td>Collective dose to 50-mile population (person-rem)</td><td>7.1</td><td>5.0×10^{-5}</td></tr>
<tr><td>Population LCFs</td><td>4.3×10^{-3}</td><td>3.0×10^{-8}</td></tr>
<tr><td>Offsite MEI dose (millirem)</td><td>4.21[a]</td><td>1.7×10^{-4}</td></tr>
<tr><td>MEI LCF risk</td><td>2.5×10^{-6}</td><td>1.0×10^{-10}</td></tr>
<tr><td>Workers</td><td></td><td></td></tr>
<tr><td>Number of radiological workers receiving measurable dose</td><td colspan="2">615</td></tr>
<tr><td>Average annual dose to radiological worker (millirem)</td><td colspan="2">173.5</td></tr>
<tr><td>Average annual radiological worker risk (LCFs)</td><td colspan="2">1.0×10^{-4}</td></tr>
<tr><td>Collective annual dose to radiological workers (person-rem)</td><td colspan="2">106.7</td></tr>
<tr><td>Total Annual Radiological Worker Risk (LCFs)</td><td colspan="2">0.06</td></tr>
</table>
a. Modelled doses from radiological air emissions. Includes maximum of 4 mrem/year in skyshine dose from NIF operations.</td></tr>
</table>

Baseline Data (2019)	No-Action Alternative (2020-2022)	Proposed Action (2023-2035)
Site Contamination and Remediation		
Both Sites: Remediation of groundwater and soil contamination at both the Livermore Site and Site 300 is ongoing. NNSA complies with provisions specified in the two FFAs entered into by USEPA, DOE, the California EPA Department of Health Services (now DTSC), and the San Francisco Bay or Central Valley Regional Water Quality Control Boards.	Both Sites: Remediation of groundwater and soil contamination at both the Livermore Site and Site 300 would continue. NNSA complies with provisions specified in the two FFAs entered into by USEPA, DOE, the California EPA Department of Health Services (now DTSC), and the San Francisco Bay or Central Valley Regional Water Quality Control Boards. Any future remediation actions would be conducted in accordance with these FFAs, and NNSA is not proposing any specific future remediation activities in this SWEIS. None of the activities associated with the No-Action Alternative would complicate or delay any of the monitoring or cleanup activities at the Livermore Site or Site 300.	Both Sites: Remediation of groundwater and soil contamination at both the Livermore Site and Site 300 would continue. NNSA complies with provisions specified in the two FFAs entered into by USEPA, DOE, the California EPA Department of Health Services (now DTSC), and the San Francisco Bay and Central Valley Regional Water Quality Control Board. Any future remediation actions would be conducted in accordance with the FFA, and NNSA is not proposing any specific future remediation activities in this SWEIS. None of the activities associated with the Proposed Action would complicate or delay any of the monitoring or cleanup activities at the Livermore Site or Site 300.
Accidents		
Both Sites: Bounding accidents and potential bounding impacts would be the same as the No-Action Alternative (see Table S.3-11). With regard to non-bounding accidents, the only notable difference in accident impacts involves a Tritium Processing System Fire in the NIF (B581). Under both the No-Action Alternative and the Proposed Action, that accident would have higher impacts than the current baseline due to an increase in the tritium inventory in the NIF (*see* Appendix C, Section C.3.2.2).	Both Sites: Bounding accidents and potential bounding impacts are presented in Table S.3-11.	Both Sites: Bounding accidents and potential bounding impacts are presented in Table S.3-11.
Intentional Destructive Acts (IDA)		
Both Sites: The baseline conditions would have the same IDA results as presented for the No-Action Alternative (see Table S.3-11).	NNSA has prepared an IDA appendix to support this LLNL SWEIS that analyzes the potential impacts of intentional destructive acts (e.g., sabotage, terrorism). That appendix contains Official Use Only information related to security concerns and is not publicly releasable. The accident analyses done in the SWEIS represents the bounding accidents relative to environmental concerns for the IDA analysis.	The Proposed Action would have the same IDA results as presented for the No-Action Alternative.

Table S.3-10. Summary Comparison of Infrastructure Requirements of the Alternatives

		Baseline, 2019			Projected Requirements			
Resource	**Site**	**Use**	**Total Capacity**	**Available Capacity**	**Construction: No-Action Alternative**	**Construction: Proposed Action**	**Operations: No-Action Alternative**	**Operations: Proposed Action**
Electricity–power consumption (million kilowatt-hours per year)	Livermore Site	402.4	Not Applicable	Not Applicable	No notable change	No notable change	475	535
	Site 300	12.2	ND	ND	No notable change	No notable change	12.6	24.7
Electricity–Monthly Peak Load (MW)	Livermore Site	63.6	125	61.4	No notable change	No notable change	65.5	81.9
	Site 300	2	ND	ND	No notable change	No notable change	2	5
Natural Gas (million therms/year)	Livermore Site	4.51	8.94	4.43	No notable change	No notable change	4.65	4.91
	Site 300	None	None	None	None	None	None	None
Petroleum Fuel (gallons per year)	Both Sites	102,014	Not Applicable[a]	N/A	No notable change	No notable change	75,300[b]	85,000[b]
Domestic water (million gallons per year)	Livermore Site	267	1,051	784	3.33	3.51 (6.12 peak year)	386	482
	Site 300	14	473	459	0.37	0.39 (0.68 peak)	14	21
Wastewater (million gallons per year)	Livermore Site	132.5	3,467[c]	3,335	1.5	2.2 (4.5 peak year)	134.1	147.8
	Site 300	1.46	2.73	1.27	0.5	0.8 (1.5 peak year)	1.6	1.9

ND = no available data

a. fuel delivered by truck

b. estimated usage in year 2035 for the No-Action Alternative and the Proposed Action.

c. Capacity of the Livermore Wastewater Reclamation Plant (LWRP), 9.5 MGD

Sources: CWB 2016; CRWQCB 2008; LLNL 2020b; Stantec 2019.

