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Livermore Site Office
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SUPPLEMENT ANALYSIS

of the

2005 Final Site-wide Environmental Impact Statement

For Continued Operation of Lawrence Livermore National Laboratory

Volume I: Main Report

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NOTATION

The following is a list of acronyms, abbreviations, and units of measure used in this document.

ACRONYMS AND ABBREVIATIONS

ACE	Altamont Commuter Express
AESC	Applied Energy Simulation Center
AFV	Alternative Fuel Vehicle
ALARA	as low as reasonably achievable
BA	Biological Assessment
BO	Biological Opinion
BAAQMD	Bay Area Air Quality Management District
BART	Bay Area Rapid Transit
BAWSCA	Bay Area Water Supply and Conservation Agency
BCC	Birds of Conservation Concern
BMP	Best Management Practice
BSL	Biosafety Level (facility)
CAFPS	California Fully Protected Species
CAMS	Center for Accelerator Mass Spectrometry
CASSC	California Species of Special Concern
CDFG	California Department of Fish and Game
CEDE	Committed Effective Dose Equivalent
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation

CF-R&D	Community Facilities-Research and Development
CNPS	California Native Plant Society
D&D	decontamination, deactivation, and/or demolishing
DOE	U.S. Department of Energy
DRB	Drainage Retention Basin
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EMPC	Energetic Material Processing Center
EMS	Environmental Management System
EPA	Environmental Protection Agency
ERD	Environmental Restoration Department
ERPG	Emergency Response Planning Guidelines
ES&H	Environment, Safety and Health
FGR	Federal Guidance Report
FONSI	Finding of No Significant Impact
FSC	Federal Species of Concern
GI/LID	Green Infrastructure/Low Impact Development
GSA	General Services Area
HEDS	High-energy Density Science
HID	Human Infective Dose
HVAC	heating, ventilation, and air conditioning
ICRP	International Commission on Radiation Protection

ISMS	Integrated Safety Management System
LCF	latent cancer fatalities
LCW	Low conductivity water
LEED®	Leadership in Energy and Environmental Design
LINAC	linear accelerator
LLNL	Lawrence Livermore National Laboratory
LLW	low-level (radioactive) waste
LVOC	Livermore Valley Open Campus
LWRP	Livermore Water Reclamation Plant
MAR	material-at-risk
MEI	maximally exposed individual
MTRU	mixed transuranic (radioactive) waste
MLLW	mixed low-level (radioactive) waste
NARAC	National Atmospheric Release Advisory Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIF	National Ignition Facility
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
NRHP	National Registry of Historic Places
PA	Programmatic Agreement
PBA	Programmatic Biological Assessment
PBO	Programmatic Biological Opinion

PCB	Polychlorinated biphenyl
PCE	Primary Constituent Elements
PE-Ci	Plutonium 239-equivalent curie
PEIS	Programmatic Environmental Impact Statement
POC	precursor organic compounds
PPA	property-protected area
PS	Photon Science
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RMP	Resource Management Plan
RHWM	Radioactive and Hazardous Waste Management Division
ROD	Record of Decision
SA	Supplement Analysis
SHPO	State Historic Preservation Officer
SJVAPCD	San Joaquin Valley Air Pollution Control District
SNL	Sandia National Laboratories
SNM	special nuclear material
SPEIS	Supplemental Programmatic Environmental Impact Statement
SWEIS	*Site-Wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement*
SW MEI	site-wide maximally exposed individual
SWMP	stormwater monitoring plan
SWPPP	storm water pollution prevention plan

TBD	to be determined
TSCA	Toxic Substances Control Act
TSF	Terascale Simulation Facility
TRU	transuranic (radioactive) waste
TYSP	Ten-Year Site Plan
UC	University of California
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGBC	United States Green Building Council
USAMRIID	United States Army Medical Research Institute of Infection Diseases
WCI	Weapons and Complex Integration
WIPP	Waste Isolation Pilot Plant

UNITS OF MEASURE

Ci	Curie
ft	feet
FY	fiscal year
gal/day	gallons per day
in	inch
kg	kilograms
kg/day	kilograms per day
M kWh/yr	million kilowatt-hours per year
m^3/yr	cubic meters per year

MeV	million electron volts
MGD	million gallons per day
MG/yr	million gallons per year
MJ	megajoule
mi	miles
mrem/year	millirems per year
mt	metric ton
ppm	parts per million
rem/year	rems per year
sf	square feet
ug/L	microgram per liter

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Supplemental Analysis of the
2005 Final Site-wide Environmental Impact Statement for
Continued Operation of Lawrence Livermore National Laboratory

SUMMARY

This supplement analysis (SA) was prepared in accordance with the Council on Environmental Quality (CEQ) and U.S. Department of Energy (DOE) regulations for implementation of the National Environmental Policy Act of 1969 (NEPA). The SA considers whether the *Final Site-Wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (DOE/EIS-0348 and DOE/EIS-0236-S3), hereafter referred to as the "2005 SWEIS" or "SWEIS," should be supplemented, a new environmental impact statement (EIS) should be prepared, or no further NEPA documentation is required.

The 2005 SWEIS (DOE 2005a) was prepared to meet the requirements of NEPA; it evaluated the impacts on the environment of existing and proposed operations at LLNL for the period 2005 through 2014. On November 29, 2005, the U.S. DOE issued a NEPA record of decision (ROD) in the *Federal Register* (70 FR 71491; 2005 ROD) (DOE 2005b), announcing that the Department had decided to implement individual components of the Proposed Action Alternative over the ensuing decade, subject to DOE's continuing assessment of its mission needs and of LLNL's role in meeting those needs.

The proposed action in the 2005 SWEIS continued the ongoing support of major DOE and National Nuclear Security Administration (NNSA) programs such as defense programs, nuclear nonproliferation, environmental management, energy research, and the continued construction and subsequent operation of major facilities including the National Ignition Facility (NIF), the Biosafety Level-3 (BSL-3) Facility, and the Terascale Simulation Facility.

Sitewide environmental impact statements, such as LLNL's 2005 SWEIS, must undergo the SA process at least every five years after issuance to determine whether a supplemental or new EIS is necessary (10 CFR 1021.330[d]). This SA for the LLNL 2005 SWEIS examines the current project and program plans and proposals for the period from now to 2015, as well as new information not available for consideration when the 2005 SWEIS was prepared.

For purposes of this SA, a number of sources and approaches were used to identify new and modified plans, projects or operations for the 2010-2015 period as well as new information that was not available for consideration in the 2005 SWEIS. An initial list of issue areas, projects, facilities, and new proposals compiled from these sources and approaches was circulated for review by program, facility, and area managers at LLNL and NNSA. The list was also evaluated by LLNL and NNSA environmental staff. Following the application of screening and exclusion

criteria, 19 likely or reasonably foreseeable projects were included for further consideration in this SA. These projects are described in Chapter 1, Table 1.1.

An initial analysis of the 19 projects was performed to determine, without further analysis, whether their combined environmental impacts, by resource area, clearly remained consistent with the analysis in the 2005 SWEIS. On the basis of this initial analysis, the potential environmental impacts in the following resource areas were judged to still be consistent with the 2005 SWEIS analysis: socioeconomics and environmental justice, community services, cultural resources, soils and geology, noise, site contamination and remediation, and traffic and transportation. For each of these resource areas, the analysis in Chapter 2 of the SA concluded that the SWEIS remains an adequate description of potential LLNL site-wide environmental impacts for the years 2010 to 2015, and no supplementation of the 2005 SWEIS is needed.

The following resource areas were judged to require a more detailed environmental analysis: land use, aesthetics, biological and wetlands, air quality, water, utilities and energy, materials and waste management, human health and safety, and accident analysis. For each of these environmental resource areas, the analysis in the 2005 SWEIS was summarized, the changes from 2005 to 2010 were described, and the projected changes from 2010 to 2015 were analyzed. For those resource areas involving quantitative projections, the 2005 SWEIS projections were compared to the current projections for the 2010-2015 period.

For the resource areas of land use, aesthetics, water, human health and safety, and accident analysis, the detailed analyses in Chapter 3 of this SA showed that the projected impacts for the 2010-2015 period are consistent with the impacts projected in the 2005 SWEIS. For the resource areas of biological and wetlands, air quality, and utility and energy, the detailed analyses showed that the projected impacts for the 2010-2015 period are comparable to or slightly exceed the 2005 SWEIS projections. In none of these resource areas are any of the projected environmental impacts significantly greater than those described in the 2005 SWEIS.

For the materials and waste management resource area, the 2005 SWEIS included waste generation projections for a number of waste streams, including hazardous waste, radioactive low-level waste, radioactive mixed low-level waste, radioactive transuranic waste, radioactive mixed transuranic waste, sanitary solid waste, and waste water. For each of these except the last two, the projections were made for both routine and non-routine wastes. Routine waste is generated from normal operations, whereas non-routine waste is generated from construction, demolition, and environmental restoration activities. The projected 2010-2015 annual generation amounts for most of these waste streams are the same as those in the 2005 SWEIS. An increase in the generation of routine low-level waste is anticipated based mainly on projections for NIF and Photon Science (NIF & PS) and Weapons and Complex Integration (WCI) Principal Directorate facility operations. Temporary increases in non-routine low-level waste and non-routine mixed low-level waste are projected due to the decontamination and decommissioning of several facilities. Small quantities of non-routine mixed transuranic waste could also be generated from decontamination of legacy workstations and repackaging of oversize waste boxes in the Superblock. (The Superblock is the group of facilities on site where the majority of work

with special nuclear material occurs.) The increases are within the handling and storage capacities of existing waste management facilities. An analysis of the projected increases showed that environmental consequences are not expected to significantly exceed those of the 2005 SWEIS.

Consistent with the DOE policy and requirements in effect at that time, the 2005 SWEIS document did not discuss the potential environmental impacts of intentionally destructive acts such as might be committed by a terrorist attack on facilities at LLNL. In preparing this SA, DOE/NNSA's NEPA analyses of the potential environmental impacts from intentional destructive acts at LLNL prepared subsequent to the 2005 SWEIS were reviewed and determined to remain valid. The January 2008 revised Environmental Assessment for the Biosafety Level 3 facility (BSL-EA) demonstrated that the consequences of a successful terrorist attack on the LLNL BSL-3 facility would be bounded by the consequences of the accident scenarios evaluated for that facility. The October 2008 DOE/NNSA *Complex Transformation Supplemental Programmatic EIS* (2008 Complex Transformation SPEIS) included a classified analysis of the potential environmental consequences of intentionally destructive acts involving nuclear materials at LLNL and other sites within the NNSA Complex. The conclusion from that analysis was that the impact from certain intentionally destructive acts, if successful, would exceed those of bounding accidents analyzed in the 2005 SWEIS and would extend off-site to the general public. The 2008 Complex Transformation SPEIS and the 2008 BSL-EA discuss the DOE/NNSA strategy for the prevention and mitigation of environmental impacts resulting from intentionally destructive acts, focusing primarily on efforts to prevent and deter terrorists from executing successful attacks. DOE/NNSA implements a number of protection strategies designed to be effective against a range of postulated terrorist threats. These protection strategies taken together reduce the overall probability of a successful terrorist attack to the point where it is considered extremely unlikely. Additional details and a description of DOE/NNSA's emergency response preparedness are given in Chapter 4 of this SA.

The cumulative impact analysis for this SA included an examination of the cumulative impacts in the 2005 SWEIS (DOE 2005a), the results of the analyses in this SA, and reasonably foreseeable actions by other Federal and non-Federal agencies and private parties for the region impacted by LLNL. As a result, the following resource areas were identified as requiring further analysis in relation to cumulative impacts of new and modified projects and modifications to ongoing operations for the 2010 to 2015 period: land use, biological resources and wetlands, air quality, utilities and energy, materials and waste management, and human health and safety. These analyses are described in Chapter 5 of this SA. Although LLNL's regulated non-radioactive air emissions remain well below their conformity threshold limits, any LLNL emissions may contribute to local air districts' non-attainment status for certain criteria pollutants. Proposed facilities and the resulting growth in electrical energy use would make Federal greenhouse gas emission reduction targets very challenging. However, both LLNL and Sandia National Laboratories (SNL) will address greenhouse gas reduction goals as part of their site sustainability plans being developed as required by the DOE. Continued population growth of the surrounding areas together with new development, and a potential increase in potable

water consumption by LLNL and SNL, continue to constitute a cumulative impact upon water resources, although water supplies are expected to be adequate through 2015 and both LLNL and SNL have implemented water conservation programs to reduce their use of potable water. In all, the cumulative impacts remain comparable to those projected in the 2005 SWEIS. Although NEPA regulations do not require public involvement in the preparation of a SA, the DOE/NNSA believed it would be beneficial to educate and inform the public as much as possible during the preparation of the document.

An extensive public outreach campaign included mailing letters to 3,000 neighbors advising them of the 45-day public comment period beginning March 30, 2011, as well as issuing news releases and posting advertisements in local newspapers that reach 300,000 people in the Tri-Valley area. Additionally, two public informational meetings were held on April 14, 2011 at the Robert Livermore Community Center, 4444 East Avenue, Livermore, CA in which the public had an opportunity to attend a presentation explaining the document and the process and also ask questions. The public comment period ended May 13, 2011.

Details on the public comments received, responses to the public comments, and consideration of the public comments in the Final SA are described in Volume II, Comment Response Document, of this SA.

1.0 INTRODUCTION

This supplement analysis (SA) was prepared in accordance with the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) (Code of Federal Regulations, Title 40, Parts 1500–1508 [40 CFR Parts 1500–1508]), and DOE's NEPA Implementing Procedures (10 CFR Part 1021). This SA considers whether the *Final Site-Wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (DOE/EIS-0348 and DOE/EIS-0236-S3) (DOE 2005a), hereafter referred to as the "2005 SWEIS" or "SWEIS", should be supplemented, a new environmental impact statement (EIS) should be prepared, or no further NEPA documentation is required.

1.1 Purpose and Need

The 2005 SWEIS was prepared to meet the requirements of NEPA; it evaluated the impacts on the environment of existing and proposed operations at LLNL for the period 2005 through 2014. On November 29, 2005, the U.S. DOE issued a NEPA record of decision (ROD) in the *Federal Register* (70 FR 71491; 2005 ROD) (DOE 2005b), announcing that the Department had decided to implement individual components of the Proposed Action Alternative over the ensuing decade, subject to DOE/NNSA's continuing assessment of its mission needs and of LLNL's role in meeting those needs.

The proposed action in the 2005 SWEIS continued the ongoing support of major DOE and NNSA programs such as defense programs, nuclear nonproliferation, environmental management, energy research, and the continued construction and subsequent operation of major facilities including the National Ignition Facility (NIF), the Biosafety Level-3 (BSL-3) Facility, and the Terascale Simulation Facility (TSF). In addition, the proposed action included a number of programmatic and facility enhancements, including use of other materials in NIF experiments (including plutonium, other fissile materials, fissionable materials, and lithium hydride), an increase in the administrative limit for plutonium in the Superblock, an increase in the administrative limit for tritium in the Tritium Facility, construction of a neutron spectrometer for NIF diagnostics, and other proposed changes.

DOE NEPA regulations state that a supplemental EIS "shall be prepared if there are substantial changes to the proposal or significant new circumstances or information relevant to environmental concerns." If it is not clear whether a supplemental EIS is required, a supplemental analysis (SA) is to be prepared to resolve the question. According to 10 CFR 1021.314(c)(1 and 2), an SA shall "discuss the circumstances that are pertinent to deciding whether to prepare a supplemental EIS." The SA shall "contain sufficient information for DOE to determine whether: (i) an existing EIS should be supplemented; (ii) a new EIS should be prepared; or (iii) no further NEPA documentation is required."

Sitewide environmental impact statements, such as LLNL's 2005 SWEIS, must undergo the SA process at least each 5 years after issuance to determine whether a supplemental or new EIS is necessary (10 CFR 1021.330[d]).

1.2 Determining Projects, Operations, and Information to be Considered in this Supplemental Analysis

This SA for the LLNL 2005 SWEIS examines changes in programs, projects, or operations since the 2005 SWEIS, new and modified plans, projects, and operations for the period from now to 2015, as well as new information that was not available for consideration when the 2005 SWEIS was prepared. For purposes of this SA, a number of sources and approaches were used including the following:

- Evaluation of NEPA documentation and safety analyses prepared after issuance of the 2005 SWEIS (see Appendix A).
- Evaluation of institutional and other plans to identify major new plans, proposals or projects that would be implemented within the 2010 to 2015 time frame; e.g., the LLNL FY 2009 Annual Report (LLNL 2009b) and the LLNL FY11 Ten Year Site Plan — March 2010 (LLNL 2010c).
- Identification and considerations of any changes in applicable federal, state, and local regulations.
- Assigning managers of operational units within LLNL (including program and facility managers) and programmatic staff at the DOE/NNSA LSO to identify any new proposals or projects proposed for the 2010 to 2015 time frame, including:
  - Ongoing actions that have been modified and proposals for new facilities;
  - Administrative limits proposals for nuclear materials that were not addressed in the 2005 SWEIS or that were modifications to the descriptions in the 2005 SWEIS;
  - Chemical inventory and management modifications; and
  - Waste generation and waste management modifications, including pollution prevention, decontamination and decommissioning, site cleanup, and upgrade of waste management facilities.
- Identification of new information on the natural and human environment at LLNL and new areas of impact analysis now required for DOE NEPA reviews.

An initial list of issue areas, projects, facilities, and new proposals compiled from these sources and approaches was circulated for review by program, facility, and area managers at LLNL and NNSA. The list was also evaluated by LLNL and NNSA environmental staff.

1.3 Screening of the Initial List

As a preliminary matter, if the project or operation was included in the 2005 SWEIS and had already been completed without major modifications, it was not given further considerations. The remaining 32 proposed new or modified plans, projects or operations fell into one or more of the following categories:

1. A plan, project or operation cited in the 2005 SWEIS that had been modified, as indicated in additional NEPA reviews or LLNL plans.

2. A new or modified plan, project or operation that had been reviewed and approved or funded through the DOE/NNSA planning process.

3. A new or modified plan, project or operation that LLNL or DOE/NNSA managers forecasted was likely or reasonably foreseeable to go forward within the next 5 years.

The 32 projects were then screened to eliminate those that clearly would have no appreciable change in environmental consequences from those contained in the 2005 SWEIS, considering the environmental topics normally included in a DOE EIS: air quality, water, noise, impacts under normal and accident conditions for radiological materials and hazardous materials, materials and waste management, biological/wetlands, soils/geology, site contamination and remediation, socioeconomics/environmental justice, community services, cultural resources, aesthetics, land use, traffic/transportation, utilities and energy, human health and safety, and cumulative impacts.

The 23 projects that remained after this screening are shown in Table 1.1.

1.4 Environmental Consequence Analysis

Of the 23 projects that remained after the screening, four were excluded from consideration in this SA on the basis of not yet being sufficiently defined for inclusion in this analysis. If, in the future, they are sufficiently developed for analysis as an alternative, they will require separate NEPA consideration.

An initial analysis of the remaining 19 projects in Table 1.1 identified the following environmental resource areas for which the combined environmental consequences clearly remained consistent with the analysis in the 2005 SWEIS: socioeconomics and environmental justice, community services, cultural resources, soils and geology, noise, site contamination and remediation, and traffic and transportation. The reasons for these conclusions are presented in Chapter 2 of this SA.

More detailed environmental analyses were performed for the remaining environmental resource areas: land use, aesthetics, biological and wetlands, air quality, water, utilities and energy, materials and waste management, human health and safety, and accident analysis. These analyses are documented in Chapter 3 of this SA.

The Chapter 2 and Chapter 3 analyses for each of the environmental resource areas included the anticipated environmental impacts for all of the 19 projects in Table 1.1.

Intentional destructive acts were not considered in the 2005 SWEIS, but were included in the 2008 Complex Transformation Supplemental Programmatic Environmental Impact Statement (DOE 2008a) and the 2008 revised Environmental Assessment for the Biosafety Level 3 facility (DOE 2008b), and are addressed here in Chapter 4.

The cumulative impacts are addressed in Chapter 5.

1.5 Public Involvement

Although NEPA regulations do not require public involvement in the preparation of a SA, the DOE/NNSA believed it would be beneficial to educate and inform the public as much as possible during the preparation of the document.

An extensive public outreach campaign included mailing letters to 3,000 neighbors and stakeholders advising them of the 45-day public comment period beginning March 30, 2011, as well as issuing news releases and posting advertisements in local newspapers that reach 300,000 people in the Tri-Valley area. Additionally, two public informational meetings were held on April 14, 2011 at the Robert Livermore Community Center, 4444 East Avenue, Livermore, CA in which the public had an opportunity to attend a presentation explaining the document and the process and also ask questions. The public comment period ended May 13, 2011.

1.6 Conclusions and Determination

The conclusions are given in Chapter 6. The determination of whether DOE/NNSA should prepare a supplemental EIS, a new SWEIS, or no further NEPA documentation is required is given in a separate determination document.

Table 1.1 New and Modified Projects and Modifications in Site Operations

Location	Building	Project Title	Project Description
Livermore Site	332	D&D of TRU Legacy Work Stations (B332)	D&D and removal and disposal of several old workstations that are shut down but require ongoing maintenance due to ventilation issues, seal issues, and seismic concerns. Temporary increase in TRU waste generation.
Livermore Site	391	MegaRay	MegaRay accelerator with primary beam energies up to 750 MeV, and average beam power less than 450 Watts.
Livermore Site	581	NIF Operations	Modify NIF operational parameters: tritium inventory 8,000 Ci; routine tritium release limit, 80 Ci/yr; maximum credible single shot yield, 120 MJ; Beryllium inventory (as particulate), 1 kg; Eliminate discussion of tritium throughput (1,750 Ci/yr) as no environmental impacts derive from this value.
Livermore Site	332, Sitewide	SNM De-Inventory	Continue removal of Security Category I/II SNM from LLNL through the end of 2012. Waste generated from SNM de-inventory activities, as well as small, low quality, materials would generate new non-routine TRU waste. Modify two gloveboxes for TRU waste drum processing.
Livermore Site	332, Sitewide	Superblock TRU Waste Projections (routine)	Post 2012, routine operations would be conducted with much smaller quantities of materials. Approximately 26 m^3/yr of routine TRU waste would be generated. Non-routine TRU waste projections would remain below the SWEIS projections of 60 m^3/yr.
Livermore Site	625, 696R	Radioactive and Hazardous Waste Management	Revise the radiological curie-limit per container to be consistent with current documented safety analysis for waste storage facilities.
Livermore Site	Livermore Site	Eastside Access Control Modifications	New proposal. Modify the fencelines and security access requirements on the east side of the Livermore Site to allow an increase in collaborative projects. A new on-site connector road would also be constructed to provide circulation.
Livermore Site	Livermore Site	Northwest Corner Access Control Modifications	New proposal. Modify the fencelines and security access requirements at the northwest corner to a General Access Area (GAA) to allow for an increase in collaborative projects.
Livermore Site	New building	Applied Energy Simulation Center (AESC)	New proposal. High-performance Computational Facility, approx. 132,000 ft^2, 65.7 MkWh/yr of electrical use, 17.5 Mg/yr water use, 2 cooling towers or access to the site-wide LCW loop, 300 offices, auditorium, etc.

Table 1.1 New and Modified Projects and Modifications in Site Operations *(continued)*

Location	Building	Project Title	Project Description
Livermore Site	New building	High-Energy Density Science Center (HEDS)	New proposal. High-Energy Density Science Center, approx. 42,000 ft^2, 80 offices, auditorium, virtual control room, 3 diagnostic labs, 2 laser labs and 2 target preparation labs.
Livermore Site	New building	Commons/Visitor/ Collaboration Center	New proposal. Commons/Visitor Center, approx. 25,000 ft^2, foyer, offices, conference room, and cafeteria/lounge.
Livermore Site	Sitewide	Livermore Site Environmental Restoration (ERD)	Perform environmental restoration activities to include continuing soil and groundwater contamination characterization, remediation, and long-term stewardship.
Livermore Site	TBD	Size-Reduction and Repackaging of TRU Waste Boxes	Size reduction of several oversized TRU legacy waste boxes. A containment structure would be installed in a LLNL nuclear facility, where the waste boxes would be size-reduced for WIPP acceptance.
Livermore Site and Site 300	Sitewide	Facility Beryllium Decontamination Efforts	Continue beryllium decontamination at several facilities at LLNL.
Livermore Site and Site 300	Sitewide	Programmatic Biological Assessments and a Conservation Area at Site 300	New proposal. Develop a programmatic Biological Assessment (PBA) covering activities that may affect listed species at Site 300 and the Livermore Site, and develop a Conservation Area at Site 300.
Livermore Site and Site 300	Sitewide	Space Consolidation Initiative	Consolidate activities and close down or decommission excess facilities. Accelerates footprint reduction identified in the DOE/NNSA Complex Transformation PEIS.
Site 300	801, 812	Revision of Control Burning Practices	Revision of yearly controlled burn practices at 812 Complex and around Building 801, because explosives operation ceased at the B812 Complex, and the need to burn around B801 has decreased and is used predominately as a resource management tool to manage rare plant species.
Site 300	Sitewide	Next Phase Site 300 Erosion Control	Implement erosion control projects and repair multiple eroded areas at Site 300.
Site 300	Sitewide	Site 300 Environmental Restoration (ERD)	Perform environmental restoration activities to include continuing soil and groundwater contamination characterization, remediation, and long-term stewardship.

Table 1.1 New and Modified Projects and Modifications in Site Operations *(continued)*

Location	Building	Project Title	Project Description
Proposed Projects Not Ready for NEPA Analysis			
Livermore Site	New building	Target Fabrication Facility	The Target Fabrication Facility is a concept to consolidate target preparation work at LLNL for the purposes of inertial confinement fusion and high energy density physics and replace existing target preparation capabilities at other offsite facilities. The project has not been funded and is not reasonably foreseeable for the 2010-2015 time period. If funded, a NEPA review would be prepared.
Site 300	Sitewide	Monitoring Wells for Septic Systems and Equipment Percolation Pits	In a letter dated 5/25/2011, the California Regional Water Quality Control Board stated "No additional monitoring wells or changes to the existing groundwater monitoring programs are required at this time". Therefore, the installation of the proposed monitoring wells will not occur.
Livermore Site	Livermore Site	Renewable Energy Project	New proposal. Deploy photovoltaic solar array to approximately 50 acres on the north or northwest LLNL Livermore Site. NEPA review to be prepared.
Site 300	TBD	Renewable Energy Project	New proposal. Deploy a wind/solar renewable energy power project and research facility at Site 300. NEPA review to be prepared. A resource assessment is in preparation.