Table S.3-11. Potential Accident and Intentional Destructive Acts Impacts for the Alternatives

Accidents Applicable to the No-Action Alternative and the Proposed Action	Potential Impact
Livermore Site Facility Radiological Accidents—Bounding MEI Impact	
Conservative Meteorology: B693 – Waste Storage Facility Fire	Frequency: $\leq 1\times10^{-4}$ to 1×10^{-6} **MEI Dose: 17 rem; MEI LCF: 0.01** Population Dose: 160 person-rem; Population LCF: 0.096
Average Meteorology: A625 Yard TRUPACT-II Crane Drop and Fire	Frequency: $\leq 1\times10^{-4}$ to 1×10^{-6} **MEI Dose: 0.85 rem; MEI LCF: 5.1×10^{-4}** Population Dose: 5 person-rem; Population LCF: 0.003
Livermore Site Facility Radiological Accidents—Bounding Population Impact	
Conservative Meteorology: B625 Aircraft Crash	Frequency: 6.3×10^{-7} MEI Dose: 4.5 rem; MEI LCF: 0.0027 **Population Dose: 4,300 person-rem; Population LCF: 2.6**
Average Meteorology: B625 Aircraft Crash	Frequency: 6.3×10^{-7} MEI Dose: 0.041 rem; MEI LCF: 2.5×10^{-5} **Population Dose: 610 person-rem; Population LCF: 0.37**
Site 300 Radiological Accidents	Site 300 facilities are below HC-3 and have no offsite impacts.
Other Accidents	
Livermore Site Site-wide Earthquake	Frequency: $\leq 1\times10^{-4}$ to 1×10^{-6} MEI Dose: 0.97 rem; MEI LCF: 5.8×10^{-4} **Population Dose: 220 person-rem; Population LCF: 0.013**
Chemical Accidents	Average Meteorology: For the Livermore Site, MEI chemical concentrations are each below their respective PAC-1 levels, except for accidents with chlorine and hydrogen chloride/hydrochloric acid, all of which are below their PAC-2 level. For Site 300, the MEI chemical concentrations are each below their respective PAC-1 levels. Conservative Meteorology: For the Livermore Site, MEI chemical concentrations are each below their respective PAC-2 levels, except for the chlorine accident, which is below its PAC-3 level at the fenceline. For the chlorine accident scenario at 240 meters distance beyond the site boundary, concentrations are below PAC-2. For Site 300, the bounding chemical accident is a lithium hydride fire scenario, with a distance of 35 meters beyond the site boundary where concentrations are below PAC-2.
Livermore Site and Site 300 High Explosives Accidents	No offsite accident impacts.
Biological Accidents	No credible risk to the offsite population from escape of the bounding biological agent, even under the worst-case meteorological conditions at the Livermore Site.
Intentional Destructive Acts	
Theft, Sabotage, Others	The accident analyses done in the SWEIS represents the bounding accidents relative to environmental concerns for the IDA analysis.

Table S.3-12. Environmental Impacts of the New Hybrid Work Environment

Resource	Potential Impacts
Land use, visual and aesthetic resources, geology and soils, water resources, biological resources, cultural resources, socioeconomics and Environmental Justice, human health, and accidents	Although consolidation of personnel could help accelerate DD&D and construction activities, the number of facilities and offices would not change; potential decreases in office space would be countered by COVID-19 distancing requirements that may be required/accommodated for in the future. There would be no net change in safety, health, and waste generation because facility and laboratory personnel would continue to operate facilities and conduct the same types and amounts of experiments and tests. As a result, for both the No-Action Alternative and the Proposed Action, there would be no change in the following resources
Air Quality	Reduced worker commuting and reduced travel would decrease air emissions. However, some of this decrease would be expected to be offset by workers using their home heating and air conditioning systems. NNSA estimates that onsite traffic could be reduced by up to 10 percent on any given day, which could reduce emissions by a maximum of approximately one percent. Because LLNL operations do not violate any air quality standard or contribute substantially to an existing or projected air quality violation, a reduction of one percent in emissions would be inconsequential. Effects on air quality from construction would be the same with or without the implementation of this option.
Transportation	Reduced worker commuting would result in positive impacts on the level-of-service (LOS) of area roads. Compared to the current baseline, which assumes 7,909 workers would use area roads daily to commute to LLNL, average daily traffic as a result of LLNL workers would decrease by 150 vehicles for both the No-Action Alternative and the Proposed Action. Reduced onsite worker population would also reduce onsite vehicle circulation and parking.
Infrastructure	Reduced onsite worker population would reduce domestic water use by a maximum of approximately 7.4 million gallons annually. Because steady-state water usage is expected to be approximately 400-503 million gallons annually, the reduction would amount to approximately 1.5-1.9 percent of the LLNL usage.

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