2.0 IMPACT AREAS NOT REQUIRING FURTHER ANALYSIS

Without further analysis, the potential impacts of all the new and modified projects and modifications to ongoing operations identified in Table 1.1 are judged to be minimal and consistent with the analysis in the 2005 SWEIS (DOE 2005a) in the following impact areas: socioeconomics and environmental justice, community services, cultural resources, soils and geology, noise, site contamination and remediation, and traffic and transportation. These impact areas met the screening criteria described in Section 1.3. For each of these impact areas, the SWEIS remains an adequate description of potential LLNL site-wide impacts for the years 2010 to 2015, and no supplementation of the SWEIS is needed.

The reasons for eliminating these impact areas from detailed analysis are discussed below. The following subsections first describe the environmental conditions and impacts evaluated in the 2005 SWEIS for each of these impact areas. Next, any new information on impacts of operations and site conditions related to events during the years 2005 to 2010 is presented. Then, the relevant activity level or direct or indirect release terms associated with new and modified proposals and changed circumstances for the period 2010 to 2015 are described, including the potential consequences of new and proposed actions. These impacts are then compared with the consequences projected in 2005.

2.1 Socioeconomics and Environmental Justice

The socioeconomic environment of LLNL, including employment, population, housing, economic factors, and environmental justice, as described in the 2005 SWEIS, was based on an expectation for continued growth in the LLNL workforce. The Livermore Site workforce was projected to increase by approximately 500 and the Site 300 workforce was projected to remain at approximately 250. The SWEIS concluded that these increases would generate additional revenue from increased purchases of goods and services, and create additional increases in population and subsequent increases in housing demand. Employment projections were conservatively high for the purpose of evaluating reasonably foreseeable socioeconomic impacts associated with employment growth (DOE 2005a).

The SWEIS projected increases in populations and housing in the California counties providing the Laboratory workforce. The four counties considered impacted by the Laboratory's operations were Alameda, San Joaquin, Contra Costa, and Stanislaus with the remaining 10 percent of the workforce coming from other counties. The geographic distribution of future LLNL workers was assumed to be similar to the 2002 distribution of the workforce. The number of housing units affected was assumed to be proportional to the changes in worker population in the counties (DOE 2005a).

Since publication of the SWEIS, however, employment at the Livermore Site has decreased from a peak of 9,411 workers in 2005 to 6,916 in 2009 including the

approximately 110 workers at Site 300. Alameda, San Joaquin, Contra Costa, and Stanislaus counties still house the majority of the LLNL workforce.

New and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 may not completely reverse the trend of a gradually declining workforce, although a small increase in new employees is anticipated as the new facilities become available for use. Since 2005 unemployment rates have more than doubled and have negatively impacted California, as well as the region. However, consistent with the analysis in the SWEIS, the possible variations in LLNL employees and payroll are anticipated to still have small impacts on the region as a whole; therefore supplementation of the 2005 SWEIS for socioeconomics is not needed.

The environmental justice analysis in the 2005 SWEIS anticipated that there would be no discernible adverse impacts to land uses, prehistoric and historic cultural resources, aesthetics and scenic resources, geology and soils, biological resources, water, or noise, and thus, that no disproportionately high and adverse environmental or health impacts to minority or low-income communities were anticipated for these resources areas. Further analysis of employment and housing, community services, radiological air emissions, traffic, electrical demand, waste generation, worker dose due to ionizing radiation, soil and groundwater contamination, and radiological accidents were also addressed in the SWEIS with the finding that again, no disproportionately high and adverse environmental or health impacts to minority or low-income communities were anticipated for these resource areas (DOE 2005a).

It is anticipated that new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 would have qualitatively equivalent effects to those described in the SWEIS. Quantitative effects for new and modified projects and modifications in site operations and locations of minority or low-income communities remain consistent with those analyzed in the SWEIS. Supplementation of the 2005 SWEIS for environmental justice is not needed.

2.2 Community Services

The category, Community Services, includes fire protection and emergency services, police protection and security services, school services, and nonhazardous solid waste disposal from the operation of LLNL.

LLNL has mutual assistance agreements in effect with neighboring jurisdictions for fire protection and emergency services, and police and security services. No additional burden was identified for these services in the 2005 SWEIS. In 2007, the LLNL fire department and fire protection services were transitioned into the Alameda County Fire Department. All uniformed employees of the former department were hired by the county fire department and remained in their former roles.

Within the range of community services considered in the SWEIS is the generation and disposal of nonhazardous solid waste, estimated to be 5,100 metric tons (mt) per year. The SWEIS projected minimal impacts due to the potential of additional solid waste generated by LLNL (DOE 2005a). Actual nonhazardous solid waste generation for the years 2005 to 2010 averaged less than the SWEIS projection.

For the site as a whole, decommissioning and demolition (D&D) of older dilapidated buildings will continue and would contribute to nonhazardous solid waste generation, as would waste construction materials (that cannot be recycled) from new facility construction. New and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 are anticipated to be below the SWEIS projection for generation of nonhazardous solid waste, and are consistent with the impacts analyzed in the SWEIS. Supplementation of the 2005 SWEIS for community services is not needed.

2.3 Pre-Historic and Historic Cultural Resources

The 2005 SWEIS anticipated the potential to affect important historic buildings and structures on the Livermore Site and prehistoric and historic resources at Site 300 through D&D, rehabilitation, and renovation of existing facilities. LLNL has a process in place to review plans for excavations and modifications to buildings to assess adverse impacts to cultural resources and implement any necessary mitigation. An example of the current process related to the inadvertent discovery of cultural material is the requirement that LLNL employees and contractors report any evidence of cultural resources unearthed during ground-disturbing activities.

In 2005, DOE/NNSA initiated discussions with the State Historic Preservation Officer (SHPO) toward the development of a new Programmatic Agreement (PA) that would govern how National Register-eligible properties would be managed. In 2007, DOE/NNSA published the *Historic Context and Building Assessments for the Lawrence Livermore National Laboratory Built Environment* (Ullrich 2007) based on work that was conducted in 2002. Several buildings, selected objects, and two districts were recommended to be eligible for the National Register. Of the 31 prehistoric and historic archaeological resources recorded at Site 300, the DOE/NNSA recommended and the SHPO concurred that five qualify for listing in the National Registry of Historic Places (NRHP) because of their ability to yield information important in history and prehistory. The Draft Programmatic Agreement (PA) and treatment plans were revised in 2010 based on input from the SHPO. Until a new PA is in place, proposed projects will be reviewed through the National Historic Preservation Act's (NHPA) Section 106 process on a case-by-case basis. A five-year review of the LLNL built environment is currently being conducted.

New and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 include several new earth-disturbing

activities. However, LLNL has a robust process for pre-reviewing any excavations and building modification plans to assess adverse impacts to cultural resources and implement any necessary mitigation. Because the 2005 SWEIS anticipated the potential to affect important prehistoric and historic resources, and because of the processes in place to prevent these impacts, supplementation of the 2005 SWEIS for prehistoric and historic resources is not needed.

2.4 Geology and Soils

The geology and the soils analyses in the 2005 SWEIS examined the effects of the construction and the operation of facilities and other activities on the land occupied by and immediately adjacent to the Livermore Site and Site 300. The analyses evaluated the amount of disturbance that might affect the geology and/or soils of areas at the Livermore Site and Site 300. Impacts could include erosion and effects to potential geologic economic resources, such as mineral and construction material resources and fossil locations. The SWEIS quantified impacts to soils as the amount of area disturbed by construction activities. According to the SWEIS, 462,000 square feet (sf) would be disturbed by construction activities at the Livermore Site, and 40,000 sf at Site 300 (DOE 2005a). The SWEIS evaluated the impacts and determined their severity. Best Management Practices (BMPs) and possible mitigations were identified to prevent adverse impacts. Because the Energetic Material Processing Center (EMPC) and High Explosives Development Center (HEDC) were excepted in the ROD from the Proposed Action, the 40,000 sf disturbance by construction activities at Site 300 did not take place.

Since publication of the SWEIS, LLNL has completed construction of the Terascale Simulation Facility and the National Ignition Facility as proposed in the SWEIS in previously undeveloped zones in the Livermore Site. Additionally, two new 20,000 sf office facilities were constructed in previously developed locations.

New and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 include several new soil-disturbing activities in previously developed areas and one large facility construction in an undeveloped area in the southeast corner of the Livermore Site. However, LLNL requires Best Management Practices (BMPs) including storm water pollution prevention plans (SWPPPs) to reduce adverse impacts of erosion to soils, and none of the future developments are expected to adversely affect any known aggregate, clay, coal, or mineral resources. The proposed activities impacts remain consistent with those analyzed in the SWEIS. Supplementation of the 2005 SWEIS for geology and soils is not needed.

2.5 Noise

According to the 2005 SWEIS, activities associated with the continued operation of LLNL would contribute to noise generation, either directly or indirectly. Noise generated during construction activities related to facility and infrastructure renovations at the

Livermore Site and Site 300 were characterized as generally not being noticeable in nearby communities because of the relatively large spatial area, perimeter buffer zones at the sites, and intervening roadways (DOE 2005a). No additional noise impacts were identified in the 2005 SWEIS.

LLNL facilities constructed since 2005 consist primarily of offices and did not introduce any machinery or equipment that would be different from the current heating, ventilation, and air conditioning (HVAC) equipment; cooling towers; motors; pumps; fans; generators; air compressors; and loudspeakers. Noise from this equipment is generally not noticeable beyond the site boundary.

The SWEIS projected a slight increase in heavy-duty vehicle activity at both the Livermore Site and Site 300 and a corresponding increase in the frequency of associated peak noise levels. Also, continuing operations were projected to require a workforce increase, adding approximately 500 employees at the Livermore Site and approximately 250 employees would remain at Site 300 by the year 2014 resulting in a corresponding increase in vehicular activity and ambient noise levels. However, the workforce has actually decreased from the SWEIS projection; thus, vehicular activity and ambient noise levels have decreased from the 2005 level.

LLNL continues explosives research testing at both the Livermore Site (in the Building 191 High Explosives Application Facility) and at Site 300 (within the Contained Firing Facility [CFF] and on open firing tables). LLNL also continues to perform meteorological monitoring to provide necessary input data for blast forecasting. No additional noise impacts were identified.

The removal of 820,000 gross sf of excess and legacy facilities over a 10-year period was identified as new activity in the SWEIS. Although this rate would be higher than that of recent years, with the relatively large spatial area and perimeter buffer zone, noise from demolition activities would not be discernible in off-site areas (DOE 2005a). No additional noise impacts were expected. As of 2009, 530,273 sf of excess and legacy facilities have been demolished.

New and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 and may contribute to noise generation include several new construction activities and a small increase in workforce traffic as new facilities become available for use. As the workforce increases, the noise generated from traffic would increase incrementally on local roadways. Construction and operation of new facilities and introduction of new machinery and equipment would not be different from current operations and is not expected to be discernible in off-site areas; however, during construction, onsite noise would temporarily increase. The impacts are consistent with those analyzed in the SWEIS. Supplementation of the 2005 SWEIS for noise is not needed.

2.6 Site Contamination and Remediation

The 2005 SWEIS projected activities included the continued operations of investigation, cleanup, and long-term stewardship operations to address soil and ground water contamination from past operations as required by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A general increase in mission activity levels across LLNL was projected; consequently, an increase in hazardous material management and waste management activities was expected and an associated spill or release could occur. If a spill or release occurs, LLNL conducts immediate cleanup actions and performs periodic site surveys to ensure environmental impacts are minimized. This proactive approach results in minimal deposition of contaminants to soil from LLNL's continued operations and the removal of known contaminants under the cleanup effort continues (DOE 2005a). No adverse impacts to future land use or ground water from site contamination were identified in the SWEIS.

In 2007, an Environmental Assessment (EA) was prepared to analyze the potential environmental consequences of environmental remediation to reduce contaminant concentrations in ground water at the Pit 7 Complex at Site 300. A subsequent Finding of No Significant Impact (FONSI) was issued by DOE/NNSA in 2007. Biological monitoring was requested through consultation with the United States Fish and Wildlife Service (USFWS) during construction and was performed by LLNL personnel.

In 2008, a SA was prepared for the proposed cleanup of contaminated soil at the Building 850 Firing Table at Site 300. DOE/NNSA determined that no further NEPA documentation was required for this activity. The SA was made available to the public in April 2009.

New and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 include continuing site contamination characterization, cleanup, and long-term stewardship at both the Livermore Site and Site 300. Additional wells and treatment facilities, pipeline construction, and demolition of wells and facilities that are no longer required are planned at both sites to continue to remediate and monitor contamination. Source area remediation work at the Livermore Site is planned, including *in situ* bioremediation tests, subsurface mechanical fracturing, and *in situ* heating of subsurface soil and ground water.

In addition, characterization and cleanup of the Building 812 area at Site 300 is ongoing. Characterization activities include surface and subsurface surveys and borehole drilling and sampling. A separate combined CERCLA/NEPA Remedial Investigation/Feasibility Study will be initiated and completed for the Building 812 area and include an analysis of environmental impacts of potential remedial actions under NEPA.

Because the proposed remediation activities are a continuing effort and new adverse impacts are not anticipated, supplementation of the 2005 SWEIS for site contamination and remediation efforts is not needed.

2.7 Traffic and Transportation

Commuting workers and deliveries of materials needed for the operation of facilities comprise most of LLNL-generated traffic. Traffic volume at the Livermore Site was projected to increase as a result of approximately 500 additional workers by 2014, which was a small fraction of the current traffic level in the heavily congested Tri-Valley area (DOE 2005a).

The SWEIS also projected very small changes to the workforce at Site 300 with negligible impacts. Site 300 does not engage in any significant transport of radioactive materials, although explosives are often transported. The numbers of explosives shipments were not expected to significantly increase resulting in very small incremental impacts (DOE 2005a).

The SWEIS projected an increase in waste shipments for both routine and non-routine wastes. Sanitary waste was projected to produce 570 shipments annually, hazardous and radioactive wastes were projected to produce 300 shipments annually, and material shipments were projected to produce 584 shipments annually (DOE 2005a). Routine waste is generated from the normal operations, while non-routine waste is generated from construction, D&D, and environmental restoration activities.

The SWEIS calculated a collective dose to the general public from radioactive shipments to be 9.0 person-rem/year. The potential cancer risk as a result of shipments of radioactive materials was projected to be low with the calculated potential latent cancer fatalities (LCFs) to be 5×10^{-3}/year (DOE 2005a).

As stated above, the SWEIS projected a very small increase in the workforce at the Livermore Site and Site 300. However, because there was actually a large decrease in the LLNL-affiliated workforce, from the projected 11,500 to 6,900 in 2009, traffic volume from commuting workers actually decreased. New and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 may not completely reverse the trend of a gradually declining workforce although a small increase in new employees is anticipated as new facilities become available for use. For the site as a whole, current employment is expected to remain stable. In 2009, an on-site traffic study (LLNS 2010) was completed to review the civil infrastructure for vehicular circulation at the Livermore Site. The study showed sufficient capacity to handle double the current traffic volume, including peak and commute hours demand.

Any incremental increase in workforce traffic could be readily accommodated by the local road system and no impacts are anticipated.

In 2007, LLNL placed in operation an E85 fuel station to support the on-site fleet of E85 vehicles. In 2010, LLNL introduced the use of hydrogen-fueled bus operations and the refueling infrastructure required, including a mobile hydrogen-fueling station. The buses were used on site as a taxi service and off site for special events to demonstrate alternative fuel vehicles (AFVs).

New and modified projects and modifications in site operations include the potential construction of several new facilities: the Applied Energy Simulation Center (AESC), the High-Energy Density Science Center (HEDS), and the Commons/Visitor Collaboration Center. Truck traffic during the construction of facilities would increase as material and equipment are brought on site for use. Truck trips would also increase to local recycling vendors and the local landfill as construction waste materials are generated.

For the years 2005-2010, material and waste (both hazardous and radioactive) shipments have been well below the projections in the SWEIS. A rise in sanitary waste trips generated beginning in 2006 is attributed to including the non-routine sanitary waste trips in the total. Legacy waste trips for mixed low-level radioactive waste (MLLW), low-level radioactive waste (LLW), and transuranic radioactive waste (TRU) were also less than those analyzed in the SWEIS. Material and waste (hazardous and radioactive) shipments would remain below the SWEIS projections during 2010 to 2015. Sanitary waste shipments would continue at the average level of approximately 900 to 1,100 shipments annually.

The increase in LLW volumes described in Section 3.7 would require an increase in number of shipments to disposal sites. The number of shipments required for projected routine and non-routine LLW generation rates, however, would remain consistent with the 2005 SWEIS projections of 80 shipments per year for LLW transportation. For example, in FY 2010, LLNL shipped 850 cubic meters of LLW in 27 shipments. Between FY 2011 and FY 2015, the largest quantity of LLW to be shipped is in FY 2011 when approximately 2,650 cubic meters (routine and non-routine, including LLW from Building 419 demolition) would be shipped, requiring approximately 80 shipments. This would be consistent with the 2005 SWEIS estimate of 80 shipments per year.

Temporary increase in FY 2011 MLLW volumes from the B419 decommissioning activities described in Section 3.7 would require an increase in number of shipments to the disposal site in Utah. It is expected that in FY 2011 approximately 45 MLLW shipments and 20 railcar shipments would be needed for the projected generation volumes. In FY 2010, LLNL made only 3 MLLW shipments, and considering the FY 2012 to FY 2015 projections and historic generation rates, it is projected that the average number of shipments for the FY 2012 to 2015 period would not exceed the 2005 SWEIS projected 16 MLLW shipments per year to Utah under the Proposed Action.

Radioactive materials shipments would temporarily increase during the ongoing activities to transfer Security Category I/II SNM from LLNL to other NNSA sites, including the Waste Isolation Pilot Plant (WIPP). The *Complex Transformation SPEIS* (Section 3.7.2 of DOE 2008a) described that these transportation actions involving greater quantities of SNM are within the projections for material and waste shipments in the 2005 SWEIS.

As both the projected traffic and transportation impacts are consistent with the impacts analyzed in the 2005 SWEIS, supplementation of the 2005 SWEIS for traffic and transportation is not needed.

3.0 POTENTIAL ENVIRONMENTAL IMPACTS

The following discussions compare the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 with the impacts of the Proposed Action in the 2005 SWEIS (DOE 2005a).

The order and grouping of impact areas follows those presented in the SWEIS. The following resources are analyzed: Land Use, Aesthetics, Biological/Wetlands, Air Quality, Water, Utilities and Energy, Materials and Waste Management, Human Health and Safety, and Accident Analyses.

3.1 Land Use

This section discusses changes in potential impacts on land use from the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015 in Alameda and San Joaquin counties. Although as a federal facility LLNL is exempt from local plans, policies, and zoning regulations, LLNL does consider local land-use planning policies in its land-use decisions.

3.1.1 The 2005 SWEIS Analysis

The 2005 SWEIS projected that approximately 370,000 sf of new facilities would be constructed 2005 through 2014, but that there would be only a small increase in the developed space at the Livermore Site with no changes in land uses, or future land uses, adjacent to the site. The 370,000 sf included nine replacement office buildings at 180,000 sf; a central cafeteria replacement at 16,300 sf; a BSL-3 laboratory at 1500 sf; a Container Security Testing Facility at 54,000 sf; a Tritium Modernization Facility at 7,000 sf; the Material Science Modernization Project at 60,000 sf; and a Consolidated Security Facility at 50,000 sf. Facilities that were in construction when the SWEIS analysis was being conducted were not considered in the total 370,000 sf. As a result, the SWEIS projected an extremely small land-use impact for continued operation at the Livermore Site. Although Alameda County has a large amount of undeveloped land, the county is experiencing a cumulative loss of agricultural land because of the continuing development in the immediate vicinity of LLNL. The projects identified in the SWEIS were not considered as contributing to the overall loss of agricultural land because LLNL's Research and Development (R&D) facility activities are compatible with the industrial park zoning designation in Alameda County and the new Community Facilities-Research and Development (CF-R&D) designations in the City of Livermore (DOE 2005a).

The SWEIS projected that the primary impact on land uses at Site 300 would occur from the development of additional square-footage associated with certain projects but saw no major alteration occurring in the types of land uses and no changes in land ownership. Land uses adjacent to Site 300 include other explosives testing facilities,

undeveloped open space, agricultural land, and an off-road vehicle recreation area. The land uses at Site 300 were identified as compatible with the existing land uses, approved land-use designations surrounding the site, and open space policies applicable to areas near the site (DOE 2005a). Therefore, the SWEIS did not identify additional impacts to land resources/agricultural land for Site 300.

LLNL was also expected to D&D excess facilities and remodel and update existing buildings. The SWEIS had projected 820,000 sf would be decontaminated and demolished through the year 2014, or approximately 82,000 sf per year (DOE 2005a).

3.1.2 Changes from 2005 to 2010

Some of the new facilities described in the SWEIS have since been completed including a central cafeteria replacement, three new office facilities, a BSL-3 laboratory, a truck inspection station, as well as the addition of small temporary modular office complexes. These have added 111,186 sf through 2010, as shown in Table 3.1-1. Several facilities identified in the SWEIS for construction have not been built to date due to lack of funding or change in need. These include the Container Security Testing Facility, the Material Science Modernization Project, the Consolidated Security facility, and the replacement of several office facilities.

In 2008, LLNL undertook an effort to re-measure facilities against original as-built drawings in order to validate the accuracy of the facility database. As a result, an additional 83,994 sf was added in 2008 and 96,516 sf was added in 2009. These changes were due only to net adjustments from the remeasurements and not new construction. Table 3.1-1 identifies actual new square footage constructed at LLNL in 2003 through 2009. Because 2002 data was used as a base year to complete the SWEIS, years 2003 and 2004 have also been included in the tables in this section.

Table 3.1-1 New LLNL Facilities in Square Feet (sf)

Year	New sf	Cumulative sf
2003 Actual (FY)	2,280	2,280
2004 Actual (FY)	41,335	43,615
2005 Actual (FY)	43,843	87,458
2006 Actual (FY)	21,978	109,436
2007 Actual (FY)	1,750	111,186
2008 Actual (FY)	0	111,186
2009 Actual (FY)	0	111,186

LLNL 2010a

The SWEIS also projected that LLNL would D&D 820,000 sf of excess and legacy facilities. Table 3.1-2 identifies the actual sf that has been D&D'd during 2003 to 2009.

Table 3.1-2 Decontamination and Demolition Projects at LLNL

Fiscal Year	Demolished sf	Cumulative sf
2003 Actual (FY)	25,982	25,982
2004 Actual (FY)	79,045	105,027
2005 Actual (FY)	73,562	178,589
2006 Actual (FY)	58,976	237,565
2007 Actual (FY)	150,164	387,729
2008 Actual (FY)	58,128	445,857
2009 Actual (FY)	84,416	530,273

LLNL 2010a

3.1.3 Analysis of Projected Changes from 2010 to 2015

The new and modified projects and modifications in site operations listed in Table 1.1 that are likely to be implemented and may have an effect on land use at LLNL through the year 2015 are those encompassed in Table 3.1-3. In addition to the approximately 199,000 sf identified in Table 3.1-3, three other replacement office buildings may add 60,000 sf by the year 2015 if funding becomes available. New facility construction would thereby add approximately 259,000 sf at the Livermore Site.

The AESC, HEDS, and the Visitor/Commons/Collaboration Center would support established facilities and operations by providing graded security site access for foreign nationals and other collaborators. As proposed, the facilities would be located on the east side of the Livermore Site within the realigned fence line of the open access area. Although necessary to support current programmatic work, the AESC and HEDS are envisioned to be anchor facilities for the proposed Livermore Valley Open Campus (LVOC) effort. (The LVOC is an initiative to increase the accessibility of the Laboratory and its researchers to visiting scientists, industrial partners, and students. Facilities like the AESC, HEDS, and the visitor/commons/collaboration center will play an important role in the success of this effort.) As additional new facilities and operations are proposed in open access areas (northwest and eastside) of LLNL and SNL, NNSA would perform appropriate environmental reviews and documentation.

Table 3.1-3 New and Modified Projects and Modifications in Site Operations Considered in Land Use Analysis

Project Title	Description	Additional Square Footage
Eastside Access Control Modifications	Security fence line relocations	Does not add sf to LLNL
Northwest Corner Access Control Modifications	Security fence line relocations	Does not add sf to LLNL
Applied Energy Simulation Center (AESC)	High-performance computational facility	132,000 sf
High-Energy Density Science Center (HEDS)	Offices, an auditorium, diagnostic labs, and laser and target preparation labs	42,000 sf
Visitor/Commons Collaboration Center	Offices, conference room and small cafeteria	25,000 sf
Livermore Site and Site 300 site contamination remediation	Performance of long term stewardship including well installation and treatment facility upgrades and modifications	Location specific, but considered negligible as related to land-use
Site 300 Environmental Restoration	Continued remediation of contaminants in soil and groundwater	NA
Livermore Site Environmental Restoration	Continued remediation of contaminants in groundwater	NA
Conservation Set Aside Area at Site 300	Several acres would be set aside from further development in perpetuity	Acreage to be determined

As stated in Section 3.1.1, the SWEIS projected that approximately 370,000 sf of new facilities would be constructed through 2014. Table 3.1-1 showed that approximately 111,000 sf has actually been constructed through 2009. Combining this with the current estimate in the previous paragraph of an additional 259,000 sf for the 2010-2015 period, the total for the 2003-2015 period would be 370,000 sf. This would be consistent with the 370,000 sf estimate in the 2005 SWEIS if all the facilities were constructed.

New facility construction and modifications in site operations are not anticipated at Site 300; therefore, there would be no change in land use.

Environmental restoration activities are proposed to continue at both the Livermore Site and Site 300 including the installation of new monitoring or treatment wells and treatment facilities, with the possibility that they may remain in place for as long as 50 years. This would place a land use constraint on how those particular areas are used, but would not be considered significant.

LLNL proposes to continue consultations with the USFWS through use of a new Programmatic Biological Assessment (PBA) and resulting Opinion that would include setting aside acreage at Site 300. The Site 300 Conservation Area would be used to meet conservation or compensation objectives by conserving an area in perpetuity using land

use restrictions to prevent incompatible activities. The PBA would cover maintenance, improvements, construction, environmental restoration, conservation, and related activities performed by LLNL at Site 300. This would place a land use constraint on how DOE/NNSA or future owners use those particular areas, but would not be considered significant.

LLNL also proposes to continue to D&D excess and legacy facilities as funding becomes available.

3.1.4 Conclusion

LLNL's activities continue to be compatible with the industrial park zoning designation in Alameda County and the Community Facilities-Research and Development designations in the City of Livermore. The new and modified projects and modifications in site operations are consistent with the land use designations and the sf of construction projections analyzed in the SWEIS. Supplementation of the 2005 SWEIS for land use is not needed.

3.2 Aesthetics

This section discusses changes in potential impacts on aesthetic impacts from the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015.

3.2.1 The 2005 SWEIS Analysis

The SWEIS addressed the impact of LLNL's continued operations on the scenic quality of the landscape but was limited to the construction of buildings and infrastructure located in areas visible to the public. At Site 300, the proposed changes were projected to have little or no impact on aesthetics resources because they would occur largely within the developed portion of Site 300 in the General Services Area (GSA) (DOE 2005a).

Activities that were proposed in the SWEIS that would change the built environment at the Livermore Site and at Site 300 included improvements to existing buildings and infrastructure, D&D of existing buildings, and construction of new facilities with developments and modifications occurring within the developed portion of the site. The changes were anticipated to be consistent with the existing character of LLNL (DOE 2005a). Therefore, no additional impacts to visual resources were identified in the SWEIS.

3.2.2 Changes from 2005 to 2010

The off-site views of the Livermore Site have changed with the completion of the East Avenue security upgrade project, the International Security Research Facility, and NIF. Other new facilities at the Livermore Site such as two-story office facilities, a BSL-3 laboratory, and a central cafeteria replacement cannot be seen off site.

The off-site views of Site 300 have changed very slightly with completion of utility upgrades, environmental remediation projects (treatment facilities seen from Corral Hollow Road), and erosion control efforts.

3.2.3 Analysis of Projected Changes from 2010 to 2015

The new and modified projects and modifications in site operations listed in Table 1.1 that are likely to be implemented and may have an effect on aesthetics at LLNL through the year 2015 are those encompassed in Table 3.1-3. Many of the new facilities planned for construction would be located on the east side and southeast quadrant of the Livermore Site and would add approximately 259,000 sf of offices, laboratories, and visitor collaboration space. These facilities would be consistent with the existing character of LLNL on-site office and laboratory facilities and would also be similar to the Patterson Pass office park to the north and SNL to the south. New signage would be placed at the Livermore Site boundary and Greenville Road or Vasco Road to direct visitors and workers to the new facilities.

The primary features to the east of the Livermore Site remain rural residences and grazing land; to the north is an office park; the west side remains residential; and SNL is to the south.

Security fence-line changes are proposed as part of the Eastside Access Control Modifications to support the LVOC initiative. The Property Protected Area (PPA) fencing would be relocated from the edge of Greenville Road to align with new administratively-controlled office and research facility areas on the east side and southeast quadrant of the Livermore Site. The proposed Northwest General Access Area may require realignment or new fencing to allow researchers access to facilities that are now in a PPA. The 9-ft chain link security fencing would remain at the perimeter of federal property to the west and north (Vasco Road and Patterson Pass Road), but may be replaced at the modified access points. All remaining PPA areas would continue to be secured by 9-ft chain link security fencing.

LLNL's strategy for landscaping on site, as well as landscape that can be seen at off-site locations is to strive for a campus-like environment, and be responsive to a sustainable design. As reported in the *2009 DOE 430.2b Executable Plan Update*, LLNL will review its general landscaping plan and update it accordingly for use of drought-tolerant planting, "xeriscape" (a landscaping method developed especially for arid and semiarid climates), native landscaping, and use of reclaimed water for irrigation with a view of site-wide application and water conservation projects. LLNL will continue to assess and identify existing turf areas with potential for conversion to drought tolerant planting and implement best practices.

New facility construction, and therefore projects that may have a visual impact, is not anticipated at Site 300 with the exception of new wells or treatment facilities.

3.2.4 Conclusion

The new and modified projects and modifications in site operations would not significantly change the Livermore Site or Site 300 built environment or impact the off-site views and are consistent with the existing character of LLNL and the impact analyzed in the 2005 SWEIS. Supplementation of the 2005 SWEIS for aesthetics impacts is not needed.

3.3 Biological Resources and Wetlands

This section discusses changes in potential impacts on biological resources and wetlands from the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015.

3.3.1 The 2005 SWEIS Analysis

Biological Resources

A qualitative analysis in the 2005 SWEIS addressed the impacts of activities to biological resources, including vegetation, wildlife, protected and sensitive species, and wetlands that occur at the LLNL sites and contiguous areas. The potential sources of impacts considered included noise, outdoor tests, erosion, construction, demolition, and prescribed burns. Detailed surveys for federally-listed species were conducted at the Livermore Site and Site 300 to provide background information for the 2005 SWEIS. A site-wide Biological Assessment (BA) for the LLNL SWEIS was prepared and submitted to the USFWS in April 2004. The USFWS did not issue a Biological Opinion (BO).

DOE/NNSA has consulted with the USFWS regarding potential impacts to listed species that may occur during specific projects and Sitewide routine maintenance at the Livermore site and Site 300 since the early 1990s. These consultations have resulted in several Biological Opinions (BO) and associated amendments. LLNL's consultation history is described in the 2005 SWEIS.

A site-wide Biological Assessment (BA) for the LLNL SWEIS was prepared and submitted to the USFWS in April 2004. In December 2007, a revised BA was submitted to the USFWS. In response, the USFWS issued an amendment to the existing BO for maintenance activities at the Livermore site in December 2010, and an amendment to the existing BO for maintenance activities at Site 300 was issued in August 2007 (see the "Biological Assessments/Biological Opinions' section on page 3-12 for more detail).

Threatened, Endangered, and Other Special Status Species

Five species listed as endangered, threatened, proposed threatened, or candidates for listing under the federal Endangered Species Act (ESA), are known to occur at Site 300. The five species include the California red-legged frog, California tiger salamander, large-flowered fiddleneck, Valley elderberry longhorn beetle, and Alameda whipsnake. Although there are no recorded observations of the federally-endangered San Joaquin kit fox at Site 300, this species is known to have historically occurred in the adjacent Carnegie and Tracy Hills areas.

Two bird species that are listed under the California Endangered Species Act (CESA) were observed at Site 300 since 2005. This includes one species listed as endangered

under CESA, the Willow Flycatcher, and a second species, the Swainson's Hawk, which is listed as threatened under CESA.

Only one species listed under the ESA or CESA, the California red-legged frog, is known to occur at the Livermore Site. Although the California tiger salamander has not been observed at the Livermore Site, this species is considered during consultation with the USFWS regarding Livermore Site activities because of the proximity of observations of this species to the site.

The term "listed species" is used throughout the remainder of this section to refer to species listed as threatened or endangered under the ESA or CESA.

Several additional special status species occur at Site 300 or the Livermore site that are considered rare or of otherwise of special concern but are not listed as threatened or endangered under the ESA or the CESA. This includes California Fully Protected Species (CAFPS), California Species of Special Concern (CASSC), federal Bird Species of Concern, and plants included on the California Native Plant Society's Inventory of Rare and Endangered Plant of California (CNPS Inventory). Species that were included in the currently obsolete classification Federal Species of Concern (FSC) were listed in the 2005 SWEIS. The USFWS no longer maintains a FSC list. Many of the bird species that were previously included in the FSC list are now described by the USFWS as Birds of Conservation Concern (BCC). These species are described in the 2005 SWEIS.

A detailed description of the abundance and distribution of these species at Site 300 and the Livermore site is available in the 2005 SWEIS. Section 3.3.2 of this SA describes changes in the abundance and distribution of listed and special status species that have been discovered since the 2005 SWEIS was completed.

Tritium Levels in Vegetation and Commodities

LLNL has been monitoring tritium in vegetation since 1966 and has performed vegetation sampling in the vicinity of the Livermore Site and Site 300 since 1971. The monitoring program is designed to measure changes in the environmental levels of radioactivity, evaluate the environmental effect of LLNL operations, and calculate potential human doses from tritium in the food chain. In 1977, wine was added to the monitoring program. In general, the median tritium concentrations in plant water for vegetation at the Livermore Site and Site 300 showed a downward trend between 1988 and 2001. The 2005 SWEIS anticipated that tritium impacts on vegetation and wine might increase slightly as activities at the Livermore Site increase, and in addition, Site 300 and NIF would begin to use tritium (DOE 2005a).

3.3.2 Changes from 2005 to 2010

Changes in Critical Habitat Designations

The Alameda whipsnake, California red-legged frog, and California tiger salamander critical habitat designations have been the subject of litigations and have gone through many revisions since their original designations. Critical habitat for the California red-legged frog was originally designated in March of 2001. This designation included a portion of the Livermore Site and most of Site 300. The 2001 designation was later rescinded. In April 2006, a revised critical habitat was designated for the California red-legged frog that no longer included either the Livermore Site or Site 300 (71 FR 19243 - 19346). The current California red-legged frog critical habitat designation was issued on March 17, 2010. It does not include any portion of the Livermore Site, but all of Site 300 and the land surrounding the Arroyo Mocho pump station are included in the new proposal (USFWS 2010).

Critical habitat for the Alameda whipsnake originally contained a portion of Site 300, but the original designation was rescinded in May 2003. Critical habitat was designated again in October 2006. This current critical habitat final rule for the Alameda whipsnake encompasses 2,492 acres of Site 300 and all areas surrounding the Arroyo Mocho pump station.

The current critical habitat designation for the California tiger salamander does not include the Livermore Site or Site 300.

Critical habitat for the Large-flowered fiddleneck occurs at Site 300, but this critical habitat designation has not been revised since it was designated in 1985.

The current location of critical habitat at Site 300 is shown in Figure 3.3-1. No critical habitat is designated at the Livermore Site at this time.

Livermore Site

Invasive species, including the bullfrog and the largemouth bass, are a significant threat to the California red-legged frog at the Livermore Site. Lake Haussmann was drained in 2000 and 2001 in an effort to eliminate bullfrog larvae. The Habitat Enhancement Pool portion of Lake Haussmann was drained annually from 2002 through 2005, and the LLNL-reach of Arroyo Las Positas was allowed to dry out annually from 2002 through 2010 in an effort to remove bullfrog tadpoles and largemouth bass. In addition, adult bullfrogs and egg masses have been removed from Lake Haussmann during the bullfrog's breeding season each year since 2002. The USFWS approved these management techniques.

LLNL collaborated with the CDFG to apply the pesticide rotenone to Lake Haussmann in October 2006. A multidisciplinary LLNL team worked together with the

CDFG in the months preceding and after the application to thoroughly plan and ensure a successful, environmentally safe operation. Through these actions largemouth bass were eliminated from Lake Haussmann. Lake Haussmann continued to be free of largemouth bass in 2010.

Although there are no recorded observations of California tiger salamanders at the Livermore Site, they have been observed in several locations near the site. Between 2005 and 2010, California tiger salamanders have been observed at SNL (CNDDB 2010). Prior to 2005, California tiger salamanders have also been observed in several locations surrounding the Livermore Site (CNDDB 2010). The north buffer zone and the southwest buffer zone of the Livermore Site are within the accepted migration distance from known (off site) California tiger salamander observations. Because of this, impacts to California tiger salamander have been included in recent consultations with the USFWS regarding Livermore Site activities. The Arroyo Mocho Pump Station is also within range of the California tiger salamander.

Site 300

Surveys in 2009 through 2010 confirmed two branchiopod species, the California clam shrimp and the California linderiella, were present in ephemeral pools in the northwestern corner of the property. The California lideriella was previously described as a Federal Species of Concern (FSC) by USFWS. Neither species are currently considered rare.

In the fall of 2005, a portion of the Mid-Elk Ravine channel was enhanced to provide two pools for California red-legged frog breeding and year-round wetland values. These pools served as mitigation for wetlands at Buildings 865 and 801 that were the result of potable water discharges to a surface drainage. From 2006 through 2010, egg masses, larvae, and young of the year California red-legged frogs were detected at the constructed pools validating its potential as an important breeding site now and likely in the future.

The California tiger salamander has been reported at a number of Site 300 locations, including Pool A, Pool H, Pool M2, Pool S, Pool BC, and Pool D (Figure 3.3-2). Currently, and on average rainfall years, tiger salamanders breed at Pool A and Pool M2 (excavated in 2005). The California tiger salamander is known to spend the majority of each year in upland habitat up to 2 km from breeding pools. Thus, much of the northwest and southeast corners of Site 300 are considered upland habitat for this species.

Sitewide surveys for San Joaquin kit fox have not been conducted since the 2002 surveys described in the 2005 SWEIS. However, LLNL has continued to implement the comprehensive mitigation and monitoring plan that was developed for this species in the 1992 LLNL EIS/EIR. This plan includes pre-activity surveys. No sign of San Joaquin kit fox was observed during pre-activity surveys conducted at Site 300 since 1993.

Between 2001 and 2007, LLNL monitored productivity and survivorship of passerine birds at Site 300 Elk Ravine. A complete list of avian species present at Site 300 can be found in LLNL's 2009 Site Annual Environmental Report (LLNL 2010d). One species listed as endangered under the California Endangered Species Act, the Willow Flycatcher *(Empidonax trailii),* was captured during this monitoring effort. This species was not previously known to occur at Site 300. The Willow Flycatchers nesting habitat is limited to riparian habitat. Riparian habitat is very limited and occurs only in very small patches at Site 300. No significant impacts to riparian habitat are anticipated as a result of the activities described in this document, and therefore impacts to nesting Willow Flycatchers are not anticipated.

In 2009, a pair of Swainson's Hawks attempted to nest in an oak tree at Site 300 within an area that was routinely included in the Site 300 annual prescribed burn. In order to prevent potential impacts to this nest, no burning was done in the area surrounding the nest tree in 2009. Although Swainson's Hawks are occasionally observed flying over Site 300, this is the first known nesting attempt for Swainson's Hawks at Site 300. Swainson's Hawks did not attempt to nest at Site 300 in 2010.

Site 300 experimental and native large-flowered fiddleneck populations that are found near Site 300's Drop Tower are monitored annually. No large-flowered fiddleneck plants were found in the Drop Tower native population in 2008, 2009, or 2010, and this population has contained less than 20 plants each year since 2001. LLNL established the experimental population of the large-flowered fiddleneck at Site 300 beginning in the early 1990s. The size of the experimental population fluctuates as a result of seed bank enhancement efforts conducted in this population. As a result of seeding conducted in December of 2009, 217 large-flowered fiddleneck plants were found in the experimental population in the spring of 2010. No large-flowered fiddleneck have been observed at a second Site 300 location in Draney Canyon since a landslide that occurred in 1997. The site was surveyed in spring of 2005 and 2010.

No information is available to indicate the abundance or distribution of other special status species (CAFPS, CASSC, BCC, or plant species included in the CNPS Inventory) at Site 300 or the Livermore site differs significantly from the 2005 baseline with the exception of two special status plants: the round-leaved filaree and the California diamond-petaled poppy. Monitoring conducted between 2005 and 2010 has revealed that these two special status plant species are more widely distributed at Site 300 than they were known to be in 2005.

Biological Assessments/Biological Opinions

In February 2007, an amendment to the 2002 site-wide BA was submitted to the USFWS. A written response in the form of a BO was received from the USFWS in July 2007. The subject of the 2002 BO, "Routine Maintenance and Operations Projects at Site 300", addressed a suite of activities such as fire trail maintenance, storm drain

maintenance, culvert replacements, the annual prescribed burn, and termination of potable water releases. The July 2007 amendment addressed impacts of ongoing operations on California tiger salamanders at Site 300 (species was not listed at the time of the 2002 BO), as well as potential impacts of Site 300 projects that were not evaluated in the 2002 BO, such as the Pit 7 drainage diversion.

On December 13, 2007, also in response to the February 2007 BA, LLNL was issued an amendment to the 1997 Arroyo Las Positas BO to include potential impacts to California red-legged frogs in drainages throughout the Livermore Site and also included potential impacts to the California tiger salamander. A second amendment to this BO was issued on February 10, 2010 to include take of California red-legged frogs that may occur as a result of maintenance site-wide.

On November 17, 2008, LLNL submitted a BA to the USFWS for the Building 850 Polychlorinated Biphenyls-Bearing Soil Removal Project. An amendment and conference opinion was received by LLNL on April 9, 2009 for this project.

In 2004, LLNL was issued a BO from the USFWS to construct a bridge along the access road to the Arroyo Mocho pump station and to improve fish passage at this site. On July 9, 2007, LLNL was issued an amendment to this BO to remove boulders from the channel of Arroyo Mocho in the area directly below the pump station. On July 29, 2008, LLNL submitted a BA to the USFWS for the Arroyo Mocho Erosion Control Maintenance Project. An additional amendment to the 2004 BO was received in May of 2009 for this project.

Wetlands

Termination of water releases to the artificial wetlands near Buildings 801, 827, 851, and 865 were determined to impact wetlands at Site 300. In late August 2005, a habitat enhancement project was undertaken at Site 300, in accordance with the 2002 BO, to compensate for wetland values lost when the potable water surface discharges were terminated at the buildings described above.

In June of 2005, the USFWS issued a BO to DOE/NNSA for the Arroyo Seco Management Plan. The BO for this project considers potential impacts to the California red-legged frog and the California tiger salamander. The Arroyo Seco Management Plan was completed during the 2005 dry season. It included repairs to gully erosion around storm drain outfalls, installation of vegetated geogrids in eroding transition zones between existing gabion baskets and neighboring banks, and the addition of drop inlet structures to convey concentrated runoff down bank slopes at other gully erosion sites. In addition, the lower third of the LLNL reach of the Arroyo was realigned to increase the amount of meander in this area and decrease the slope of the creek banks. Minor maintenance activities were conducted under the Arroyo Seco Management Plan in 2006

through 2010 with no impacts to California red-legged frogs or California tiger salamanders.

In August 2005, a second habitat enhancement project was initiated at Site 300 that was described in a 2005 BO with USFWS on California tiger salamander mitigation of wetland habitat. Two explosives surface water impoundments were retired from use in the Chemistry Process Area that had limited value to California tiger salamanders but were known to be used occasionally by the species. A small seasonal pond in the northwest corner of the site (near Pool H) was enlarged and deepened to serve as a new breeding site for California tiger salamanders on site.

The Oasis Culvert Replacement Project was completed in the fall of 2006. This project is included in the May 17, 2002, BO for Routine Maintenance and Operations of Site 300. Fifteen California red-legged frogs were relocated during the construction of this project. The Round Valley Culvert Replacement Project was also completed in the fall of 2006. A large pool, Pool HC1, designed as breeding habitat for the California tiger salamander and California red-legged frog was constructed upstream of the Round Valley culvert as part of the project.

Tritium Levels in Vegetation and Commodities

The SWEIS anticipated that tritium impacts on vegetation and wine might increase slightly as the Tritium Facility Modernization project is completed at the Livermore Site with projected tritium emissions increasing from approximately 30 curies in 2002 to 210 curies per year, and NIF also becomes operational. However, because both the Tritium Facility Modernization project completion and NIF operations startup did not occur until the end of 2010, the actual tritium emissions through 2009 have remained below the SWEIS projections. During 2005 through 2009, the results of the LLNL monitoring program and LLNL impacts on vegetation in the Livermore Valley and Site 300 were found to be well below DOE screening dose limits. This was due to the extremely low levels of radionuclides of concern present in the soil and water samples that represent the source of exposure for the biota. These results are provided in the LLNL Environmental Reports.

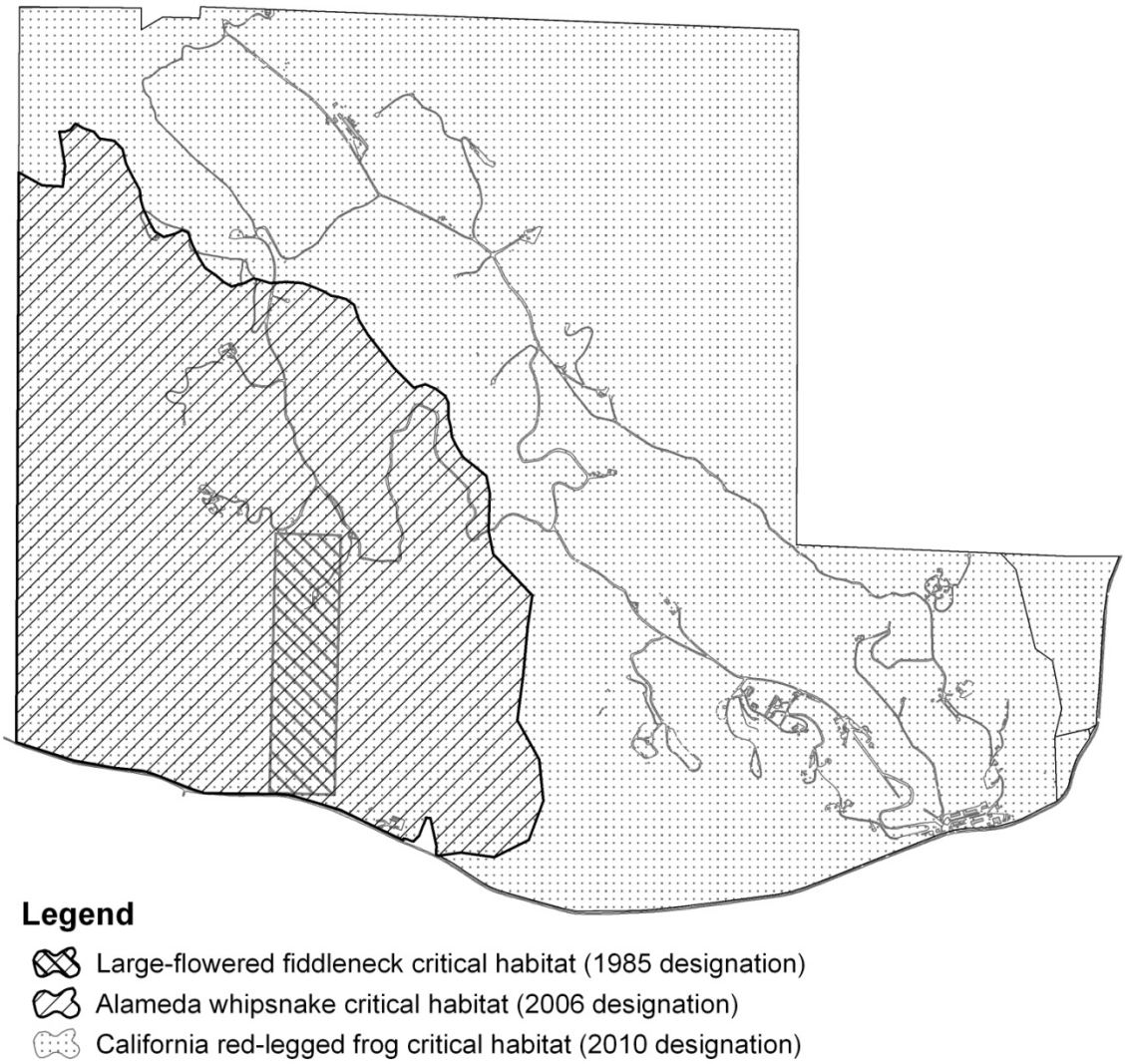

Figure 3.3-1 Critical Habitat Designations at Site 300

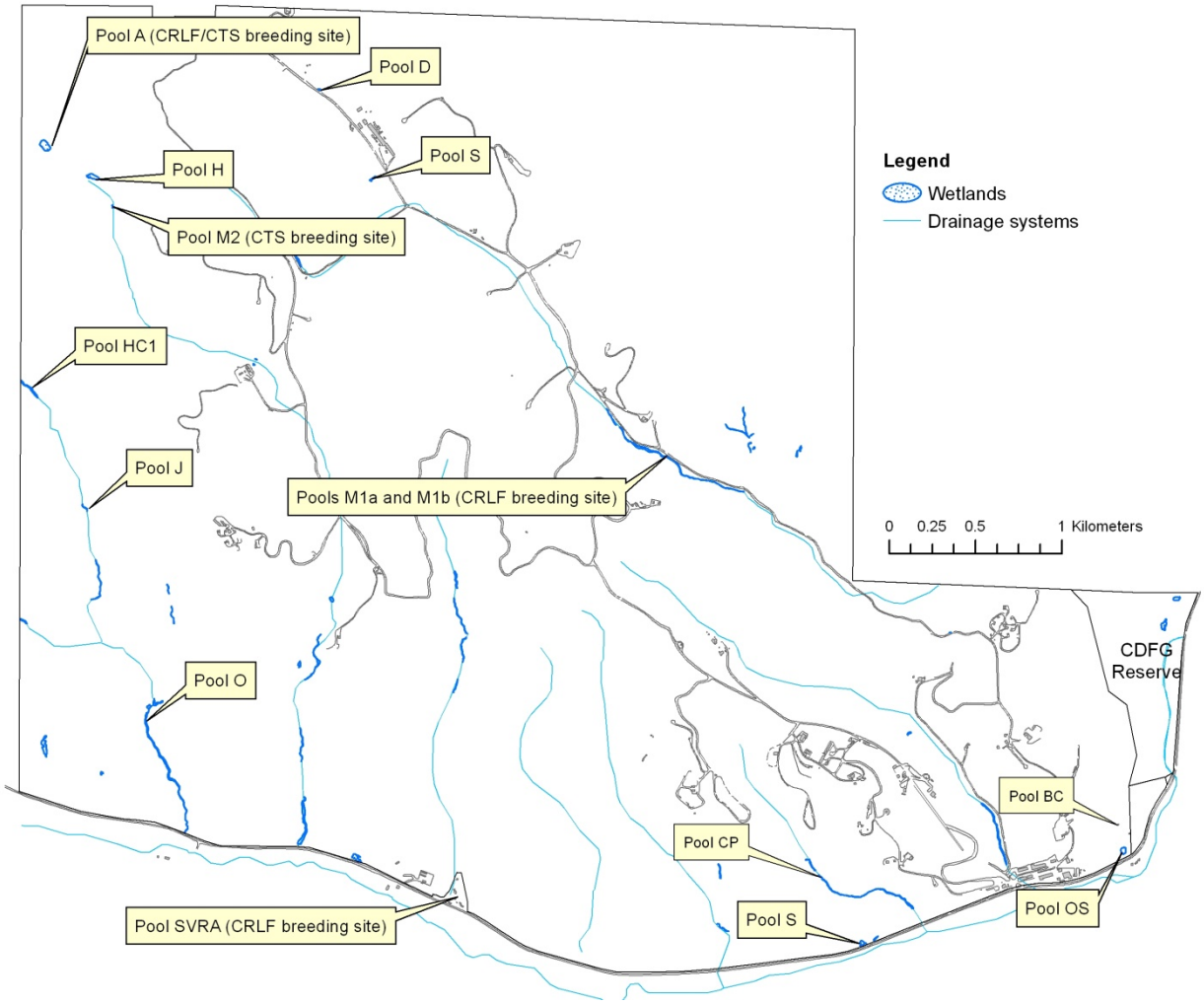

Figure 3.3-2 Wetlands and Drainage Systems at Site 300

3.3.3 Analysis of Projected Changes from 2010 to 2015

In reviewing the new and modified projects listed in Table 1.1, it was determined that the activities that might have impacts on biologic resources were those which occurred outside of existing facilities or involved changes to existing resource management activities. This includes new construction, environmental restoration activities, conservation and assessment activities, erosion control, and controlled burning practices. These are each discussed in the following sections. Also discussed are any potential impacts from air emissions on biological resources from new and modified projects.

Livermore Site

New Construction within Developed Areas

The Eastside and Northeast Corner Access Modifications, Applied Energy Simulation Center, High-energy Density Science Center, and the Common/Visitor/Collaboration Center may involve construction in developed areas that are near Arroyo Las Positas, Lake Haussmann, and associated drainage channels.

California red-legged frogs have been found within developed areas adjacent to aquatic habitat (USFWS 2010). Therefore, construction related activities such as excavation and equipment use may result in direct impacts to individual frogs when located near aquatic habitat including Arroyo Las Positas, Lake Haussmann, and associated drainage channels. These impacts would be minimized by implementing the Conservation Measures including natural resources awareness training, exclusion barriers, minimizing saturated soil or standing water at construction sites, and monitoring.

As with construction in annual grasslands, maintenance and use of this new construction within developed areas may result in future direct impacts to California red-legged frogs after construction is complete. At LLNL's Livermore Site, California red-legged frogs have been attracted to heavily irrigated lawn areas. Frogs within landscaped areas may be harmed by equipment during maintenance of these areas. To avoid impacts to California red-legged frogs within lawn areas, maintenance of these areas may be suspended until a LLNL biologist verifies that frogs are no longer present. To further avoid impacts, LLNL would consider using native or drought-tolerant plant materials in any new landscaped areas.

New construction projects may require the realignment or removal of drainage channels at the Livermore Site that are utilized by the California red-legged frog. Additional Conservation Measures will be implemented for projects in drainage channels that may support California red-legged frogs. For example, drainage channel work would be conducted when the channel is dry, and channels with appropriate habitat for California red-legged frogs would be surveyed by a wildlife biologist prior to construction and any California red-legged frogs present in the construction area would

be relocated. LLNL would consult with the U.S. Fish and Wildlife Service as necessary for these projects.

Programmatic Consultation and Conservation Buffer

LLNL has begun a programmatic consultation with the USFWS regarding potential impacts to listed species that may occur as a result of new construction in the security buffer zones and new construction within developed areas that are described above. As part of this consultation, LLNL submitted a Programmatic Biological Assessment (PBA) to the USFWS on April 15, 2011. The PBA describes the measures that LLNL plans to implement to minimize the potential to "take" listed species including: the implementation of a Resource Management Plan for the Livermore Site, conservation measures, and a proposed Conservation Buffer.

The Conservation Buffer would include an area adjacent to Arroyo Las Positas and Arroyo Seco in the security buffer zones. The Conservation Buffer is a semi-developed area. Existing activities may continue within the Conservation Buffer, including environmental monitoring, road maintenance, power line maintenance and upgrade, security fence maintenance or relocation, but other new facilities would not be constructed within the Conservation Buffer. California red-legged frogs are known to spend time in upland habitat that is adjacent to aquatic habitat such as the North Buffer Zone. By maintaining the current level of activity adjacent to the Arroyos, LLNL would minimize the potential for direct impacts to this species that may result from construction and use of new facilities and also minimize the potential for indirect impacts that may result from impacts to water quality in the Arroyos that could result from new development adjacent to these water ways.

Potential impacts to listed species that may occur during maintenance of existing facilities at the Livermore Site have been addressed in previous consultation. The requirements of these existing maintenance consultations would be incorporated into the new programmatic consultation.

Site 300

Programmatic Biological Assessment (PBA) and Conservation Area

On April 15, 2011, DOE/NNSA submitted a *Programmatic Biological Assessment for Continued Operations of the Lawrence Livermore National Laboratory Experimental Test Site, (Site 300)* to the USFWS. This administrative activity seeks to streamline the Section 7 Endangered Species Act regulatory processes with the USFWS through development of a PBA covering projects that may affect listed species at Site 300. A PBA detailing routine and proposed projects on site would include a long-term conservation proposal allowing LLNL to formally consult with the Service under a PBA; develop a Conservation Area at Site 300 for ongoing mitigation of project impacts;

implement a Resource Management Plan (RMP) to assist in conduct of site-wide activities and protection of natural resources; and formally receive agency buy-in in the form of a programmatic Biological Opinion (PBO). This strategy minimizes impacts to listed species through long-term protection of habitat at Site 300. The location of the Conservation Area was chosen to encompass areas of abundant biological diversity that can be dedicated for the preservation of listed species. The proposed Conservation Area boundaries protects important habitat for listed species as well as several other special status species

Despite significant efforts to avoid and minimize take of federally- or State-listed species at LLNL, the potential exists that during routine maintenance and operations and the implementation of future projects on site, that adverse effects (e.g., incidental take) could occur for one or more of the following listed species: the Alameda whipsnake, the California red-legged frog, the California tiger salamander, the Valley elderberry longhorn beetle and the Swainson's Hawk.

The large-flowered fiddleneck would not be affected by the proposed activities. The native and experimental Drop Tower populations are within designated large-flowered fiddleneck critical habitat and also the existing *Amsinckia grandiflora* Reserve that is protected through a Memorandum of Agreement between the Department of Energy and the Department of Interior. The Draney Canyon population is located within the proposed Conservation Area.

This proposed Conservation Area is considered to have no potentially significant adverse effect on listed plant or animal species on site (in fact it may have significant long-term beneficial effects) or cause a reduction in Critical Habitat associated with presence of a listed species. Furthermore, no adverse effect (e.g., kill or injure) is anticipated for species protected under the Bald Eagle Protection Act or the Migratory Bird Treaty Act.

Site 300 Environmental Restoration Department (ERD)

Potential exists that, during environmental restoration, infrastructure and well maintenance, and operations and implementation of future projects on site, adverse effects (e.g., incidental take) could occur to one or more of the following listed species: the Alameda whipsnake, the California red-legged frog, the California tiger salamander, the Valley elderberry longhorn beetle, or the Swainson's hawk.

Previously undisturbed upland and possibly aquatic habitats would be developed during conduct of remediation activities, expansion of infrastructure such as roads, and installation of future wells. The total acreage effected would likely result in 65 to 85 acres of ground disturbance.

These activities may be required within a conservation set-aside area and such impacts would be minimized through implementation of PBO Conservation Measures and Resource Management Plan (RMP) best management practices (BMPs). Under the proposed PBA, both the upland habitat and elderberry beetle habitat would be compensated for loss at a 3:1 ratio within the Conservation Area. Additional mitigation measures would likely consist of pre-construction requirements such as pre-activity surveys for protected species; construction avoidance and minimization measures; and post-construction restoration such as hydro-seeding and erosion control implementation practices outlined in the SWPPP.

Groundwater withdrawals would not likely affect water flow rates at springs on or around the area. In fact, the concentrations of hazardous test materials and to a lesser extent radionuclides that flora and fauna are exposed to would not increase, but decrease in these areas, and may have positive impacts on the survival of listed species.

Rehabilitation and revegetation of disturbed sites or on-site mitigation in the Conservation Area would benefit conservation and recovery under Section 7(a)(1) of the Endangered Species Act.

Based on the currently planned size of the physical impact, implementation of project-specific mitigation measures, and compensation of upland habitat loss or elderberry beetle habitat loss through the proposed PBA, the proposed activities are considered to have no potentially significant adverse impact on listed plant or animal species on site or cause a reduction in Critical Habitat associated with presence of a listed species. Because there would be limited adverse impacts to populations of protected species or habitats on site, the activity would have little negative impact on biodiversity or ecosystem function at Site 300. Furthermore, based on the current project scope, no adverse effect (e.g., kill or injure) is anticipated for species protected under the Bald Eagle Protection Act or the Migratory Bird Treaty Act.

Revision of Prescription Burning Practices

As a result of explosives testing operations ceasing at the Building 812 complex in FY 2008, there would no longer be an operational need to perform a prescribed burn around the facility for wildfire control. Similarly, the need to burn around Building 801 (Contained Firing Facility) has decreased. The current need to burn around Building 801 is predominately a resource management tool to support rare plant species populations such as the big tarplant.

Impacts of changing the prescription burn regime at Site 300 could have a variety of direct and indirect effects on both plants and animals. Indirect effects may be the most adversely impacting. These effects would chiefly result from the changes in frequency and intensity/severity of fires on site. Native bunchgrass at Site 300 occurs primarily in areas receiving the annual prescription burn. Changing the burn practice would

negatively impact this valuable and rare habitat type on site. Prescribed burning as a strategy for reducing non-native annual grass biomass is a recognized land management tool.

No reduction in the Primary Constituent Elements (PCEs) of Critical Habitat associated with presence of a listed species has been determined. Direct adverse effects (e.g., kill or injure) to species protected under the Bald Eagle Protection Act or the Migratory Bird Treaty Act are not anticipated. Negative indirect effects could result from changes in foraging base and therefore nesting areas, or greater competition for territories resulting in possible compensatory mortality as a space is reduced.

Next Phase Site 300 Erosion Control

Multiple areas at Site 300 have been identified that are subject to erosion. Erosion control projects have been ongoing for several years but the specific areas of concern change based on the weather conditions, controlled burns, wild fires and other changes in vegetation. Previously undisturbed upland and aquatic habitats would be modified to reduce or arrest soil erosion and prevent or reduce the amount of sediment entering down-gradient drainages.

Potential exists that, during erosion control projects involving watercourses and natural drainages on site, adverse effects could occur to one or more of the following listed species: the Alameda whipsnake, the California red-legged frog, the California tiger salamander, the Valley elderberry longhorn beetle, or the Swainson's hawk.

Habitat qualities or PCEs for listed species would be destroyed during soil removal in upland and aquatic habitats, although attempts would be made to re-seed and vegetate the areas afterward. Most of Site 300 has PCEs that are required for California red-legged frog Critical Habitat. Disturbance of these areas would result in Conservation Area compensations. Following the Conservation Measures and the BMPs of the PBO and RMP, respectively, could significantly reduce the chance of take of listed species.

Rehabilitation and revegetation of disturbed sites or on-site mitigation in the Conservation Area will benefit conservation and recovery under Section 7(a)(1) of the Endangered Species Act.

Tritium Levels in Vegetation and Commodities

The SWEIS anticipated that tritium impacts on vegetation and wine might increase slightly as Tritium Facility activities at the Livermore Site increased and NIF became operational. The continuing tritium emissions from the Tritium Facility and the proposed increase of tritium emissions from NIF, along with other diffuse sources, would slightly increase the impacts on vegetation and wine. However, it is anticipated that impacts to aquatic and terrestrial biota would remain below DOE screening dose limits for biota.

These results would continue to be provided annually in the LLNL Environmental Reports.

3.3.4 Conclusion

Potential impacts to California red-legged frogs and California tiger salamanders that may occur as a result of new construction in the security buffer zones or adjacent to California red-legged frog aquatic habitat at the Livermore Site would be minimized through avoidance and minimization measures which are consistent with current practices. As a result, the proposed activities at the Livermore Site are considered to have no potentially significant adverse effect on listed species.

The proposed activities at Site 300 are considered to have no potentially significant adverse effect on listed plant or animal species on site or cause a reduction in Critical Habitat associated with presence of a listed species. This is based on the potential size of the physical impact, on the implementation of avoidance and minimization measures (e.g., Service Conservation Measures), and on the compensation of upland habitat, aquatic habitat, or loss or elderberry beetle habitat loss through the proposed PBA. Furthermore, based on the proposed scope of activities at Site 300, no adverse effect (e.g., kill or injure) is anticipated for species protected under the Bald Eagle Protection Act or the Migratory Bird Treaty Act.

The DOE/NNSA would continue to complete necessary BAs and obtain BOs from the USFWS on any identified impacts on critical habitat(s). Supplementation of the 2005 SWEIS for biological resources is not needed.

3.4 Air Quality

This section discusses changes in potential impacts on air quality from proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015. All LLNL activities with the potential to produce air pollutant emissions were evaluated in the SWEIS to determine the need for permits and assessed for continued compliance. The areas of major concern for air quality at LLNL are criteria air pollutants, toxic and hazardous air pollutants, and radiological emissions. This section reviews the changes affecting potential air quality impacts.

3.4.1 The 2005 SWEIS Analysis

Radiological Air Emissions

Radiological air emissions from DOE owned or operated sites are subject to the National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61). The NESHAPs standard limits emissions of radionuclides to the ambient air from DOE facilities to not exceed amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem per year (mrem/year). Compliance with the standard is determined by calculating the highest effective dose equivalent to the maximally exposed individual (Site-wide MEI) member of the public. The Site-wide MEI is the resulting dose from the combination of all LLNL site radionuclide to ambient air releases at an off-site location such as a school, business, or residence.

Low quantities of radioactive air emissions are emitted to the atmosphere by a few LLNL facilities, either from stack releases (point sources) or from diffuse sources, such as off-gassing from storage areas. The SWEIS evaluated routine radiological emissions from these facility operations on the basis of dose to the Site-wide MEI and collective dose to the general population within 50 mi of the site (population dose). The SWEIS also predicted the location of the Site-wide MEI.

Under the Proposed Action, the SWEIS predicted the Livermore Site-wide MEI dose location to be due east of the NIF stack location, and was projected to be 0.13 mrem/year (annual risk of 8×10^{-8} LCFs). The population dose from Livermore Site was projected to be 1.8 person-rem per year (1.1×10^{-3} LCFs/year). For Site 300, the Site-wide MEI location was predicted to be east-southeast of the Firing Table 851, and was projected to be 0.055 mrem/year (3.3×10^{-8} LCFs/year). The population dose from Site 300 was projected to be 9.8 person-rem/year (5.9×10^{-3} LCFs/year) (DOE 2005a).

Nonradioactive Air Emissions

Air quality is measured by quantitative ambient air quality standards, which are regulated by the federal Environmental Protection Agency (EPA) and by the State of California. The California standards are more stringent than the federal standards. The regulated air pollutants include ozone, particulate matter, carbon monoxide, sulfur

dioxide, and nitrogen oxides. Also, precursor (volatile) organic compounds are regulated because they contribute to the formation of ozone and nitrogen oxides. The major source of these emissions is from stationary sources such as combustion of natural gas for fuels for comfort heating and environmental control, and fuel used for reciprocating engines, such as emergency standby generators. All stationary sources of air emissions that impact these standards are regulated by agency permits and regulations.

The SWEIS estimated that, in the assumed worst-case year for these regulated air pollutants, Livermore Site would emit a combined total of approximately 150 kg per day (60 tons per year) (Table 3.4-3). Individual regulated pollutants were projected to be 50 kg per day (20 tons per year) of carbon monoxide, 55 kg per day (22 tons per year) of nitrogen oxides, 30 kg per day (12 tons per year) of particulate matter, 5.2 kg per day (2.1 tons per year) of sulfur oxides, and 9.4 kg per day (3.8 tons per year) of precursor organic compounds, respectively (DOE 2005a).

Regulated air pollutants were projected in the SWEIS to be much lower at Site 300 with an estimated total of 30 kg per day (12 tons per year) (Table 3.4-4). Air emissions were projected to be 3.7 kg per day (1.5 tons per year) of carbon monoxide, 12 kg per day (5.0 tons per year) of nitrogen oxides, 11 kg per day (4.5 tons per year) of particulate matter, 1.3 kg per day (0.52 tons per year) of sulfur oxides, and 1.9 kg per day (0.77 tons per year) of precursor organic compounds, respectively (DOE 2005a).

Certain operations at Livermore Site and Site 300 require air permits from the Bay Area Air Quality Management District (BAAQMD) or the San Joaquin Valley Air Pollution Control District (SJVAPCD). The stationary emission sources that release the greatest amounts of regulated air pollutants from the Livermore Site are from boilers (natural gas fired), internal combustion engines (diesel fuel and propane), and solvent operations (including surface coating). The stationary emission sources that release the greatest amounts of regulated air pollutants at Site 300 include internal combustion engines (diesel fuel and propane), a gasoline-dispensing facility, and general machine shop operations.

Conformity

Under the Federal Clean Air Act General Conformity Rule, federal agencies must work with state, tribal, and local governments in air quality nonattainment or maintenance areas to ensure that federal actions conform to the state implementation plan (SIP). A conformity determination is required for each criteria pollutant or precursor organic compounds where the total of direct and indirect emissions of the criteria pollutant or precursor organic compounds in a nonattainment or maintenance area caused by a federal action would equal or exceed specified emission rates. For Livermore Site, the BAAQMD is a “marginal” nonattainment area for ozone. Therefore a conformity threshold of 50 tons per year applies for emissions of precursor organic compounds and a threshold of 100 tons per year applies to emissions of nitrogen oxides. For Site 300, the

SJVAPCD is an "extreme" nonattainment area for ozone. Therefore a conformity threshold of 10 tons per year applies for emissions of both precursor organic compounds and nitrogen oxides. Both BAAQMD and SJVAPCD are in nonattainment for particulate matter, with a conformity threshold of 100 tons per year/each. Emissions estimates under the Proposed Action in the SWEIS are well below the applicable conformity thresholds for air quality; therefore, the projected air emissions in the SWEIS are in conformance with Clean Air Act requirements (DOE 2005a).

Hazardous Air Pollutants

Hazardous air pollutants (HAPS) are emitted to the atmosphere by various mechanisms at LLNL, such as the use of hazardous air pollutants in research and development chemistry operations, in commercial products, in construction materials, during fuel dispensing, and in the combustion of gaseous and liquid fuels. The EPA Title V permitting thresholds for hazardous air pollutants are 9 tons per year of a single hazardous air pollutant, or 23 tons per year of the combined total of hazardous air pollutants (40 CFR Part 70). The SWEIS stated that LLNL is not a major facility in terms of hazardous air pollutant emission rates; however, specific programs apply for beryllium and radionuclides. The SWEIS also stated that hazardous air pollutant emissions from the tailpipes of motor vehicles are restricted by means of federal and state regulations on motor vehicle emissions, and vehicle inspection programs, and such hazardous air pollutants are not included in the total emissions for LLNL permitted sources (DOE 2005a).

The most common non-radiological NESHAPs concern at LLNL is asbestos and asbestos-containing materials, associated with demolition or renovation work. The specific concern is regulated asbestos containing material (RACM), a material that contains greater than 1% asbestos and is friable by nature. Air district regulations require that for every demolition and renovation involving the removal of specified amounts of RACM, a notification shall be made to the district prior to commencement of demolition/renovation. After approval is received from the air district, the demolition/renovation work is conducted under strict controls to prevent the escape of asbestos fibers to the air, and the work is subject to inspection by the air district (BAAQMD 1998).

3.4.2 Changes from 2005 to 2010

Radiological Air Emissions

Livermore Site

According to the 2005 through 2009 LLNL NESHAPs Reports (LLNL 2006a, 2007a, 2008, 2009d, 2010j), the doses from radioactive air emissions at the Livermore Site to the Site-wide MEI member of the public were much lower than the estimate projected by the SWEIS, which was 0.13 mrem/year (8×10^{-8} LCFs/year) (Table 3.4-1). Additionally, the

population doses over the same period for the Livermore Site were much lower than the projected 1.8 person-rem/year under the SWEIS Proposed Action.

Table 3.4-1 Doses to the Public from Livermore Site Radioactive Air Emissions

LLNL Site-Wide MEI	SWEIS Projection	2005 Actual (CY)	2006 Actual (CY)	2007 Actual (CY)	2008 Actual (CY)	2009 Actual (CY)
Individual Dose (mrem/year)	0.13 (8×10^{-8} LCFs/year)	0.0065 (4×10^{-9} LCFs)	0.0045 (3×10^{-9} LCFs)	0.0031 (2×10^{-9} LCFs)	0.0013 (8×10^{-10} LCFs)	0.0042 (3×10^{-9} LCFs)
Population Dose (Person-rem/year)	1.8 (1.1×10^{-3} LCFs/year)	1.2 (7.2×10^{-4} LCFs)	0.75 (4.5×10^{-4} LCFs)	0.50 (3×10^{-4} LCFs)	0.14 (8.4×10^{-5} LCFs)	0.20 (1.2×10^{-4} LCFs)

Site 300

The SWEIS estimated that the Site-wide MEI dose at Site 300 would be 0.055 mrem/year with the Site-wide MEI located west-southwest of Firing Table 851, the only outdoor firing facility that was expected to use depleted uranium or tritium. The population dose was estimated to be 9.8 person-rem/year (DOE 2005a). The 2005 through 2009 LLNL NESHAPs Reports also reported that doses from radioactive air emissions for Site 300 were much lower than projected by the SWEIS (Table 3.4-2) (LLNL 2006a, 2007a, 2008, 2009d, 2010j).

Table 3.4-2 Doses to the Public from Site 300 Radioactive Air Emissions

S300 Site-Wide MEI	SWEIS Projection	2005 Actual (CY)	2006 Actual (CY)	2007 Actual (CY)	2008 Actual (CY)	2009 Actual (CY)
Individual Dose (mrem/year)	0.055 (3.3×10^{-8} LCFs/year)	0.018 (1×0^{-8} LCFs)	0.016 (9.6×10^{-9} LCFs)	0.0035 (2×10^{-9} LCFs)	4.4×10^{-8} (3×10^{-14} LCFs)	2.7×10^{-7} (2×10^{-13} LCFs)
Population Dose (person-rem/year)	9.8 (5.9×10^{-3} LCFs/year)	1.7 (1×10^{-3} LCFs)	3.3 (2×10^{-3} LCFs)	0.28 (2×10^{-4} LCFs)	9.8×10^{-6} (6×10^{-9} LCFs)	5.1×10^{-5} (3×10^{-8} LCFs)

Nonradioactive Air Emissions

A "major source" of air emissions is defined in 40 CFR Part 70 as a facility that emits or has the potential to emit 100 tons per year of one or more air pollutants. LLNL has the option to limit its emissions below the "major source" threshold under a "Synthetic Minor Operating Permit," administered by Bay Area Air Quality Management District (BAAQMD). The District regulations adopt the federal threshold for a "major source" (100 tons per year) under Regulation 2-6-212 (BAAQMD 2003). The District also requires that the Synthetic Minor Operating Permit have a slightly lower threshold of 95 tons per year under its Regulation 2-6-423 (BAAQMD 2003), as a margin of safety. Similarly, Regulation 2-6-423 applies slightly lower thresholds of 9 tons per year and 23 tons per year to the federal Title V hazardous air pollutant thresholds of 10 tons per year and 25 tons per year. LLNL has voluntarily accepted enforceable permit conditions including emission limits that would keep LLNL's potential to emit under 95 tons per year of any regulated air pollutant, less than 9 tons per year of any hazardous air pollutant, and 23 tons per year of any combination of hazardous air pollutants. The exceptions are that nitrogen oxides and precursor organic compounds would each be less than 35 tons per year. Bay Area Air Quality Management District Regulation 2-2-302 "Offset Requirements, Precursor Organic Compounds and Nitrogen Oxides (BAAQMD 2003)," requires contemporaneous emissions offsets from facilities with emissions of 35 tons per year or more of precursor organic compounds or nitrogen oxides. Facilities below the threshold of 35 tons per year may use the "District Emissions Bank" for offsets. LLNL has committed to remain below the threshold of 35 tons per year in order to retain access to the District Emissions Bank. To establish compliance with all Synthetic Minor Operating Permit requirements, monthly totals of precursor organic compounds and hazardous air pollutants are maintained and a 12-month rolling total is calculated each month.

Tables 3.4-3 and 3.4-4 summarize the actual emissions of regulated air pollutants from stationary sources at the Livermore Site and Site 300 during the 2005 through 2009 reporting period. The values do not include emissions from mobile sources, such as motor vehicles, or emissions from prescribed burning of annual grasses at Site 300. The data is obtained from logbook records associated with permitted air emission sources, and from natural gas meter records.

During the period of 2005 through 2009, the worst-case year (i.e., 2005) for these regulated pollutants at the Livermore Site was approximately 150.7 kg per day (60 tons per year) (Table 3.4-3). The individual air pollutant worst-case year amounts were 52.3 kg per day (21 tons per year) of carbon monoxide, 68.6 kg per day (28 tons per year) of nitrogen oxides, 6.0 kg per day (2 tons per year) of particulate matter, 1.7 kg per day (0.7 tons per year) of sulfur oxides, and 24.9 kg per day (10 tons per year) of POCs, respectively (LLNL 2010a).

The increase in precursor organic compounds at the Livermore Site in 2005 can be attributed to the fact that precursor organic compounds from permit-exempt adhesive sources and architectural paint sources (9.5 kg/day) were added to the total Livermore Site precursor organic compounds emissions. The increase in nitrogen oxides and carbon monoxide emissions at the Livermore Site is attributed to natural gas boilers used for facility heating for newer facilities such as Terascale Facility (TSF), NIF, and several office buildings; as well as temporary increases related to construction activities. Pollution prevention efforts, decrease in personnel, and changes in the types of work attributed to the lower quantities in the most recent years.

Table 3.4-3 Non-Radioactive Regulated Air Emissions – Livermore Site

Pollutants	SWEIS Projection (worst case year) (kg/day)	2005 Actual (kg/day) (CY)	2006 Actual (kg/day) (CY)	2007 Actual (kg/day) (CY)	2008 Actual (kg/day) (CY)	2009 Actual (kg/day) (CY)
Carbon Monoxide	50 (20 tons/year)	49.9	50.3	52.3	49.0	46.8
Nitrogen oxides	55 (22 tons/year)	68.6	67.2	65.7	63.0	59.3
Particulate Matter	30 (12 tons/year)	5.6	5.4	6.0	5.8	5.21
Sulfur oxides	5.2 (2.1 tons/year)	1.7	1.6	1.5	1.7	1.48
Precursor organic compounds	9.4 (3.8 tons/year)	24.9	16.1	17.3	13.3	9.91
Total	150 (60 tons/year)	150.7	140.6	142.8	132.8	122.8

LLNL 2010a

Table 3.4-4 Non-Radioactive Regulated Air Emissions - Site 300

Pollutants	SWEIS Projection (worst case year) (kg/day)	2005 Actual (kg/day) (CY)	2006 Actual (kg/day) (CY)	2007 Actual (kg/day) (CY)	2008 Actual (kg/day) (CY)	2009 Actual (kg/day) (CY)
Carbon monoxide	3.7 (1.5 tons/year)	0.19	0.27	0.51	0.51	0.46
Nitrogen oxides	12 (5.0 tons/year)	0.52	1.2	2.32	2.32	2.14
Particulate matter	11 (4.5 tons/year)	0.28	0.32	0.39	0.49	0.32
Sulfur oxides	1.3 (0.52 tons/year)	0.03	0.15	0.21	0.21	0.17
Precursor organic compounds	1.9 (0.77 tons/year)	0.41	0.44	0.48	0.42	0.42
Totals	30 (12 tons/year)	1.43	2.38	3.91	3.95	3.51

LLNL 2010a

During the period of 2005 through 2009, the worst-case year (i.e., 2008) for these regulated pollutants at Site 300 was approximately 3.95 kg per day (Table 3.4-4). The individual air pollutant worst-case year amounts were 0.51 kg per day of carbon monoxide, 2.32 kg per day of nitrogen oxides, 0.49 kg per day of particulate matter, 0.21 kg per day of sulfur oxides, and 0.48 kg per day of POCs, respectively (LLNL 2010a). These values reflect decrease in personnel and much lower activities than anticipated in the SWEIS for Site 300.

Greenhouse Gas Emissions

Under the authority of Assembly Bill 32 (AB32), signed on September 27, 2006, the State of California has adopted several new regulations regarding emissions of greenhouse gases (CARB 2010). For facilities like LLNL, California requires mandatory reporting of greenhouse gases from stationary source combustion of natural gas that exceed 25,000 metric tons per year of carbon dioxide-equivalent emissions. For the previous two mandatory reporting years (Calendar years 2008 and 2009), LLNL Livermore Site has been slightly below the reporting threshold (LLNL 2010a) with a total carbon-dioxide-equivalent of 24,942 metric tons and 23,912 metric tons for calendar years 2008 and 2009, respectively. The EPA also has a mandatory reporting regulation for stationary emission sources, similar to California's regulation (40 CFR 98). LLNL continues to implement reductions and controls, such as shutting down buildings and improving HVAC systems that should reduce carbon dioxide emissions in future years. Site 300 emissions of carbon dioxide are much lower than Livermore Site emissions.

There is no natural gas service at Site 300 and no heating with fuel oil, with a small amount of heating with propane.

California also has special regulations pertaining to sulfur hexafluoride, because of its high greenhouse-gas potential. LLNL is taking measures to reduce emissions of sulfur hexafluoride, such as reducing the amount of the gas in inventory and using alternative gases, where practical, in X-ray radiography equipment, accelerators, and switchgear. Research facilities, such as LLNL, must submit an annual report describing the research uses of sulfur hexafluoride and the measures taken to control their sulfur hexafluoride emissions. LLNL must also report the amount of sulfur hexafluoride contained in electrical switchgear, and the amount of sulfur hexafluoride that leaks from that switchgear.

Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," was signed by the President on October 5, 2009. The Order requires federal facilities to make improvements in environmental and energy performance, including the reduction of greenhouse gas emissions. The President has set 2020 greenhouse gas emission reduction targets for the federal government of 28% (Scope 1 and 2) and 13% (Scope 3) with FY 2008 as the baseline. As directed by the Order, LLNL is in the process of inventorying its greenhouse gas emissions from stationary sources as well as from motor vehicles, portable engines, emergency standby generators, indirect sources (electricity), air travel and other sources. Reporting requirements follow a phased approach (Scope 1, 2, and 3), starting with Scope 1, direct emissions of greenhouse gases. Scope 2 refers to indirect greenhouse gas emissions from purchased electricity, heat or steam; and Scope 3 concerns indirect greenhouse gas emissions from business travel, waste disposal, employee commuting, product use and other indirect emissions.

Conformity

BAAQMD is a "marginal" nonattainment area for ozone. Therefore a conformity threshold of 50 tons per year applies for emissions of precursor organic compounds and a threshold of 100 tons per year applies for emissions of nitrogen oxides. SJVAPCD is an "extreme" nonattainment area for ozone. Therefore a conformity threshold of 10 tons per year applies for emissions of both precursor organic compounds and nitrogen oxides. The emissions summarized in Table 3.4-3 show that Livermore Site emissions of precursor organic compounds are well below the threshold of 50 tons per year, and the emissions of nitrogen oxides are well below the threshold of 100 tons per year. The emissions summarized in Table 3.4-4 show that Site 300 emissions of precursor organic compounds and nitrogen oxides are both well below the threshold of 10 tons per year. Both BAAQMD and SJVAPCD are in nonattainment for particulate matter, with a conformity threshold of 100 tons per year, and the emissions summarized in Tables 3.4-3 and 3.4-4 show that particulate emissions at both sites have been well below the threshold.

Hazardous Air Pollutants

The EPA Title V permitting thresholds for hazardous air pollutants are 9 tons per year of a single hazardous air pollutant, or 23 tons per year of the combined total of hazardous air pollutants. LLNL emissions of hazardous air pollutants were very low relative to the EPA thresholds. For example, LLNL's emissions of hazardous air pollutants in calendar year 2009 were 810 pounds (or 1.0 kg/day) (LLNL 2010e). Ongoing space consolidation efforts and demolition of buildings were in compliance with air district notification requirements for regulated asbestos containing materials. After approval is received from the air district, the demolition and renovation work is conducted under strict controls to prevent the escape of asbestos fiber to the air.

3.4.3 Analysis of Projected Changes from 2010 to 2015

The cumulative impacts from all the projects listed in Table 1.1 were considered in the following section. The analysis also focuses on potential impacts from the proposed changes to NIF operations.

Radiological Air Emissions

Radioactive air emissions from the Livermore Site are expected to change as a result of projected increase in tritium emissions from NIF from 30 Ci per year to 80 Ci per year. Since the 2005 SWEIS, the installation of NIF contamination control systems has been completed and NIF has become operational, which has allowed NIF to gain experience in maintenance and operations involving tritium. Potential sources of tritium air emissions were originally identified during the data collection efforts in 2002 for the SWEIS. These include operations such as target change-outs, diagnostic change-outs, vacuum system maintenance, maintenance of contamination control systems, etc. The Tritium Processing System, which includes two skids, has been provided to receive effluents from the target area vacuum systems and other incident loads. The system is comprised of a common arrangement of heaters and catalyst beds for oxidation of the tritium gas and other hydrogen species to water, which is subsequently captured on molecular sieve beds. The molecular sieve beds are disposed of as radioactive waste when either the capacity of the beds is reached or when facility tritium inventories dictate that they could be changed and removed from the facility.

Access to NIF contaminated volumes requires that the initial effluents be sent to the facility's Tritium Processing System. Subsequent low tritium concentration effluents are sent to either the Target Bay or Diagnostic Building exhaust systems, which are monitored for release at the elevated release point. The operational experience also shows that at low tritium concentrations other hydrogen species will load the molecular sieve beds excessively, thereby making them inefficient in capturing higher concentrations of

tritium. Sending air effluents with very low tritium concentrations directly to the exhaust systems optimizes the use of the molecular sieves, allowing for capture of higher concentrations of tritium while avoiding excessive radioactive waste generation for low tritium concentrations and potential worker exposures from frequent molecular sieve change-outs.

Building 331 annual tritium emissions projection would remain 210 Ci per year as described in the 2005 SWEIS. The 2005 SWEIS estimated that the radioactive air emissions from all LLNL sources would result in a Site-wide MEI dose (to members of public) of 0.126 mrem/year (rounded to 0.13 mrem /year [8 x 10^{-8} LCFs/year]), a value less than 2 percent of the NESHAPs site-wide standard for routine radiological airborne emissions of 10 mrem/year. The 2005 SWEIS predicted that the Site-wide MEI would be located due east of the NIF stack, along the eastern site boundary (assumed at the Country Pet Hospital on Greenville road). The 2005 SWEIS also included an evaluation of routine radioactive air emissions from the NIF to the environment and subsequent dose to the public. The contribution from NIF radioactive air emissions to the Site-wide MEI dose was predicted at 0.068 mrem/year (4 x 10^{-8} LCFs/year).

To evaluate an increase in projected tritium emissions from the NIF from 30 Ci per year to 80 Ci per year (an increase of 50 Ci per year), the U.S. approved CAP88-PC air dispersion and dose assessment modeling code was utilized. The resulting modeled dose to an MEI at the Country Pet Hospital for the increase in 50 Ci per year of tritium airborne effluent emissions is 0.016 mrem/year (1 x 10^{-8} LCFs/year). Adding the 0.016 mrem/year dose to the NIF 2005 SWEIS dose contribution of 0.068 mrem/year results in an updated estimated NIF dose contribution of 0.084 mrem/year (5 x 10^{-8} LCFs/year) (LLNL 2010g).

Adding the increase in NIF dose contribution of 0.016 mrem/year to the 2005 SWEIS Site-wide MEI dose of 0.126 mrem/year corresponds to an updated site-wide dose of 0.142 mrem/year (rounded to 0.14 mrem/year [8.4 x 10^{-8} LCFs/year)) at the Country Pet Hospital for site-wide routine radiological air emissions to ambient air (LLNL 2010g). The updated Site-wide MEI dose of 0.14 mrem/year would remain less than 2 percent of the NESHAPs 10 mrem/year site-wide standard for routine radiological airborne emissions. As a comparison, the National Council on Radiation Protection and Measurement (NCRP) estimate for average doses from background radiation (natural and man-made) for U.S. population is 350 mrem/year (2 x 10^{-4} LCFs/year) (LLNL 2010d).

The contribution to the Livermore Site population dose from the projected increase in tritium emissions from NIF would be 0.07 person-rem/year (4 x 10^{-5} LCFs/year). Adding this increase to the 2005 SWEIS population dose of 1.84 person-rem/year (1.1 x 10^{-3} LCFs/year) would result in an updated site-wide population dose of 1.91 person-rem/year (1.2 x 10^{-3} LCFs/year).

There are no planned changes for Site 300 radioactive air emissions. The emissions would remain within the SWEIS projections of 0.055-mrem/year Site-wide MEI dose (3.3×10^{-8} LCFs/year) and 9.8 person-rem/year population dose ($5.9\ 10^{-3}$ LCFs/year).

Nonradioactive Air Emissions

The proposed new building projects include the Applied Energy Simulation Center, High-Energy Density Science Center, Visitor/Commons Collaboration Center, and office replacement facilities. The additional electricity requirements to provide power to these facilities would be offset to some extent by electricity reductions from the closure of existing buildings and the implementation of energy efficiencies. In addition, new buildings would be Leadership in Energy and Environmental Design (LEED) certified, resulting in a reduced demand for purchased electricity, and, consequently, reduced air emissions from the off-site generation of electricity. LEED certification is the Green Building Rating System developed by the United States Green Building Council (USGBC). LEED certification is a recognition that a construction project or building can attain by utilizing environmentally friendly building practices during construction or remodeling.

As stated in Section 3.1, Land Use, new and modified projects and modifications in site operations that are likely to be implemented through 2015 would add approximately 259,000 sf of new facilities, and the D&D of excess and legacy facilities would continue. Therefore, there would be minor changes in potential impacts on air quality.

The proposed new and modified projects and modifications in site operations would not significantly impact the emissions of regulated air pollutants. To the extent that the proposed new buildings use natural gas for space heating or hot water heating, there would be a small increase in emissions of nitrogen oxides and carbon monoxide, and a very small increase in particulates and sulfur oxides. However, nitrogen oxides and carbon monoxide emissions would remain within the Bay Area Air Quality Management District (BAAQMD) enforceable permit conditions of 35 tons per year for nitrogen oxides and 95 tons per year for carbon monoxide. To the extent that the proposed new buildings use solvents for research work, there would be a small increase in emissions of precursor organic compounds. Given the public-use nature of the proposed new buildings, it is expected that there would be no need for emergency standby power generation, using diesel-fueled generators, with the possible exception of the Applied Energy Simulation Center. During the construction of the proposed new buildings, there would be some particulate dust generation as a part of the site grading and site preparation, and an increase in regulated pollutants from the operation of gasoline and diesel fueled construction machinery. The regulated air pollutant emissions would remain well below their conformity threshold limits.

Greenhouse Gas Emissions

The proposed new and modified projects and modifications in site operations would increase electricity consumption and, therefore, increase indirect air emissions from

purchased electricity generated from off-site electricity generation stations. This may be offset by the Space Consolidation Initiative described in Table 1.1 and in DOE/NNSA's *Complex Transformation PEIS* (DOE 2008a), which would close down or decommission excess facilities and increased energy efficiency efforts. Several excess facilities are placed on "cold and dark" status, where natural gas and electricity use is significantly reduced or completely shut off. These facilities would eventually be demolished. Indirect emissions from the purchase of electricity accounts for 60% of DOE's Scope 1 and 2 greenhouse gas inventory and the proportion is similar for LLNL. If new buildings use natural gas appliances for comfort heating, there would an increase in direct emissions of greenhouse gases, as well as nitrogen oxides and carbon dioxide.

As stated earlier, LLNL is in the process of inventorying its greenhouse gas emissions from stationary sources as well as from motor vehicles, portable engines, emergency standby generators, indirect sources (electricity), air travel, and other sources. Additionally, the reporting of sulfur hexafluoride emissions from research and switchgear would commence in calendar year 2011. LLNL is striving to reduce greenhouse emissions from all sources to support the federal reduction of greenhouse gas emissions.

Hazardous Air Pollutants

The levels of emissions of hazardous air pollutants are anticipated to continue at about the same levels, or lower, in future years. As more of the older buildings with regulated asbestos containing materials (RACM) are renovated or demolished, the number of asbestos projects would decrease. The locations and amounts of RACM are determined at the beginning of each demolition project. Samples of building materials are obtained and analyzed, and RACM is quantified prior to each air district notification. In some cases, hidden RACM is discovered during the demolition process, and a change notification is reported to the air district. In summary, it is expected that demolition and renovation projects at LLNL would continue to generate RACM waste, and the locations and amounts of RACM would be determined as such projects are carried out.

The amount of hazardous air pollutants in commercial products would also be reduced over time, as manufacturers continue to reformulate their products with lesser amounts of hazardous air pollutants.

3.4.4 Conclusion

Radioactive air emissions from stack releases or from diffuse sources would continue to be released in small quantities. Over the past five calendar years, facilities and areas with a potential for radioactive air releases to ambient air at both Livermore Site and Site 300 have operated at levels below the SWEIS projections. The doses in the SWEIS represent the individual and population doses evaluated at maximum operational estimated release levels of radionuclides to ambient air for the Livermore Site and Site 300, and represent conservative upper-bound estimates of the doses to members of the public. Radioactive air emissions from new and modified projects and modifications

in site operations, including projected increase in tritium air emissions from the NIF, represent only a slight variation to the individual and population doses, and would remain well below the NESHAPs site-wide standard for routine radiological airborne emission of 10 mrem/year dose to the Site-wide MEI (member of the public).

The major sources of regulated air pollutants would continue to be from combustion of natural gas for comfort heating and environment control, and fuel used for reciprocating engines, such as emergency standby generators. The consumption of natural gas is impacted by weather and the number of buildings in use, therefore some variation in emissions is expected. There are no significant increases anticipated in emissions of regulated pollutants from these types of sources. The emissions of nitrogen oxides and carbon monoxide would be near or above the 2005 SWEIS projections, but would remain within the BAAQMD enforceable permit conditions. If new buildings are constructed and heated with natural gas, the additional emissions would be offset by emissions reductions from HVAC improvement efforts and the Space Consolidation Initiative, which would shut down and demolish excess facilities.

In general, emissions of regulated air pollutants from other sources are declining, due to implementation of pollution prevention measures, including the increased use of products that are manufactured with less content of precursor organic compounds. The emissions of certain greenhouse gases, such as sulfur hexafluoride, are expected to decline, as new reporting and management requirements are implemented. Indirect emissions of greenhouse gases may increase proportional to any increases in electricity purchased from off site. LLNL would establish a baseline for greenhouse gas emissions, and would establish reductions strategies for implementation where practicable.

The emissions of hazardous air pollutants are anticipated to continue at about the same level, or lower, in future years. The ongoing space consolidation projects involving demolition and renovation of buildings would remove asbestos materials, and the number of these asbestos projects would decrease over time.

Because the emissions of regulated, hazardous, and radiological materials remain comparable with the analyses in the SWEIS and below regulatory thresholds, supplementation of the 2005 SWEIS for air quality is not needed.

3.5 Water

This section discusses changes in potential impacts on water from the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015. This section discusses projected impacts on surface water, groundwater, and floodplains. Water use (consumption) is discussed in Section 3.7.

3.5.1 The 2005 SWEIS Analysis

The affected environment discussion in the SWEIS includes a description of local surface water resources at the Livermore Site and Site 300, flow characteristics and relationships, and existing water quality. Water quality sampling results are published in the site annual environmental reports. These reports are available on the LLNL Environmental Community Relations website (https://www-envirinfo.llnl.gov/).

The Livermore Site's primary water source is the San Francisco Hetch-Hetchy Aqueduct System. The secondary or emergency water source is the Alameda County Flood and Water Conservation District Zone 7. The SWEIS projected that approximately 1.37 million gallons per day would be used at the Livermore Site, and that water use would be primarily for industrial cooling processes, sanitary systems, and irrigation (DOE 2005a).

Site 300's water is supplied with water from a system of wells. A project to connect Site 300 with water pumped from the city of San Francisco's Hetch-Hetchy water supply system was expected to be completed by early 2004; however, the project has recently been completed and became operational in late 2010. The new water system's capacity is estimated to be 648,000 gallons per day with the capability of expanding to 1.2 million gallons per day (DOE 2005a).

3.5.1.1 Livermore Site

Surface Water

Under the Proposed Action in the 2005 SWEIS, the area of impervious surfaces at the Livermore Site was projected to increase, primarily due to construction of new roads and buildings. In addition, an increase in surface runoff was projected to occur because of the increased impervious surface area. However, because Livermore Site soils are relatively permeable and abundant uncovered acreage remains for groundwater recharge, the impact of the reduction in recharge area was expected to be minimal (DOE 2005a).

Groundwater

The SWEIS identified that groundwater could be further degraded by contaminant release during construction. Because LLNL follows prevention and mitigation steps outlined in the spill response chapter of the *LLNL Environment, Safety, and Health*

Manual (ES&H Manual), and because the depth to groundwater at the Livermore Site is approximately 50 ft, spills were expected to be cleaned up before they reached the water table, therefore, impacts were not anticipated. No impacts to groundwater from leaking underground storage tanks were identified in the SWEIS because LLNL complies with all underground storage tank regulations which enforce the use of tank and piping primary and secondary containment, detection and monitoring systems, and corrosion protection (DOE 2005a).

Groundwater quality was projected to improve because of ongoing remediation at treatment facilities. No negative impacts to groundwater were expected from operations because LLNL does not discharge to groundwater. Impacts to groundwater quality from surface water recharge were also projected to be minimal because LLNL continues to comply with National Pollutant Discharge Elimination System (NPDES) requirements (DOE 2005a).

Floodplains

Because no activities identified in the SWEIS were expected to occur within the 100-year floodplain, other than the Arroyo Las Positas Maintenance Project, no impacts to the floodplain were expected (DOE 2005a).

3.5.1.2 Site 300

Surface Water

Under the Proposed Action in the SWEIS, developed space at Site 300 was projected to decrease, likely decreasing the area of impervious surfaces, thereby allowing for increased surface area for groundwater recharge. Because Site 300 is largely undeveloped and contains permeable soils, no negative impacts to groundwater recharge were expected (DOE 2005a).

Groundwater

Impacts to groundwater at Site 300 were expected to be the same as the Livermore Site.

Floodplains

No impacts to the floodplain were expected because no activities identified in the SWEIS occur within the 100-year floodplain. Due to the high infiltration rates and lack of appreciable floodplains at Site 300, hydrologic impacts from the Proposed Action were projected to be minimal, but because of the steep slopes, high run-off velocities within the channels could occur during a storm. However, because no facilities are located in these areas, the SWEIS did not project any impact from flooding (DOE 2005a).

3.5.2 Changes from 2005 to 2010

Surface Water

The SWEIS projected that several new roads and buildings would be constructed through 2014. The effect of these projects on water resources is related to impervious surfaces and runoff from buildings, roads, and their associated site drainage measures, as well as the use of potential contaminants resulting from construction and operation of projects. Many of the construction activities described in the SWEIS have since been completed increasing the area of impervious surfaces at the Livermore Site. These include a central cafeteria replacement, new office facilities, a BSL-3 laboratory, a truck inspection station, as well as the addition of several small modular office complexes.

Compliance with approved erosion and sedimentation control plans during construction prevented impacts to surface water from construction-induced erosion. In addition, the incorporation of several USGBC LEED principles was included in the design of several of the new office facilities including the use of permeable paving and bioswales (such as the ones used in Building 140 construction). In 2005, the Lab swimming pool was discovered to be leaking and it was subsequently emptied, removed, and backfilled. In 2006, LLNL collaborated with the California Department of Fish and Game (CDFG) to apply the pesticide rotenone to Lake Haussmann to eradicate invasive species. A multidisciplinary LLNL team worked together with the CDFG in the months preceding and after the application to thoroughly plan and ensure a successful, environmentally safe operation.

In December 2007, Congress enacted the Energy Independence and Security Act (EISA) (EPA2009). EISA Section 438, Technical Guidance on Implementing Stormwater Runoff Requirements for Federal Projects, established strict stormwater runoff requirements for development and redevelopment projects and requires all projects at federal facilities adding more than 5000 sf of new development or redevelopment to restore the pre-development hydrology to the maximum extent feasible. LLNL uses site planning, design, construction, and maintenance strategies to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow. This ensures that no adverse impacts to the site hydrology occur as a result of construction activities. The Construction Stormwater General Permit was reissued to LLNL in July 2010. This revised permit added additional requirements for construction activities at sites of one acre or more to protect stormwater quality. Construction SWPPPs are prepared for each individual project and follow all best management practices as required by the permit.

In 2009, LLNL installed the Water Conservation Test Bed Project, a 3.5-acre development at the Livermore Site with an automated landscape water management feature to transport rainwater collected from non-industrial rooftop to underground storage tanks for use in irrigation; the system design allows for future expansion to nearby sources. This system operates by capturing the rainwater leaders from the roof of

the Central Café and redirecting them to one of two wet wells. The water is then pumped into six buried fiberglass holding tanks and stored for future irrigation use. Since October 2009, the collection system has collected approximately 126,000 gallons of rainwater for irrigation use. In addition, irrigation systems with 'smart' water controllers have been installed at several Livermore Site buildings to reduce the amount of potable water needed for irrigation.

Storm water was sampled for constituents such as radioactivity, metals, oxygen, dioxins, polychlorinated biphenyls (PCBs), and nitrate both upstream and downstream from both the Livermore Site and Site 300. In 2009, no acute or chronic toxicity was seen in runoff, and data showed that the quality of Livermore Site storm water effluent was similar to that entering the site, or influent (LLNL 2010d).

Groundwater

Treated groundwater from LLNL's ERD groundwater pump-and-treat remediation system is also used to provide irrigation water. The treated water is pumped from ERD's Treatment Facility "D" adjacent to the Water Conservation Test Bed Project and is used to supplement rainwater for irrigation use. Since this project was implemented, approximately 86,000 gallons of treated groundwater has been added to the irrigation water holding tanks. A small amount of domestic potable water is added to the treated groundwater to lower the level of dissolved minerals before use for plant irrigation.

Groundwater from wells downgradient from the Livermore Site was analyzed for pesticides, herbicides, radioactivity, nitrates, and hexavalent chromium. Near Site 300, monitored constituents in off-site groundwater include explosives residue, nitrate, perchlorate, metals, volatile and semivolatile organic compounds, tritium, uranium, and other (gross alpha and beta) radioactivity. With the exception of volatile organic compounds (VOCs) in wells monitored for CERCLA compliance, the constituents of all off-site samples collected at both the Livermore Site and Site 300 were below allowable limits for drinking water (LLNL 2010d). LLNL has maintained compliance with all state and federal water regulations during the 2005-2010 period.

Since 2005, approximately 1.3 billion gallons of groundwater and approximately 260 million cubic feet of soil vapor have been extracted and treated at the Livermore Site, thus removing an estimated 840 kg of VOCs from the subsurface. The Eastern General Services Area groundwater remediate system at Site 300 was shut off in 2007 when the remediation goals were achieved. Since 2005, an estimated 6,321 kg of contaminants, including VOCs, perchlorate, nitrate, high explosives compounds, and uranium have been removed from the subsurface and treated at Site 300 remediation systems. VOC concentrations in Site 300 groundwater have been reduced from a historical maximum of 1,060,000 ug/L in 1993 to a maximum of 180,000 ug/L in 2010.

Floodplains

There were no changes e.g., earth disturbance or flooding, in the 100-year floodplain, other than the continuing Arroyo Las Positas Maintenance Project described in Section 3.3.2 at the Livermore Site.

3.5.3 Analysis of Projected Changes from 2010 to 2015

The new and modified projects and modifications in site operations listed in Table 1.1 that are likely to be implemented and may have an effect on surface or groundwater at LLNL through the year 2015 are listed in Chapter 3, Land Use (Table 3.1-3). The continued CERCLA activities at Site 300 and Livermore Site are projected to have a beneficial impact to the groundwater. New facility construction is not anticipated at Site 300 with the exception of new wells or treatment facilities; and therefore, no impact is anticipated.

New building construction at the Livermore Site as well as the areas disturbed for parking areas and roads necessary for access and circulation may have an impact on surface and groundwater resources because of the increase in impervious surfaces and possible runoff. When designing new facilities and their infrastructures such as parking lots, pathways, streets, and sidewalks, LLNL would follow the Green Infrastructure/Low Impact Development (GI/LID) approaches from the EISA Section 438 guidelines, to the maximum extent feasible. These guidelines provide management practices and technologies that utilize and/or mimic the natural hydrologic cycle process of infiltration, evapotransporation, and use. GI/LID practices could include green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, porous and permeable pavements, and vegetated median strips, where applicable. Other approaches may include the use of rain barrels and cisterns used to capture and reuse rainfall for watering plants or flushing toilets.

Beginning in 2010 and during the next five years, the site-wide Industrial Stormwater Permit would transition to a site-wide Municipal Stormwater "Phase II" Program. The current Industrial Storm Water Pollution Prevention Program would be replaced with a Municipal Stormwater Monitoring Program (SWMP), and facility specific SWPPPs based on Standard Industrial Codes would be used. LLNL would continue to follow prevention and mitigation steps outlined in the spill response chapter of the *ES&H Manual,* comply with NPDES requirements, follow SWPPP requirements, and the requirements of the EISA to protect site hydrology.

LLNL would maintain monitoring of wastewaters, storm water, and groundwater, as well as rainfall and local surface waters. Detailed descriptions of sampling locations, constituents present, analyses, and subsequent actions are published in the site annual environmental reports. As underground piping distribution systems for irrigation and

cooling water age, LLNL would continue to monitor for leaks and implement repairs (e.g. a 200,000 gal/yr low conductivity water (LCW) leak was discovered and repaired in 2008).

LLNL monitors two storm events per rainy season at the Livermore Site and at Site 300 for radioactive and nonradioactive constituents in accordance with a NPDES permit issued by the San Francisco Bay Regional Water Quality Control Board and State Water Resources Control Board, respectively. LLNL is also required to visually inspect the storm drainage system during one storm event per month in the wet season (defined as October through April for the Livermore Site and October through May for Site 300) to observe runoff quality, and twice during the dry season to identify any dry weather flows. Rainwater and surface water would also be sampled and analyzed for tritium activity in support of DOE Order 5400.5.

Groundwater monitoring would continue to be conducted by LLNL at the Livermore Site and Site 300 through networks of wells and springs that include off-site private wells and on-site wells to monitor for potential groundwater contamination from LLNL operations.

Floodplains

No impacts to the floodplain are expected from the new and modified projects and modifications in site operations because no activities would occur within the 100-year floodplain, other than the continuing Arroyo Las Positas Maintenance Project at the Livermore Site, or at Site 300.

3.5.4 Conclusion

The new and modified projects and modifications in site operations would not change the impact to water resources from those analyzed in the SWEIS. LLNL would continue to follow all applicable regulations and the GI/LID approaches from the EISA Section 438 guidelines for preventing impacts to surface and groundwater, to the maximum extent feasible. The proposed projects are consistent with the impacts analyzed in the SWEIS. Supplementation of the 2005 SWEIS for water resources is not needed.

3.6 Utilities and Energy

This section discusses changes in potential impacts on utility services and energy from the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015.

3.6.1 The 2005 SWEIS Analysis

The utilities and energy analysis in the SWEIS was based on projected square-footage requirements and available system capacities at the Laboratory. Data used for the impact assessments included proposed projects, rates of water, fuel, and electrical consumption, and wastewater discharge. The existing water supply was also evaluated to determine if sufficient quantities were available to support an increased demand by comparing projected increases with the capacity of the supplier (DOE 2005a).

The Livermore Site's primary water source is the San Francisco Hetch-Hetchy Aqueduct System. The secondary or emergency water source is the Alameda County Flood and Water Conservation District, Zone 7. The SWEIS projected that approximately 1.37 million gallons per day would be used at the Livermore Site, and that water use would be primarily for industrial cooling processes, sanitary systems, and irrigation (DOE 2005a).

Site 300's water is supplied with water from a system of wells. A project to connect Site 300 with water pumped from the city of San Francisco's Hetch-Hetchy water supply system was expected to be completed by early 2004; however, the project was recently completed and became operational in late 2010. The new water system's capacity was estimated to be 648,000 gallons per day with the capability of expanding to 1.2 million gallons per day (DOE 2005a).

The total facility space at the Livermore Site was projected to decrease by approximately 1 percent, and the total facility space at Site 300 was projected to remain the same. A cumulative reduction of LLNL's floorspace under the Proposed Action was expected to incrementally decrease LLNL's water consumption and sewage discharges. Additionally, because a number of facility and utility system upgrades have been implemented and with plans to continue similar energy-saving upgrades, LLNL's total utilities and energy uses were projected to decrease by 1 percent (DOE 2005a). The SWEIS projected fuel oil use for both the Livermore Site and Site 300; however, fuel oil is no longer used at either site. The SWEIS also projected Livermore Site and Site 300 electrical consumption separately; however, fiscal year reporting is reported as a total for both sites.

3.6.2 Changes from 2005 to 2010

The SWEIS projected that facility space at the Livermore Site would decrease due to the D&D of approximately 820,000 sf of excess facilities, but also projected new facility

construction of 370,000 sf. As discussed in Section 3.1, Land Use, 530,273 sf of excess facilities have been demolished, and 111,186 sf of new facilities have been constructed.

LLNL began consolidating activities and closing down or decommissioning excess facilities in order to reduce utility usage. This activity also accelerated the overall footprint reduction of the DOE/NNSA Complex identified in the NNSA *Complex Transformation SPEIS* (DOE 2008a). An Energy Savings Performance Contract was also initiated in 2008 to implement two energy conservation measures. The measures include the installation of new and expansion of the existing Building Management System to control the HVAC System efficiency through automation and implementation of off-hours setback controls. Some individual buildings that have been commissioned already have resulted in a 30% reduction in energy use. In addition, an advanced electric metering system will be installed in over 100 buildings to implement the requirements of the Energy Policy Act of 2005 and provide a tool for LLNL to monitor building performance and implement conservation efforts. Additional energy efficiency building audits have been conducted during 2010. This ongoing work has resulted in improved HVAC system performance and energy savings and will continue through 2011.

Another energy savings effort was initiated in 2007 at the LLNL TSF using a datacenter benchmarking tool developed at the Lawrence Berkeley National Laboratory. LLNL's continuing effort to conserve energy by raising the temperature and managing air flow in the TSF computer rooms is saving energy. The savings have come from a multitrack approach, including raising the temperature in the computer rooms and chilled water used to cool some machines, replacing leaky tiles on the computer floor, and finding efficiencies in the configuration of high-performance computing systems. New energy conservation initiatives are being explored, such as the use of "free cooling," using outside air and reducing chiller water supply, or allowing chillers to go on and off as needed.

LLNL has initiated the implementation of Section 432 of EISA, Mangement of Energy and Water Efficiency in Federal Buildings, which amended the National Energy Conservation Policy Act to add a new section titled "Use of Energy and Water Efficiency Measures in Federal Buildings (42 U.S.C. 8253(f))". The new subsection prescribes a framework for facility energy project management and benchmarking, including the following elements: 1) Identify "covered facilities" comprising at least 75 percent of energy consumption; 2) Designate "facility energy managers" for ensuring compliance of "covered facilities" subject to the requirements; 3) Perform comprehensive evaluations of all "covered facilities" over a four-year period to identify potential efficiency projects; 4) Implement identified projects and track energy savings of projects on a Web-based tracking system; and, 5) Benchmark facility energy performance.

Table 3.6-1 provides the actual utilities use for water, fuel, and electrical consumption, as well as wastewater generation for years 2005 through 2009.

Table 3.6-1 2005-2009 LLNL Utilities Consumption

Utility Consumption by Site	2005 SWEIS Projections	2005 Actual (FY)	2006 Actual (FY)	2007 Actual (FY)	2008 Actual (FY)	2009 Actual (FY)
Water Consumption						
Livermore Site	273 MG/year	240 MG/year	255 MG/year	274 MG/year	264 MG/year	257 MG/year
Site 300	67,900 gal/day	(Both sites)	(Both sites)	(Both sites)	(Both sites)	(Both sites)
Fuel Consumption						
Livermore Site (natural gas)	23,000 therms/day	13,539 therms/day	13,003 therms/day	13,595 therms/day	13,337 therms/day	12,067 therms/day
Livermore Site (fuel oil)	524,000 gal/year	0	0	0	0	0
Site 300 (fuel oil)	16,600 gal/year	0	0	0	0	0
Electricity Consumption						
Livermore Site	442 MkWh/yr	340 MkWh/yr	382 MkWh/yr	386 MkWh/yr	381 MkWh/yr	384 MkWh/yr
Site 300	16.3 MkWh/yr	16 MkWh/yr	15 MkWh/yr	15 MkWh/yr	14 MkWh/yr	13 MkWh/yr
Wastewater Discharge						
Livermore Site only (includes SNL)	330,000 g/day	286,300 g/day	274,500 g/day	292,300 g/day	252,800 g/day	238,300 g/day

LLNL 2010a

To attain DOE goals identified by DOE Order 430.2B, *Departmental Energy, Renewable Energy and Transportation Management,* LLNL has actively pursued conservation goals. The *2009 DOE 430.2B Executable Plan Update* (LLNL 2009a) reports that LLNL has:

1) Achieved an energy use intensity reduction from FY 2003 levels of 12.72%, exceeding the cumulative four-year goal of 12.0%. Several initiatives contributed to the energy reduction. Some savings measures implemented, in part or in whole, included consolidating servers to reduce the number of servers and server rooms, lighting retrofits with energy efficient lighting, increasing the set points of 126 chillers, shutting down boilers in seven buildings during the non-heating season, and raising employee awareness of energy saving measures.

2) Achieved a water use reduction of 5.2% at the Livermore Site from FY 2007 levels, exceeding the cumulative two-year goal of 4%. Initiatives contributing to this reduction included shutting down facilities, increasing the use of drought-resistant plantings, xeriscaping, native landscaping, and use of reclaimed water for irrigation. LLNL has also reduced cooling tower blowdown thereby saving make-up city water, developed and installed a Water Conservation Test Bed Project to harvest rainwater for irrigation, and raised employee awareness.

3) Achieved USGBC LEED certification for three buildings under the Existing Building rating system (Building 264-Certified, Building 142-Silver, and Building 453-Gold).

4) Met and exceeded the required 10% increase by an additional 10.4% increase in alternative fuel consumption primarily by using ethanol E85 as the alternative fuel of choice, and by exchanging eligible unleaded vehicles with ethanol E85 alternative fuel vehicles (AFVs).

5) Met and exceeded the required 2% decrease by an additional 58% decrease in petroleum fuel consumption following its fossil fuel reduction strategy by replacement of fossil fuel vehicles with AFVs, reduction of miles driven, rightsizing the fleet, use of mass transportation, and establishing vehicle preventive maintenance.

6) In FY 2009, LLNL met and exceeded the required 75% replacement of fossil fuel vehicles with AFVs. Fifty-seven vehicles were replaced with AFVs (E85). At the end of FY 2009, 77.3% of LLNL's total light duty vehicle fleet were AFVs.

In 2009, LLNL installed the Water Conservation Test Bed Project, a 3.5-acre development at the Livermore Site with an automated landscape water management feature to transport rainwater collected from a non-industrial rooftop to underground storage tanks for use in irrigation; the system design allows for future expansion to nearby sources. This system operates by capturing the rainwater leaders from the roof of the Central Café and redirecting them to one of two wet wells. The water is then pumped into six buried fiberglass-holding tanks and stored for future irrigation use. Since October 2009, the collection system has collected approximately 126,000 gallons of rainwater for irrigation use. In addition, irrigation systems with 'smart' water controllers have been installed at several Livermore Site buildings to reduce the amount of potable water needed for irrigation.

Treated groundwater from LLNL's ERD groundwater pump-and-treat remediation system is also used to provide irrigation water. The treated water is pumped from ERD's Treatment Facility "D" adjacent to the Water Conservation Test Bed Project and is used to supplement rainwater for irrigation use. Since this project was implemented, approximately 86,000 gallons of treated groundwater has been added to the irrigation

water holding tanks. A small amount of domestic potable water is added to the treated groundwater to lower the level of dissolved minerals before use for plant irrigation.

3.6.3 Analysis of Projected Changes from 2010 to 2015

There are several new and modified projects and modifications in site operations listed in Table 1.1 that are likely to be implemented and may have an effect on utilities and energy use at LLNL through the year 2015. New facility construction is expected to add approximately 259,000 sf at the Livermore Site, and as such, additional utility and electrical energy would be required. Listed below are several new construction projects and modified projects and modifications in site operations at the Livermore Site with their accompanying utility use projections. Table 3.6-2 provides a comparison of these projects along with the 2005 SWEIS utility projections. New construction is not anticipated at Site 300, and therefore, no increase in utility use is expected.

- Applied Energy Simulation Center. This 300-office, 132,000 sf high-performance computational facility is expected to use approximately 65.7 million kilowatt-hours per year (MkWh) of electricity per year, 48,500 therms per year of natural gas, 17.5 million gallons of water per year using either two cooling towers or access to the site-wide LCW loop, and generate 1.8 million gallons per year of wastewater.
- High-Energy Density Science Center. This 80-office, 42,000 sf laboratory facility is expected to use approximately 0.8 MkWh of electricity per year, 15,400 therms per year of natural gas, 0.3 million gallons of water per year, and generate 0.2 million gallons per year of waste water.
- Commons/Visitor/Collaboration Center. This facility would be approximately 25,000 sf and include offices and a cafeteria. Electrical use is expected to be 0.5 MkWh per year, 9,200 therms per year of natural gas, water use at 0.6 million gallons per year, and 0.4 million gallons per year of wastewater.
- The MegaRay LINAC is expected to expand to 750 MeV. However, no additional electrical capacity would be needed, and only a small incremental increase in electrical use during experiments is projected.
- The Space Consolidation Initiative would reduce the amount of utilities used and electricity consumed and is directly related to LLNL continuing D&D of facilities as outlined in the 2005 SWEIS and the 2008 *Complex Transformation SPEIS*. Approximately 222,000 sf of facilities have been identified for D&D through 2015 (LLNL 2010c). This would save approximately 7.5 MkWh per year and 81,600 therms per year of natural gas.
- Three additional 100-person office facilities of 20,000 sf each. These facilities would use approximately 1.2 MkWh of electricity per year, 22,000 therms per year of natural gas, and 1.0 million gallons of water per year, and generate 0.6 million gallons per year of wastewater.

Table 3.6-2 SWEIS Projections Compared to Proposed New and Modified Projects at Livermore Site

	SWEIS Projection	2009	Currently Planned and New and Modified Projects	Current Projections
New Facilities	370,000 sf	111,186 sf	259,000 sf	370,000 sf
Decon & Demo	820,000 sf	530,273 sf	222,000 sf	750,000 sf
Water Consumption	273 MG/yr	257 MG/yr	20 MG/yr (includes 17.5 MG/yr for cooling towers)	277 MG/yr
Electrical Use	442 MkWh/yr	384 MkWh/yr	61 MkWh/yr	447 MkWh/yr
Wastewater Discharge	330,000 g/day	238,300 g/day	17,000 g/day	255,000 g/day
Natural Gas Use	23,000 therms/day	12,067 therms/day	37 therms/day	12,104 therms/day

LLNL is committed to providing responsible stewardship of environmental resources and has integrated environmental stewardship into planning and decision-making processes. Pathways for full goal attainment have been identified in the following areas: energy intensity, water conservation, renewable energy, fleet, high-performance sustainable buildings, metering, and energy management. Among the most notable plans are to:

- Continue employee resource conservation awareness
- Develop renewable energy projects
- Review operations of cooling and heating systems and implement facility setback controls during off hours
- Develop additional water collection and re-use projects to provide alternative sources for irrigation (one water conservation test-bed project completed and additional projects are in planning phase)
- Assess and identify existing turf areas for conversion to drought tolerant plantings including xeriscaping
- Develop and deploy a fuel cell generating station
- Right-size the government vehicle fleet
- Provide on-site mass transportation (shuttle services)
- Restructure the AFV fleet e.g. E85, electric, hybrid, and hydrogen-powered vehicles

- Meet the Leadership in Energy and Environmental Design (LEED) Gold Standard for all new buildings and major renovations (by the close of FY 2011 LLNL will have certified or submitted 376,245 sf for LEED certification), and
- Continue advanced metering goals for electricity, natural gas, and water.

When designing new facilities and their infrastructures such as parking lots, pathways, streets, and sidewalks, LLNL would follow, to the maximum extent technically feasible, the GI/LID approaches from the EISA Section 438 guidelines. These guidelines provide management practices and technologies that utilize and/or mimic the natural hydrologic cycle process of infiltration, evapotransporation, and use. GI/LID practices could include green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, porous and permeable pavements, and vegetated median strips, where applicable. Other approaches may include the use of rain barrels and cisterns used to capture and reuse rainfall for watering plants or flushing toilets.

LLNL would also continue to develop and design projects similar to the Water Conservation Test Bed, continue using treated groundwater from ERD pump and treat activities, and would evaluate plans for a small wastewater treatment facility that may provide water for irrigation. Using these strategies discussed in this section, LLNL plans to eventually eliminate the use of potable water for on-site landscape irrigation in the future.

As described in Section 3.5, the Livermore Site's primary water source is the San Francisco Hetch-Hetchy Aqueduct System and the secondary or emergency water source is the Alameda County flood and Water conservation District, Zone 7. Hetch-Hetchy water will be unavailable due to maintenance for two months per year for the next several years resulting in increased make-up water use at the cooling towers because Zone 7 water has less desirable water attributes such as hardness and total dissolved solids (LLNL 2009a). Therefore, potable water consumption may increase incrementally as new facilities are occupied and during the months Hetch-Hetchy water is not available.

Prior to the 2009-2010 rainy season, California was in its third straight year of drought and the Governor requested a voluntary 20% water savings. LLNL is striving to comply with this request as well as with DOE Order 430.2B by continuing to develop plans for pilot landscape projects, using alternative landscaping approaches, and evaluating plans for a small wastewater treatment facility that would provide water for irrigation uses at the Livermore Site. Nevertheless, the Livermore Site domestic water system capacity is approximately 2.88 million gallons per day and has adequate capacity to meet future water demands, and impacts related to system capacity would be minimal.

By the end of 2010, Site 300's water would also be supplied by Hetch-Hetchy's water supply system. The system has an estimated capacity of 450,000 gallons per day. Site 300's water consumption was projected at 67,900 gallons per day in the SWEIS (DOE

2005a). Current use is approximately 49,000 gallons per day which does not exceed the SWEIS projection or the capacity of the system.

Wastewater generation at the Livermore Site would incrementally increase as new facilities are constructed and occupied. However, the capacity at the Livermore Water Reclamation Plant (LWRP) is 8.5 million gallons per day and is sufficient for proposed new inflows from LLNL.

The SWEIS projected that Site 300 would discharge 2,100 gallons per day to an asphalt membrane-lined oxidation pond east of the General Services Area (DOE 2005a). The projection was based on a stable workforce of 300. Because the workforce is now at approximately 100 employees, and no new facility construction is anticipated, wastewater discharges would not exceed the SWEIS projections.

Electrical use at the Livermore Site was projected in the SWEIS at approximately 442 million kilowatt-hours per year (MkWh/yr) including the added loads consumed by the NIF and the Terascale Simulation Facility. In 2009, the Livermore Site consumed 386 MkWh/yr. Electrical use is anticipated to incrementally increase as new facility construction is completed and occupied and, by 2015, slightly exceed the SWEIS projections (Table 3.6-2). The LLNL distribution system and existing capacity for the utilities to supply energy would adequately meet the projected increases in consumption, but as also mentioned in the SWEIS, the capacity and supply may limit future development at the site. LLNL will continue to promote energy efficiency and conservation efforts to reduce the demand.

Site 300 electrical use in 2009 was 13 MkWh/yr, approximately 3 MkWh/yr less than projected in the SWEIS. It is anticipated that electricity consumption at Site 300 would remain stable for the years 2010 through 2015.

The SWEIS stated that, based on the projected increase in gross square footage of developed space at the Livermore Site, fuel (natural gas) consumption would decrease by 1.0 percent to approximately 23,000 therms per day. As shown in Table 3.6-1, in 2009 the Livermore Site consumed 12,067 therms per day. Natural gas use is anticipated to incrementally increase as new facility construction is completed and occupied; however, it is not expected to exceed the SWEIS projection. Site 300 does not use natural gas.

3.6.4 Conclusion

The new and modified projects and modifications in site operations analyzed in this SA include new office and research facilities. Electrical use, water consumption, and potentially wastewater discharges could approach or slightly exceed SWEIS projections. However, the impacts of the projected facilities and infrastructure are consistent with the impacts analyzed in the SWEIS. Supplementation of the 2005 SWEIS for utilities and energy is not needed.

3.7 Materials and Waste Management

This section discusses changes in potential impacts on materials and waste management from the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015.

3.7.1 The 2005 SWEIS Analysis

Materials Management

LLNL uses hazardous and radioactive materials in a wide variety of operations and scientific and weapons research and development (R&D) activities, including diagnostic research, chemistry operations, forensics analysis, and research on properties of materials, among others. The SWEIS stated that implementation of the Proposed Action would not cause any major changes in the types of materials used on site. Material usage at LLNL would increase consistent with increase in laboratory operations, but the material increase would not exceed existing material management requirements (DOE 2005a).

Waste Management

The SWEIS stated that implementation of the Proposed Action would not cause any major changes in the types of waste streams generated on site. The SWEIS projected an increase in waste generation rates for both routine and non-routine wastes. Routine waste is generated from the normal operations of LLNL; while non-routine waste is generated from construction, D&D, and environmental restoration activities. Waste minimization and pollution prevention techniques were projected to offset a portion of the increases. The waste generation projections were not expected to exceed existing waste management capacities; therefore, no additional waste storage, treatment, handling capacity, regulatory requirements, or security requirements were projected to be needed.

The SWEIS waste generation projections for both routine and non-routine wastes are presented in Table 3.7-1.

Table 3.7-1 Routine and Non-Routine Operations Waste Generation Projections in the SWEIS[1]

Waste Type	Routine	Non-Routine
Low-level Waste (LLW)	330 m^3/yr	710 m^3/yr
Mixed LLW	88 m^3/yr	81 m^3/yr
Total Hazardous Waste[2]	510 metric tons/yr	1700 metric tons/yr
Transuranic (TRU) Waste	50 m^3/yr	60 m^3/yr
Mixed TRU waste	2.8 m^3/yr	0
Sanitary solid Waste	5100 metric tons/yr	Included in Routine
Wastewater	330,000 gal/day	Included in Routine

[1] DOE 2005a
[2] Total hazardous waste includes RCRA Hazardous, State-Regulated, and Toxic Substances Control Act (TSCA) wastes

3.7.2 Changes from 2005 to 2010

Materials Management

Hazardous and radioactive material usage has been consistent with the SWEIS projections. Since 2006, LLNL has been pursuing a De-Inventory Project that has been significantly reducing the amount of SNM in long-term storage onsite and transferring Security Category I/II SNM from LLNL to receiver sites. This project was described in the DOE/NNSA *Complex Transformation SPEIS* (DOE 2008a).

Waste Management

Tables 3.7-2 through 3.7-7 show the SWEIS annual waste projections and the total wastes generated through 2009. The increase of sanitary solid waste in 2007 was due to several cleanup and large decommissioning projects at the Livermore Site such as the partial demolition of Building 431. Discussion on wastewater discharges is presented in Section 3.6.

Beginning in fiscal year 2009, a new volumetric calculation and reporting method was initiated for transuranic and radioactive wastes. Because of this change, a comparison between fiscal year 2009 and past years' data would not accurately reflect actual changes in generated volume. However, since 2009 the reporting method tracks more closely with projected volumes in the SWEIS.

Table 3.7-2 Hazardous Waste (HW) Generation

	Routine	Non-Routine
SWEIS Projection[1]	510 metric tons/yr	1700 metric tons/yr
2005[2]	127 metric tons	414 metric tons
2006[2]	153 metric tons	688 metric tons
2007[2]	138 metric tons	159 metric tons
2008[2]	248 metric tons	385 metric tons
2009[2]	159 metric tons	175 metric tons

[1] DOE 2005a, [2] DOE 2010a

Table 3.7-3 Radioactive Low-Level Waste (LLW) Generation

	Routine	Non-Routine
SWEIS Projection[1]	330 m^3/yr	710 m^3
2005[2]	54 m^3	424 m^3
2006[2]	66 m^3	443 m^3
2007[2]	197 m^3	126 m^3
2008[2]	77 m^3	87 m^3
2009[2]	203 m^3	168 m^3

[1] DOE 2005a, [2] DOE 2010a

Table 3.7-4 Radioactive Mixed Low-Level Radioactive Waste (MLLW) Generation

	Routine	Non-Routine
SWEIS Projection[1]	88 m^3/yr	81 m^3/yr
2005[2]	16 m^3	23 m^3
2006[2]	18 m^3	17 m^3
2007[2]	30 m^3	32 m^3
2008[2]	17 m^3	6 m^3
2009[2]	25 m^3	11 m^3

[1] DOE 2005a, [2] DOE 2010a

Table 3.7-5 Radioactive Transuranic (TRU) Waste Generation

	Routine	Non-Routine
SWEIS Projection[1]	50 m^3/yr	60 m^3/yr
2005[2]	0 m^3	4 m^3
2006[2]	0 m^3	0 m^3
2007[2]	2 m^3	0 m^3
2008[2]	3 m^3	0 m^3
2009[2]	8 m^3	3 m^3

[1] DOE 2005a, [2] DOE 2010a

Table 3.7-6 Radioactive Mixed Transuranic Radioactive (MTRU) Waste Generation

	Routine	Non-Routine
SWEIS Projection[1]	2.8 m^3/yr	0 m^3/yr
2005[2]	1 m^3	4 m^3
2006[2]	1 m^3	0 m^3
2007[2]	1 m^3	0 m^3
2008[2]	1 m^3	0 m^3
2009[2]	1 m^3	0 m^3

[1] DOE 2005a, [2] DOE 2010a

Table 3.7-7 Sanitary Solid Waste Generation

	Routine
SWEIS Projection[1]	5,100 metric tons/yr
2005[2]	2,905 metric tons
2006[2]	3,174 metric tons
2007[2]	12,754 metric tons
2008[2]	1,891 metric tons
2009[2]	3,766 metric tons

[1] DOE 2005a, [2] DOE 2010a

3.7.3 Analysis of Projected Changes from 2010 to 2015

Many of the new and modified projects and operational modifications listed in Table 1.1 could impact material and waste management activities at LLNL. Their potential collective and individual impacts are discussed in the next sections.

Materials Management

LLNL would continue usage of hazardous and radioactive materials consistent with the SWEIS projections. The ongoing De-Inventory Project would decrease the amount of SNM in long-term storage onsite and continue the transfer of Security Category I/II SNM from LLNL to receiver sites through the end of 2012. Proposed materials use at the Contained Firing Facility at Site 300 would include additional hazardous and radioactive compounds very similar to materials and quantities already used in ongoing programs.

Since the 2005 SWEIS, the NIF has become operational and personnel and environmental protection systems have been installed, qualified, and operated. As discussed in Section 3.4.3, it is desirable from a waste and worker safety perspective to utilize the NIF Tritium Processing System molecular sieve beds for capturing tritium in concentrated streams. However at the same time, this capture of concentrated streams rapidly loads the molecular sieves with tritium, requiring them to be changed out prior to full capture capacity due to the current maximum tritium inventory limits. NIF would change its maximum tritium inventory from 0.05 g (500 Ci) to 0.8 g (8,000 Ci), which would remain well within the radiological classification of the facility, yet allow for less frequent molecular sieve bed change-outs minimizing radioactive waste volume and lowering worker exposures.

Sources of beryllium contamination in the NIF include ablated target capsules and diagnostic windows. Since the 2005 SWEIS, the strategy for NIF Target Chamber cleanup options has been evaluated and the preferred option is to retain the first wall panels, which capture most of the particulate contamination, in place; as opposed to decontamination or replacement and disposal. This operational change would warrant changing the NIF maximum beryllium inventory from 20 g to 1 kg. The increase in the amount of beryllium inventory will allow the first wall panels to remain in place for an extended period of time, possibly for the lifetime of the facility; thereby, avoiding unnecessary worker exposure and an increase in waste generation that would occur if these panels needed to be removed sooner. Controls in the NIF workplace to manage beryllium include the establishment of beryllium work areas, use of negative ventilation, area draping, use of personnel protective equipment, and monitoring.

The High-Energy Density Science Center would use materials (including nano-materials), chemicals (solvents), or equipment similar to existing construction and office/laboratory operations. Other new facilities would use building materials and operational equipment similar to existing LLNL facilities.

Waste Management

Most of the waste generation rates are not projected to increase significantly for the 2010 to 2015 time period. Tables 3.7-8 through 3.7-11 show the projected rates for 2010 to 2015 as compared to the SWEIS projections. Fluctuations within the annual generation rates for the various waste types are anticipated, but it is projected that average generation rates for most waste types would remain within the SWEIS projections. The

exception is routine radioactive LLW, which is projected to increase above the SWEIS projections. The projected increase is largely attributed to the increased need for NIF & PS and WCI Directorate personnel to work in radioactive management areas, thereby generating increased LLW comprised mostly of wipe cleaning waste as well as personal protective equipment (PPE) such as coveralls, gloves, and booties. The increase in routine LLW above that anticipated in the 2005 SWEIS is based upon operational experience with contamination control rooms and tritium processing areas in which repeated worker access occurs on a daily basis requiring several changes of coveralls, booties, and gloves. LLNL continues to actively pursue alternatives that, if suitable and cost-effective, could reduce the amount of radioactive-material-contaminated PPE waste. Temporary increases in non-routine LLW and non-routine MLLW are also expected in 2010 and 2011 due to decontamination and decommissioning activities. Projections for wastewater discharges are discussed in Section 3.6.

Hazardous waste generation rates are projected to remain within the SWEIS projections for routine and non-routine wastes over the next five years. Table 3.7-8 shows the routine and non-routine hazardous waste projections as compared to the SWEIS projections.

Table 3.7-8 Hazardous Waste Generation[1]

	Routine	Non-Routine
SWEIS Projection[2]	510 metric tons/yr	1700 metric tons/yr
Projected for 2010 - 2015	510 metric tons/yr	1700 metric tons/yr

[1] Hazardous waste includes RCRA hazardous, State-regulated, and TSCA wastes.
[2] DOE 2005a

LLW generation rates are projected to increase for both routine and non-routine activities. LLNL generated 1,012 cubic meters of non-routine LLW in FY 2010, largely attributed (over 80%) to the Building 321C decontamination efforts and removal of contaminated equipment from Building 491. In FY 2011 it is expected that approximately 1800 cubic meters of non-routine LLW would be generated due mainly to facility decontamination and decommissioning (D&D) of Building 419, ongoing decontamination activities in Buildings 321C and 391, and continuation of the Grinder Project for tritium dials in Building 331. The remaining volume for FY 2011 would be the rest of the laboratory-projected non-routine LLW generated at the same rate as the FY 2010 volumes. The FY 2011 estimates for non-routine LLW do not include any other "non-routine" projects that could potentially be funded during the fiscal year. The above-mentioned projects are scheduled to end in FY 2011, and generation rates in following years are expected to return to below the volumes projected in the SWEIS (i.e., below 710 m^3 per year) (LLNL 2010k). Chapter 3.1, Land Use, Section 3.1.2 provides projections for decontamination and decommissioning activities from 2005 to 2010.

Variation in the volumes for non-routine LLW is consistent with the nature of these "non-routine" projects as they are most often driven by availability of funding and resources. Projected volumes of non-routine LLW would not exceed existing waste management capacities; therefore, no additional waste storage, treatment, handling capacity, or security requirements would be needed.

For routine operations, LLNL generated 312 cubic meters of LLW in FY 2010, which is below the SWEIS projection of 330 cubic meters per year. However, beginning in FY 2011, the routine LLW generation rates are projected to increase to approximately 850 cubic meters per year. Operations at NIF and Photon Sciences (PS) and Weapons and Complex Integration (WCI) Principal Directorate facilities would generate almost 90% of the projected routine LLW. Routine LLW volumes generated by the rest of the Laboratory are projected to remain at the same quantity as reported for FY 2010. A large portion of the routine LLW that LLNL anticipates generating is composed of wipe cleaning waste as well as personal protective equipment (PPE) such as coveralls, gloves, and booties. LLNL is actively exploring alternatives that, if suitable and cost-effective, could reduce the amount of radioactive-material-contaminated PPE waste.

The projections for routine and non-routine radioactive LLW and MLLW are shown in Table 3.7-9. The anticipated increases in LLW generation rates are not expected to exceed existing waste management capacities; therefore, no additional waste storage, treatment, handling capacity, regulatory requirements, or security requirements are projected to be needed.

Increase in LLW volumes would require an increase in number of shipments to disposal sites and potential radiation exposure to workers. The number of shipments required for projected routine and non-routine LLW generation rates, however, would remain within the 2005 SWEIS projections of 80 shipments per year for LLW transportation. For example, in FY 2010, LLNL shipped 850 cubic meters of LLW in 27 shipments. Between FY 2011 and FY 2015, the largest quantity of LLW to be shipped would be in FY 2011 when approximately 2,650 cubic meters (routine [850 cubic meters] and non-routine LLW [1,800 cubic meters], including LLW from Building 419 demolition) could be shipped, requiring approximately 80 shipments. This would remain consistent with the 2005 SWEIS estimate of 80 shipments per year.

There were no significant changes to worker health and safety impacts from the increased non-routine LLW generation rates from D&D projects. For example, the decontamination workers in Building 321 received zero radiation dose to the whole body or skin in FY 2010. All workers follow LLNL's Integrated Safety Management System (ISMS) guidelines and DOE's as-low-as-reasonably-achievable (ALARA) principles.

In FY 2011, Building 419 decontamination activities, as well as the demolition of the structure and removal of contaminated soil and concrete slab, is expected to temporarily increase the generation of non-routine MLLW. It is expected that approximately 2,000

cubic meters of non-routine MLLW would be generated from these activities. The actual volumes however would depend on sampling and characterization of the waste stream. This temporary one-year increase would exceed the 2005 SWEIS projection for non-routine MLLW of 81 cubic meters per year, but would fall back to within the 81 cubic meter projection in FY 2012 to FY 2015 period.

All MLLW from the Building 419 decommissioning activities would be sent to Energy Solutions of Utah for final disposition. It is expected that in FY 2011 approximately 45 MLLW shipments and approximately 140 intermodals for rail transport would be needed for the projected generation volumes. Up to eight intermodals could be placed in one railcar shipment; therefore, 140 intermodals would require approximately 20 railcar shipments. In FY 2010, LLNL made only 3 MLLW shipments, and considering the FY 2012 to FY 2015 projections and historic generation rates, it is projected that the average number of shipments for the FY 2012 to 2015 period would not exceed the 2005 SWEIS projected 16 MLLW shipments per year to Utah under the Proposed Action.

Table 3.7-9 Radioactive Waste Generation – LLW and MLLW

	Routine	Non-Routine
LLW SWEIS Projections	330 m^3/yr	710 m^3/yr[1]
Projected for 2010 – 2015[2]	850 m^3/yr	710 m^3/yr
MLLW SWEIS projections	88 m^3/yr	81 m^3/yr[1]
Projected for 2010 – 2015	88 m^3/yr	81 m^3/yr

[1] Temporary increases in non-routine LLW and MLLW volumes are projected as a result of B419, B391, B491, and B321 D&D activities. These volumes are expected to return to within the SWEIS projections at the completion of these projects.
[2] In FY 2010, 1,012 cubic meters of non-routine LLW were generated. In FY 2011 it is estimated 1,800 cubic meters would be generated. However, in FY 2012 to 2015 non-routine LLW amounts would be below the SWEIS values of 710 m^3/yr.

Routine and non-routine TRU waste generation rates are projected to increase above the actual generation rates shown for 2005 to 2009 in Table 3.7-5, but would remain within the SWEIS projections. The projected increases are a result of processing activities related to the De-Inventory Project, the decontamination and removal of legacy workstations in Building 332, and the size reduction and repackaging of oversize TRU waste boxes. Small quantities of non-routine MTRU waste could also be generated from decontamination of legacy workstations and repackaging of oversize waste boxes. Generation rates of routine TRU wastes are expected to decrease after the completion of the De-Inventory Project. The decrease in routine waste generation would most likely be offset by an increase in non-routine waste generated from the decommissioning of legacy workstations. However, the generation rates of non-routine and routine TRU waste are projected to remain within the volumes projected in the SWEIS. The projections for radioactive TRU and MTRU are shown in Table 3.7-10.

Table 3.7-10 Radioactive Waste Generation – TRU and MTRU

	Routine	Non-Routine
TRU SWEIS Projections[1]	50 m^3/yr	60 m^3/yr
Projected for 2010 - 2015	50 m^3/yr	60 m^3/yr
MTRU SWEIS Projections[1]	2.8 m^3/yr	0 m^3/yr
Projected for 2010 – 2015[2]	2.8 m^3/yr	0 m^3/yr

[1] DOE 2005a
[2] Small quantities of non-routine MTRU waste could be generated from decontamination and repackaging activities.

Sanitary solid waste generation rates are projected to remain within the SWEIS projections. While large demolition projects, such as the partial demolition of Building 431, resulted in elevated generation rates for 2007, the average annual generation rates were within the volumes projected in the 2005 SWEIS. The projections for sanitary solid waste are shown in Table 3.7-11.

Table 3.7-11 Sanitary Solid Waste Generation

	Routine	Non-Routine
SWEIS Projection[1]	5,100 metric tons/yr	Included in Routine
Projected for 2010 - 2015	5,100 metric tons/yr	Included in Routine

[1] DOE 2005a

Wastewater generation at the Livermore Site would incrementally increase as new facilities are constructed and occupied (see Section 3.6 for discussion on wastewater projections).

3.7.4 Conclusion

LLNL would continue usage of hazardous and radioactive materials consistent with the SWEIS projections. The ongoing De-Inventory Project would decrease the amount of SNM in long-term storage onsite and continue the transfer of Security Category I/II SNM from LLNL to receiver sites through the end of 2012. The proposed new and modified projects and modifications in site operations would increase usage of certain hazardous and radioactive materials; however, this increase would not be a significant change from current and historical usage of such materials. None of the increases would warrant changing the hazard classification of the facilities. Supplementation of the 2005 SWEIS for materials management is not needed.

Most waste generation rates are not projected to increase significantly for the 2010 to 2015 time period. Fluctuations within the annual generation rates for the various waste types are anticipated, but for most waste types, generation rate projections would remain

within the SWEIS projections. The exception is routine LLW, which is projected to increase primarily due to operations at NIF & PS and WCI Principal Directorate facilities. Temporary increases in non-routine LLW and non-routine MLLW are projected due to the decontamination and decommissioning activities occurring in B419, B391 and B321C. Small quantities of non-routine MTRU could also be generated from decontamination and repackaging activities. At the completion of these projects, generation rates are projected to then return to the volumes projected in the SWEIS. The anticipated increases in LLW, MLLW, and MTRU waste are not expected to exceed existing waste management capacities; therefore, no additional waste storage, treatment, handling capacity, regulatory requirements, or security requirements were projected to be needed. Supplementation of the 2005 SWEIS for waste management is not needed.

3.8 Human Health and Safety

This section discusses changes in potential impacts on human health and safety from proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015.

3.8.1 The 2005 SWEIS Analysis

The human health and safety section of the SWEIS described both radiological and non-radiological health impacts. For non-radiological health impacts it projected that new buildings and building additions would increase LLNL's usage of hazardous material over the next 10 years. It also stated that this increase in hazardous material usage would not cause any major changes in the types of occupational, toxic, or physical hazards encountered by site personnel. Facility improvements and additions would improve control measures for handling hazardous chemicals and controlling physical hazards. Worker exposure to hazardous chemicals would be minimized by the use of improved facilities for handling toxic chemicals and controlling physical hazards. Continued application of site environmental, safety, and health (ES&H) programs and ISMS principles would result in minimizing impacts to workers and the public (DOE 2005a).

For radiological health impacts the SWEIS predicted that involved workers would be exposed to low-levels of radiation in the performance of their jobs, while non-involved workers and the public would be exposed to radioactive air emissions. The projected occupational (involved) worker dose from ionizing radiation would be approximately 93 person-rem/year. This would result in an increase of 0.055 latent cancer fatalities (LCFs) per year. For non-involved workers, the radiation dose would be approximately 0.14 person-rem/year. This would result in an increase of approximately 8.4×10^{-5} LCFs per year (DOE 2005a). Radiation exposure to workers is kept ALARA through facility and equipment design and administrative controls (DOE 2005a).

The SWEIS also predicted that radiological health impacts to the general public would result from radiation dose from atmospheric emissions (Section 3.4, Air Quality), and from neutrons produced during NIF yield operations and scattering off of the atmosphere (skyshine). The dose to the site-wide maximally exposed individual (Site-wide MEI) member of the public from LLNL Livermore Site would be 0.33 mrem/year (0.13 mrem/year from air emissions and 0.2 mrem/year from skyshine) (2.0×10^{-7} LCFs per year). The population dose from Livermore Site would be 1.8 person-rem/year (1.1×10^{-3} LCFs per year). For Site 300, the MEI dose would be 0.055 mrem/year (3.3×10^{-8} LCFs per year), and the population dose would be 9.8 person-rem/year (5.9×10^{-3} LCFs per year) (DOE 2005a).

3.8.2 Changes from 2005 to 2010

Working conditions at LLNL have remained essentially the same as those identified in the SWEIS, and more than half of the workforce remains routinely engaged in

activities that are typical of office and computing industries. Much of the remainder of the workforce is engaged in light industrial and bench-scale research activities. Existing ES&H programs and ISMS principles continued to address worker and general population protection measures implemented to control, reduce, or eliminate operational hazards.

Doses to workers during the calendar years 2003 through 2009 are listed in Table 3.8-1. They range from 9.31 person-rem (5.6×10^{-3} LCFs) in 2005 to 26.16 person-rem (1.6×10^{-2} LCFs) in 2009. The slight increase in worker population doses from 2005 to 2009 are attributed to the ongoing De-inventory Project and waste management activities. However, the values remain well below the SWEIS projection of 93 person-rem/year.

Table 3.8-1 Doses to Worker Population at LLNL

	SWEIS Projection (person-rem)	2005 (person-rem)	2006 (person-rem)	2007 (person-rem)	2008 (person-rem)	2009 (person-rem)
Involved Worker Population Dose	93 (5.5×10^{-2} LCFs)	9.31 (5.6×10^{-3} LCFs)	15.75 (9.5×10^{-3} LCFs)	15.87 (9.5×10^{-3} LCFs)	20.55 (1.2×10^{-2} LCFs)	26.16 (1.6×10^{-2} LCFs)

LLNL 2006a, 2007a, 2008, 2009d, 2010j

Doses to members of the public from radiological air emissions are presented in Table 3.8-2 for the 2005 to 2009 period. Doses have been low and have declined during this period.

Table 3.8-2 Doses to the Public from LLNL Livermore Site Radioactive Air Emissions

	SWEIS Projection	2005 Actual (CY)	2006 Actual (CY)	2007 Actual (CY)	2008 Actual (CY)	2009 Actual (CY)
Site-wide MEI Dose (mrem)	0.13 (8×10^{-8} LCFs/year)	0.0065 (4×10^{-9} LCFs)	0.0045 (3×10^{-9} LCFs)	0.0031 (2×10^{-9} LCFs)	0.0013 (8×10^{-10} LCFs)	0.0042 (3×10^{-9} LCFs)
Population Dose (person-rem)	1.8 (1.1×10^{-3} LCFs/year)	1.2 (7.2×10^{-4} LCFs)	0.75 (4.5×10^{-4} LCFs)	0.50 (3×10^{-4} LCFs)	0.14 (8.4×10^{-5} LCFs)	0.20 (1.2×10^{-4} LCFs)

LLNL 2006a, 2007a, 2008, 2009d, 2010j

A human health risk assessment (LLNL 2007b) was completed in 2007 for the Explosives Waste Treatment Facility located in the north-central section of Site 300 pursuant to 22 CCR 66270.23. This regulation requires emissions from explosive waste

treatment units to be evaluated to determine the potential pathways of exposure of humans or environmental receptors to waste constituents, hazardous constituents and reaction products, and to assess the potential magnitude and nature of such exposures. The carcinogenic and non-carcinogenic risks to the maximally exposed off-site resident and on-site worker or acute and chronic exposures were evaluated to be less than one in a million which is below the level of regulatory concern.

3.8.3 Analysis of Projected Changes from 2010 to 2015

Of the new and modified projects and modifications listed in Table 1.1, only those that involve unusual hazards such as nuclear material, energized particles, or hazardous materials that could potentially impact human health and safety are discussed in the following section.

Working conditions at LLNL would slightly change in the 2010 to 2015 period. NIF has become an operational facility and implementation of the new and modified projects and modifications in site operations add new hazardous operations and facilities through the year 2015. As a result, the worker and public doses would increase from the 2005 to 2009 period, but would remain below the SWEIS projections. Existing ES&H programs and ISMS and ALARA principles would continue to be implemented to address worker and general population protection measures to control, reduce, or eliminate operational hazards.

A significant reduction in Category I/II Special Nuclear Materials from the Superblock from the ongoing De-inventory Project would have no effect on population doses to the surrounding population. There are no emissions of radionuclides from Building 332, the Plutonium Facility (DOE 2008a). Both individual and cumulative worker doses would be managed and maintained in accordance with ALARA principles.

Experiments at NIF would generate prompt “skyshine” doses from neutrons produced during NIF yield operations and scattering off of the atmosphere to the public from normal operations. The skyshine dose was calculated in the SWEIS based on the 1200 MJ annual yield total (DOE 2005a), which would not change; and therefore there would be no change to the dose to the public from prompt radiation (LLNL 2010i). Although the total dose due to prompt radiation over the year would remain unchanged at any location, the dose from an individual maximum yield shot would increase. The 5 mrem isodose contour for the maximum yield shot would move further from the NIF Target Bay and Switchyard, but would remain inside the LLNL Livermore Site within the NIF fenced area which is normally inaccessible to non-involved workers. The NIF would establish administrative procedures to warn or exclude any non-involved workers within the potential 5-mrem isodose contour area.

NIF workers would be exposed to radioactivity during re-entry after yield shots; for example, to perform routine maintenance. The yield for a year would remain 1200 MJ as

described in the SWEIS, so the overall doses to workers would not be expected to change. To support the development of future applications for the facility, higher yields are desired. Stay-out times after shots with the new maximum shot yield limit of 120 MJ would be revised to accommodate the change. Worker doses would remain within legal limits at all times. Both individual and cumulative worker doses would be managed and maintained in accordance with ALARA principles (LLNL 2010i).

The proposed changes at the Mega-Ray Facility would increase the beam power from approximately 16.5 Watts at 275 MeV to 45 Watts at 750 MeV. Changing the beam energy to 750 MeV would then basically triple the dose rates in the accelerator bay. The dose rates in occupied areas outside the shield walls would increase from 0.05 mrem/hr to 0.15 mrem/hr at 750 MeV (LLNL 2010h). Worker doses would be managed in accordance with ALARA principles, e.g., stay-out times before re-entry after accelerator operation, shielding, etc. (LLNL 2010h). The estimated dose to an individual standing at the site boundary for an entire year from the release of activated air products is approximately six nano-rem, which is negligible. Tripling these values for 750 MeV operation would increase to 18 nano-rem/year dose at the site boundary, still negligible (LLNL 2010h).

Radiant energy from the Mega-Ray Facility during operation would create potentially hazardous airborne chemical compounds, the most significant of which is ozone. Calculations for operation at 275 MeV give an equilibrium ozone concentration in the bay of approximately 0.0007 ppm (parts per million). Tripling this for 750 MeV operation gives approximately 0.0021 ppm, which is significantly less than the Threshold Limit Value (TLV) of 0.1 ppm. TLV is the concentration to which a worker could be exposed for 8 hours per day, on an ongoing basis, and not incur any adverse health effects (LLNL 2010h).

Adding the capability to accelerate multiple “bunches” of electrons per pulse at the Mega-Ray Facility, in addition to the present single-bunch capability effectively increases the average beam current, and therefore the beam power. A factor of ten is assumed for the increase, giving a total beam power of 450 Watts at 750 MeV. The increase in beam power would result in increases to local radiation fields, primarily at the beam dump and diagnostic screens inserted into the beam path, and during a beam mis-steering event. The addition of this capability is not expected to result in any change in impacts to the public (LLNL 2010h).

There were no significant changes to worker health and safety impacts from the increased non-routine LLW generation rates from D&D projects. For example, the decontamination workers in Building 321 received zero radiation dose to the whole body or skin in FY 2010. All workers follow LLNL’s ISMS guidelines and DOE’s ALARA principles. Worker dose from increased routine LLW generation at NIF & PS facilities can be minimized by optimizing waste generation with worker dose and emissions as described earlier in this document.

Other new and modified projects and changes in operations involving radioactive materials and waste would be conducted according to existing ES&H programs and ISMS and ALARA principles, which implement worker and general population protection measures to control, reduce, or eliminate operational hazards.

3.8.4 Conclusion

Operations at LLNL involve workers with potential exposure to low-levels of hazardous and radiological materials. LLNL applies ES&H programs and follows ISMS and ALARA principles to control, reduce, or eliminate these operational hazards. The doses in the SWEIS represent conservative upper bound estimates for workers and members of the public. Implementation of new and modified projects and modifications in site operations represent only a slight variation to the individual and population doses, and would remain comparable to the SWEIS projections. The doses to workers would remain ALARA, and public doses would be less than 0.4 percent of the DOE standard of 100 mrem/year, and well below the NESHAPs standard of 10-mrem/year dose to the Site-wide MEI member of the public.

An increase in routine and non-routine LLW would result in worker population doses comparable to the 2005 SWEIS projections. All radiation workers follow LLNL's ISMS guidelines and DOE's ALARA principles.

The impacts on human health and safety remain consistent with the impacts projected in the SWEIS. Supplementation of the 2005 SWEIS for human health and safety is not needed.

3.9 Accident Analyses

This section discusses changes in potential impacts on accident analyses from the proposed new and modified projects and modifications in site operations that are likely to be implemented at LLNL through the year 2015.

3.9.1 The 2005 SWEIS Analyses

Radioactive and Hazardous Waste Management

The bounding radioactive accident scenario in the SWEIS is a single prop airplane crash into Building 625 (B625). In this scenario, the engine of the airplane pierces the structure and impacts four drums of transuranic (TRU) waste, causing catastrophic failure of the drums. Fuel from the airplane forms a pool and catches fire, and causes another 46 drums to lose their lids or have lid seal failure. The scenario assumes all drums are loaded to 12 plutonium-239 equivalent Curies (PE-Ci), with the exception of one drum, which is loaded to 60 PE-Ci. The 60-PE-Ci drum is considered to be one of the four drums directly impacted by the engine (DOE 2005a).

The source term for this accident scenario takes into consideration the damage ratio of the drums, airborne release fraction, and respirable fraction. Damage ratio is the fraction of the material at risk that is exposed to the effects of the energy/stress generated (i.e., fire). The source term as developed in the SWEIS is 1.40 PE-Ci, and is summarized in Table 3.9-1 (DOE 2005a). The dose to the public at the nearest site boundary from this source term is derived from dose conversion factors in EPA's Federal Guidance Report No. 11 (FGR 11), and converted to 70-year committed effective dose equivalents (CEDE). Dose conversion factors are used to convert the activity of radiological intake into a dose to tissue (measured in roentgen-equivalent-man or rem dose). The CEDE is converted to latent cancer fatalities (LCFs) using the factor 6×10^{-4} LCFs per person-rem. The CEDE to the public from this bounding scenario in the SWEIS is 23.1 rem (1.39×10^{-2} LCFs). This dose consequence bounds all other radiological accident scenarios for LLNL. Following a similar methodology, the SWEIS described the CEDE to the public from an airplane crash into B696R to be 16.6 rem (9.96×10^{-3} LCFs) (DOE 2005a).

Table 3.9-1 Derivation of Source Term for Building 625 Aircraft Crash Scenario in the SWEIS

No. of Drums	PE-Ci/Drum	Airborne Release Fraction	Respirable Fraction	Damage Ratio	Source Term (PE-Ci)
1	60	0.01	1	1	0.6
3	12	0.01	1	1	0.36
20% of 25	12	0.01	.5	1	0.3
5	12	5×10^{-4}	.5	1	0.015
36	12	5×10^{-4}	0.6	1	0.13
			Total Source term		1.40

DOE 2005a

Section 3.3.14 of the SWEIS described that the amount of transuranic waste stored in Building 625 would be increased to consolidate waste from LLNL facilities planned for D&D and to accept drums from facilities prior to shipment to the WIPP. This section stated that possible configurations of drums would be limited to those where the consequences of the bounding accident for Building 625 analyzed in the SWEIS would not be exceeded.

Superblock

The bounding accident scenario analyzed in the SWEIS for the Superblock was an evaluation-basis room fire of sufficient magnitude that the entire room is threatened, all of the radioactive material-at-risk within the room is engulfed in the fire, and the fire burns long enough to release the material from storage containers to the glovebox, room, and the environment (DOE 2005a). The material-at-risk was assumed to be 40 kg of 30-year-old fuel-grade plutonium. The scenario assumed an airborne release fraction of 5×10^{-4}, respirable fraction of 0.5, and damage ratio of 1.0. The leak path factor is bounded by a value of 0.05. Therefore, the source term for this release scenario is 0.50 g of 30-year-old fuel grade plutonium. The consequences of the bounding accident would result in a 5.6 rem dose (3.36×10^{-3} LCFs) to the MEI located at the nearest site boundary (public dose).

National Ignition Facility

The bounding accident scenarios analyzed in the SWEIS for NIF were releases of radioactivity due to a beyond-design basis earthquake with an estimated frequency of 2.0×10^{-9} per year under unfavorable meteorology conditions. These bounding case scenarios in the SWEIS Appendix M, Table M.5.6.1.2-4, were the release of the entire tritium inventory (500 Ci) plus one year's worth (1200 MJ) of accumulated radioactivity and: (Event 1) a last 45 MJ shot with 1 gram of plutonium, and (Event 2) a last non-yield shot with 3 grams of plutonium (DOE 2005a). The dose to the MEI located at the nearest

site boundary for these two events was estimated to be 0.0116 rem and 0.0216 rem (6.96×10^{-6} and 1.3×10^{-5} LCFs), respectively.

Biosafety Level 3 (BSL-3) Facility

The bounding biological accident scenario in the SWEIS involves an accidental release of a rickettsial microorganism, *Coxiella burnetii*, which causes Q fever. As a result of worker error, a source term of 3×10^4 Human Infective Dose (HID_{50}) of *Coxiella burnetii* is released from the facility, where HID_{50} is the estimated human infective dose with a 25 to 50 percent chance of causing an exposed person to contract the disease through the inhalation route for Q fever. Using a simple Gaussian plume dispersion model, the quantity of human infective doses would dissipate to less than 0.1 HID_{50} per liter of air at 16 meters and less than 0.01 HID_{50} per liter of air at 38 meters. Thus this bounding accident level of release from the BSL-3 facility would not represent a significant risk to the noninvolved worker or off-site population.

3.9.2 Changes from 2005 to 2010

Radioactive and Hazardous Waste Management

To support operational needs to increase transuranic waste storage in B625, DOE/NNSA reviewed possible configurations of container-loading limits such that the consequences of the bounding accident for Building 625 would not be exceeded. One such configuration involves containers to be loaded to 18 PE-Ci, which results in a source term of 1.39 PE-Ci (LLNL 2006b) from the accident involving 50 drums. This possible storage configuration remains within the bounds of the SWEIS, as the source term is below 1.40 PE-Ci. See Table 3.9-2 for derivation of this revised source term.

Table 3.9-2 Derivation of Source Term for Building 625 Aircraft Crash Scenario with 18 PE-Ci Drums

No. of Drums	PE-Ci/Drum	Airborne Release Fraction	Respirable Fraction	Damage Ratio	Source Term (PE-Ci)
4	18	0.01	1	1	0.72
5	18	0.01	0.5	1	0.45
5	18	5×10^{-4}	0.5	1	0.023
36	18	5×10^{-4}	0.6	1	0.194
			Total Source term		1.39

LLNL 2006b

Superblock

There were no changes in operating parameters during the 2005 to 2010 period. Operations remained within the envelope of the accident scenarios contained in the SWEIS. Since 2006, LLNL has an ongoing De-Inventory Project to transfer Security Category I/II SNM from LLNL to receiver sites through the end of 2012. This project was described in the DOE/NNSA *Complex Transformation SPEIS* (DOE 2008a). After

the de-inventory effort is complete, Building 332 would remain a Hazard Category 2 Nuclear Facility.

National Ignition Facility

There were no changes in operating parameters during the 2005 to 2010 period. Operations remained within the envelope of the accident scenarios contained in the SWEIS.

Biosafety Level 3 (BSL-3) Facility

The bounding biological accident scenario in the SWEIS was essentially the same as that used by the Department of the Army in its Final Programmatic Environmental Impact Statement (PEIS) for the United States Army Medical Research Institute of Infectious Diseases (USAMRIID) at Ft. Detrick, Maryland (USAMRDC 1989).

In a recent review of the PEIS by the National Research Council (NRC 2010), the accident analysis was criticized because the mathematical model used to calculate the potential biological release was proprietary and therefore not available to the NRC to make an independent determination. An attempt by the NRC to reproduce the findings using a different model did not produce the same result.

In view of the NRC criticism, it was decided to re-examine the consequences of the LLNL BSL-3 bounding accident using a publicly accessible dispersion model. This current evaluation (LLNL 2010b) uses the Hotspot health physics code (LLNL 2009c), a DOE/NNSA-developed, publicly accessible Gaussian plume-dispersion model that is included as part of the DOE/NNSA Safety Analysis Tool Chest for performance of nuclear safety analysis calculations. It is also a companion dispersion model for the National Atmospheric Release Advisory Center (NARAC), which provides tools and services to the Federal government that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere.

The results of this re-evaluation are an estimated dose concentration of 0.084 HID_{50} per liter of air at 16 meters and 0.015 HID_{50} per liter of air at 38 meters from the BSL-3 facility. The results also estimated that the dose consequence applicable to the nearest public receptor at 810 meters would be 4.5×10^{-5} HID_{50} per liter of air. Thus the re-evaluation essentially confirmed the consequence estimates in the SWEIS and showed that the potential consequences to the public would be far below the minimum infectious dose of one organism.

3.9.3 Analysis of Projected Changes from 2010 to 2015

After reviewing the list of new and modified projects and modifications in site operations in Table 1.1, only three activities were viewed as having potential impacts on the accident scenarios included in the SWEIS: radioactive and hazardous waste management activities, de-inventory, and NIF operations. These are discussed in the following sections.

Radioactive and Hazardous Waste Management

DOE/NNSA proposes to review additional configurations of drums and make them consistent with updated methodologies in the most recent safety documents for B625 and B696R. The current safety document for B625 describes accident scenarios with container-loading limits up to 50 PE-Ci for all scenarios except for the airplane crash scenario, which remains consistent with the SWEIS. Therefore, there is a need to develop consistent container-loading limits and methodologies, such as using the most recent EPA-recommended dose conversion factors, between the safety documents and the SWEIS. Consistency in methodologies would provide direct comparison between the two documents, and support operational needs in LLNL's waste management facilities.

Since the mid-1980s, the EPA has issued a series of federal guidance documents for the purpose of providing the Federal and State agencies technical information to assist their implementation of radiation protection programs. The 1988 Federal Guidance Report No. 11 (FGR 11) provided updated dose coefficients for internal exposure of members of the general public and limiting values of radionuclide intake and air concentrations. The DOE/NNSA used these values in the accident scenario methodologies for the SWEIS. In 1999, the EPA issued FGR 13, which provided numerical factors for use in estimating the risk of cancer from low-level exposure to radionuclides (EPA 1999). FGR 13 uses dose conversion factors based on the International Commission on Radiation Protection (ICRP) Publications 71 and 72. The LLNL safety documents use the FGR 13 dose conversion factors.

The EPA stated that the FGR 13 does not replace FGR 11 or affect its use for radiation protection purposes. However, the risk coefficients tabulated in FGR 13 have a different purpose – they are intended for use in assessing risks in a variety of applications, including application of the risk coefficients for environmental impact statements (EISs) and environmental assessments (EAs) (EPA 1999). EPA also stated that the use of these risk coefficients by federal agencies is discretionary, but their use is encouraged to promote consistency in risk assessment. Hence, DOE/NNSA proposes to use the risk coefficients from FGR 13 for the B625 and B696R accident scenarios, which would provide consistency with the safety documents for those facilities. The FGR 13 dose conversion factors for plutonium-239 are reduced by a factor of 5.2 when compared to the dose conversion factors for plutonium-239 in FGR 11 (LLNL 2010f).

Therefore, a new analysis was performed on the SWEIS airplane crash scenarios for B625 and B696R (LLNL 2010f). To be consistent with the safety document, this new analysis used configurations of drums with container-loading limits of 50 PE-Ci for both B625 and B696R and FGR 13 dose conversion factors. The resulting CEDE from an accident involving 50 drums to the MEI member of the public would be 13.4 rem (8.04×10^{-3} LCFs) for B696R and 12.4 rem (7.44×10^{-3} LCFs) for B625. These values remain bounded by the CEDE to the MEI of 23.1 rem (1.39×10^{-2} LCFs) in the SWEIS accident scenario for B625.

The changes in calculated CEDE values to the MEI are illustrated in Table 3.9-3. The second column in the table shows the SWEIS values, which used FGR 11 dose conversion factors. Converting to the FGR 13 dose conversion factors results in the CEDE values shown in the third column of the Table. Increasing the drum loading limits (from 12 PE-Ci in B696R and 18 PE-Ci in B625) to 50 PE-Ci for both facilities produces the CEDE values shown in the fourth column of the Table. Finally, the implementation of both the 50 PE-Ci drum loading limits and the FGR 13 dose conversion factors results in the CEDE values shown in the last column of the Table. The container-loading limits of 50 PE-Ci are well within the allowed disposal limits for the Waste Isolation Pilot Plant (WIPP).

Table 3.9-3 Converting B625 and B696R SWEIS Accident Analysis CEDE Values to Maximally Exposed Individual from FGR 11 to FGR 13

	SWEIS Values with FGR 11		SWEIS Values Converted to FGR 13		50 PE-Ci Drums with FGR 11		50 PE-Ci Drums Converted to FGR 13	
	Rem	**LCFs**	**Rem**	**LCFs**	**Rem**	**LCFs**	**Rem**	**LCFs**
B696R	16.6	9.96×10^{-3}	3.2	1.92×10^{-3}	69.7	4.18×10^{-2}	13.4	8.04×10^{-3}
B625	23.1	1.39×10^{-2}	4.4	2.64×10^{-3}	64.2	3.85×10^{-2}	12.4	7.44×10^{-3}

LLNL 2010f

Superblock

The goal of the De-inventory Project is to reduce the amount of SNM on site while retaining the ability to complete the mission. Removing the Security Category I/II SNM inventory from the Superblock may reduce the material-at-risk (MAR) for plutonium. A reduction in MAR would reduce the consequences of accident scenarios, assuring that the consequence of the accident scenario analyzed in the SWEIS remains bounding for the Superblock.

Even if all Security Category I/II SNM were removed, the Superblock facilities would continue to operate with Category III quantities of SNM, although it is possible that small amounts of Category I/II SNM would be present for limited time periods. During Complex Transformation the Superblock facilities would continue to perform machining, foundry operations, analytical chemistry, and materials characterization on SNM originating from LANL facilities. These activities would produce impacts smaller than those analyzed for Superblock facilities in the SWEIS (DOE 2008a).

National Ignition Facility

NIF tritium inventories reside in a variety of components including: molecular sieves, cryopumps, target reservoirs, gas handling systems, contamination control systems, etc. Operational changes at NIF include increasing the maximum tritium inventory from 0.05 g (500 Ci) to 0.8 g (8000 Ci), increasing the maximum per-shot yield from 45 MJ to 120 MJ (the total annual yield of 1200 MJ would remain unchanged), and increasing the

maximum beryllium inventory from 20 g to 1 kg. The consequences of NIF bounding radiological accidents in the SWEIS (for the 2 events described in Section 3.9.1) are revised from 0.0116 rem and 0.0216 rem (6.96×10^{-6} and 1.3×10^{-5} LCFs) to 0.104 rem and 0.114 rem (6.24×10^{-5} and 6.84×10^{-5} LCFs), respectively (LLNL 2010i).

The increase of beryllium inventory from 20 g to 1 kg would not warrant additional controls beyond those already in place in the NIF. In the event of a bounding accidental release, the impact at the site boundary would remain very low – less than 0.0051 mg/m^3 at 350 meters, or approximately 20% of its Emergency Response Planning Guidelines (ERPG)-2 value (LLNL 2010i). This is well below the bounding chemical accident described in the SWEIS, a chlorine gas release with an ERPG-2 distance of 1900 meters (DOE 2005a). ERPG-2 is defined by the American Industrial Hygiene Association (AIHA) as the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

3.9.4 Conclusion

Storage of transuranic waste within LLNL's waste management facilities, B625 and B696R, is limited to possible configurations of drums such that the consequences of the bounding accident for Building 625 would not be exceeded. The bounding accident for B625 in the SWEIS is an aircraft crash scenario, which would result in a CEDE to MEI value of 23.1 rem (1.39×10^{-2} LCFs). A similar scenario for B696R would result in a CEDE to MEI value of 16.6 rem (9.96×10^{-3} LCFs). The SWEIS used EPA's recommended dose conversion factors in FGR 11. Revising the scenarios with the FGR 13 dose conversion factors, as recommended by the EPA for environmental impact statements and environmental assessments, allows for configurations of drums with container-loading limits up to 50 PE-Ci. The resulting CEDEs to MEI would be 12.4 rem (7.74×10^{-3} LCFs) for B625 and 13.4 rem (8.04×10^{-3} LCFs) for B696R. Therefore, with the approval of this SA, the container loading limits for both B625 and B696R would be changed to 50 PE-Ci, consistent with the safety documents for these facilities and consistent with and remaining within the 23.1 rem (1.39×10^{-2} LCFs) bounding CEDE dose to MEI established by the SWEIS.

The ongoing De-Inventory Project in the Superblock may reduce the MAR for plutonium in the Superblock, thereby reducing the consequences of accident scenarios. After de-inventory, Building 332 would remain a Hazard Category 2 Nuclear Facility. Operational changes at the NIF would increase the consequences of bounding radiological accidents in the SWEIS (for the 2 events described in Section 3.9.1) from 0.0116 rem and 0.0216 rem MEI doses (6.96×10^{-6} and 1.3×10^{-5} LCFs) to 0.104 rem and 0.114 rem (6.24×10^{-5} and 6.84×10^{-5} LCFs), respectively. These values remain well below the accident scenario for B625 described in the SWEIS, with an MEI consequence of 23.1 rem (1.39×10^{-2} LCFs). A chemical accident involving 1 kg of beryllium from the NIF would have a

consequence at the site boundary of 0.0051 mg/m^3 at 350 meters, or approximately 20% of its ERPG-2 value. This is well below the chemical accident described in the SWEIS, a chlorine gas release with an ERPG-2 distance of 1900 meters.

The consequences from the accident analyses remain below the consequences of accidents analyzed in the SWEIS. Supplementation of the 2005 SWEIS for accident analyses is not needed.

4.0 INTENTIONAL DESTRUCTIVE ACTS

The 2005 SWEIS (DOE 2005a) did not discuss the potential environmental impacts of intentionally destructive acts such as might be caused by a terrorist attack on facilities at LLNL. This approach was consistent with the DOE policy and requirements in effect at the time the SWEIS was issued. Since that time, the United States Court of Appeals for the Ninth Circuit issued two opinions that require that NEPA documents explicitly address potential environmental consequences of intentional destructive acts (i.e., acts of sabotage or terrorism).

In preparing this SA, DOE/NNSA's NEPA analyses of the potential environmental impacts from intentional destructive acts at LLNL prepared subsequent to the 2005 SWEIS were reviewed and determined to remain valid. Two analyses were considered, the analysis from the Revised Environmental Assessment for the Biosafety Level-3 (BSL-3) facility (DOE 2008b) and the analysis from the *Complex Transformation SPEIS* (DOE 2008a). These are discussed below.

4.1 Intentionally Destructive Acts Involving Biological Agents

Prior to the issuance of the 2005 SWEIS, DOE/NNSA proposed to construct and operate a BSL-3 facility at LLNL to meet the DOE/NNSA mission to "develop, demonstrate and deliver technologies and systems to improve domestic defense capabilities and, ultimately, to save lives in the event of a chemical or biological attack". An Environmental Assessment (EA) and a Finding of No Significant Impact for the proposed BSL-3 facility was issued in December 2002 (BSL-3 EA, DOE/EA-1442, DOE 2002), and construction of the facility began.

In response to the Ninth Circuit Court decision in 2006 that a NEPA decision that did not consider the possibility of a terroroist act was inadequate, DOE/NNSA decided to issue a revised EA (DOE 2008b) that included an analysis of the potential impacts of terrorist attacks involving the BSL-3 facility in January of 2008. Three terrorist acts were considered: 1) a terrorist attack resulting in facility damage; 2) a theft of pathogenic agent by a terrorist from outside of LLNL; and 3) a theft of pathogenic agent by an insider. The review concluded that:

> *1) a successful terrorist attack involving facility damage and loss of containment is not expected to occur due to the extensive layered security programs at the LLNL; in any event, the environmental consequences would be bounded by the effects that would occur during catastrophic events or operational accidents;*
> *2) because pathogenic agents are available in nature and other, less secure locations, operation of the LLNL BSL-3 facility would not make pathogenic agents more readily available to an outside terrorist, or increase the likelihood of an attack by an outside terrorist; and*

3) the theft of pathogenic materials by an insider from any bio research facility could have very serious consequences; this scenario is not expected to occur at LLNL due to human reliability programs, security procedures, and management controls at the Facility (DOE 2008b).

The analysis demonstrated that the consequences of a successful terrorist attack on the LLNL BSL-3 facility would be bounded by the consequences of the accident scenarios evaluated for the facility.

4.2 Intentionally Destructive Acts Involving Nuclear Materials

In October 2008, the DOE/NNSA issued DOE/EIS-0236-S4, *Complex Transformation SPEIS* (DOE 2008a). The document analyzed the potential environmental impacts of alternatives for transforming the nuclear weapons complex (Complex) into a smaller, more efficient enterprise that can respond to changing National security challenges. As part of this process, the potential environmental consequences of intentionally destructive acts were examined for each site in the Complex in detail, including LLNL. The results of this analysis are in a classified appendix to the 2008 *Complex Transformation SPEIS* (DOE 2008a). The analysis includes credible scenarios for terrorist attacks and potential impacts of attacks. Depending on the intentional destructive acts, impacts would be similar to or exceed the impacts of accidents analyzed in the 2005 SWEIS. The 2008 *Complex Transformation SPEIS* classified appendix has not been released to the public because disclosure of this information could be exploited by terrorists and assist them in the planning of attacks.

The classified appendix contains a site-specific analysis for LLNL which includes the types, maximum amounts, and locations of nuclear materials which could be targeted. The analysis assumes that an adversary is successful in achieving their objective in several credible scenarios, and calculates consequences to a noninvolved worker, maximally exposed individual, and population in terms of direct effects, radiation dose, and latent cancer fatalities. The MACCS2 and RISKIND computer codes were used along with other manual methods to calculate possible human health effects of each credible scenario. Site-specific meteorology and population distribution for LLNL were used in the incident analyses.

The conclusion from the analysis is that the impact from certain intentionally destructive acts, if successful, would exceed those of bounding accidents analyzed in the 2005 SWEIS and would extend offsite to the general public. Although the details of the analyses cannot be disclosed, in general, the potential consequences are highly dependent upon distance of the affected individuals to the site boundary, with those closest being most impacted.

4.3 Prevention and Mitigation of Impacts from Intentionally Destructive Acts

The 2008 *Complex Transformation SPEIS* and the 2008 revised BSL-EA discuss the DOE/NNSA strategy for the prevention and mitigation of environmental impacts resulting from intentionally destructive acts. The strategy focuses on three key efforts:

1) Prevent and deter terrorists from executing successful attacks.
2) Plan and provide timely and adequate response to emergency situations.
3) Progressive recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environment.

The most important effort is to prevent and deter intentionally destructive acts. Federal law requires that the DOE/NNSA protect the laboratory and the public against a broad range of terrorist threats and other hostile acts that may cause unacceptable impacts on national security or on the health and safety of employees, the public, or the environment. DOE/NNSA implements a protection strategy designed to be effective against a range of postulated terrorist threats, with measures applied site-wide and at the facility and personnel levels. Increasing levels of protective strategies are put into place to reduce the risk of a successful terrorist attack to an acceptable level, and subsequently the potential for the facility to be an attractive target for terrorism. These security measures are tested frequently against simulated threats to ensure they will perform as planned if necessary. Implementation of these protection strategies taken together reduces the overall probability of a successful terrorist attack to the point where it is considered extremely unlikely.

Maintaining the security at DOE facilities is a critical concern to the Department. The DOE/NNSA continues to identify and implement measures designed to defend against and deter attacks at its facilities. Details on the security protection at LLNL, as well as information on emergency response and recovery planning and preparation at the site, are contained in the referenced documents (the 2005 SWEIS, the revised BSL-EA, and the 2008 *Complex Transformation SPEIS*) (DOE 2005a, DOE 2008a, DOE 2008b).

4.4 Emergency Response Preparedness

While DOE/NNSA has comprehensive security measures to prevent terrorist attacks, it is also necessary to have the capability for timely and adequate response to an attack as well as to other emergency situations. DOE/NNSA's comprehensive all-hazards approach to emergency management is established in DOE Order 151.1C, *Comprehensive Emergency Management System*. This Order provides a general structure and framework for responding to any emergency at a DOE/NNSA facility or for a DOE/ NNSA activity and specific requirements to address protection of workers, the public, and the environment from the release of hazardous materials.

DOE/NNSA's comprehensive emergency management system is based on a three-tiered structure with each tier having specific roles and responsibilities during an emergency. Each organizational tier provides management, direction, and support of emergency response activities. Management personnel of a facility, site, or activity manage the tactical response to the emergency by directing the mitigative actions necessary to resolve the problem, protect the workforce, the public, and the environment; and return the facility, site, or activity to a safe condition. The Cognizant Field Element oversees the facility/site response and provides local assistance, guidance, and operational direction to the facility/site management. The Cognizant Field Element also coordinates the tactical response to the event with tribal, state, and local governments. NNSA Headquarters provides strategic direction to the response, provides assistance and guidance to the Cognizant Field Element, and evaluates the broad impacts of the emergency on the NNSA complex. Headquarters also coordinates with other Federal agencies on a National level, provides information to representatives of the executive and legislative branches of the Federal government, and responds to inquiries from the National media.

Each DOE/NNSA facility, site, or activity is required by DOE Order 151.1C to have an Operational Emergency Base Program, which provides the framework for responding to serious events or conditions that involve the health and safety of the workforce and the public, the environment, and safeguards and security. The objective of the Operational Emergency Base Program is to achieve an effective integration of emergency planning and preparedness requirements into an emergency management program that provides capabilities for all emergency responses through communication, coordination, and an efficient and effective use of resources that is commensurate with the hazards present at that facility, site, or activity.

5.0 CUMULATIVE IMPACTS

In accordance with the Council on Environmental Quality (CEQ) regulations, a cumulative impact is defined as the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. (40 CFR Part 1508.7).

The cumulative impact analysis for this SA includes: 1) an examination of the cumulative impacts in the 2005 SWEIS (DOE 2005a); 2) a review of past, present, and reasonably foreseeable actions for other federal and non-federal agencies; 3) a summary of impacts identified in this SA; and 4) a summary of the cumulative impacts and changes since the 2005 SWEIS (DOE 2005a) was issued. Reasonably foreseeable future actions of LLNL were discussed in Chapters 2 and 3 of this SA. Reasonably foreseeable actions for the region impacted by LLNL were also reviewed in the analysis.

As discussed in Chapter 2, the potential impacts of new and modified projects and modifications to ongoing operations were determined to be minimal and within the bounds of the 2005 SWEIS in the following resource areas: socioeconomics and environmental justice, community services, cultural resources, soils and geology, noise, site contamination and remediation, and traffic and transportation. In addition, the cumulative impacts to the resource areas of aesthetics, water, and accident analysis were also determined to be within the bounds of the SWEIS using the screening criteria and the analyses in the previous chapters. For each of these resource areas, the cumulative impacts projections in the SWEIS remains adequate for the 2010 to 2015 period, and no supplementation of the SWEIS is needed.

The following resource areas require further analysis in relation to cumulative impacts of new and modified projects and modifications to ongoing operations for the 2010 to 2015 period: land use, biological resources and wetlands, air quality, utilities and energy, materials and waste management, and health and safety. They are discussed below.

5.1 Land Use

Livermore Site

The continuing land use trend in Alameda County of the encroachment of residential, commercial, and industrial uses upon agricultural and open space remains consistent with that identified in the 2005 SWEIS. Such trends include the City of Livermore's plans to re-designate nonresidential sites to residential sites, and introduce higher density transit-oriented development in the area of the Altamont Commuter Express (ACE) station on Vasco Road and the proposed Bay Area Rapid Transit (BART) stations on Vasco Road by LLNL and in downtown Livermore.

LLNL's land use proposals described in Chapter 3 would not directly contribute to the cumulative effect on the loss of agricultural land and open space because the LLNL Livermore Site and SNL site are already committed to R&D land uses and no acquisition of new open space or agricultural land is proposed. Similarly, an additional facility is planned for the southeast area of SNL and is consistent with local zoning. Because land uses would not change and no acquisition of new open space is proposed, the proposed new and modified projects and modifications to operations would not create significant cumulative land use impacts.

Site 300

New facility construction or modification in site operations are not anticipated at Site 300 in the next few years. As stated in the 2005 SWEIS, the residential community, Tracy Hills, could be compatible with Site 300 depending on the final design and siting of residences. The Tracy General Plan also provides for a conservation, or open space, area to be established that would be a buffer zone between Site 300 and any potential development.

The types of land use and their cumulative impact at Site 300 and in the surrounding areas are expected to remain consistent with those described in the SWEIS. However, LLNL is in the initial phase of analyzing the feasibility of a wind and solar renewable energy project at Site 300 as described in Chapter 1, Table 1.1. At this time, the proposal was excluded from consideration on the basis of being premature ("not ripe") for scope definition and analysis. DOE/NNSA plans to perform appropriate environmental reviews and documentation under NEPA once the scope is defined.

5.2 Biological Resources and Wetlands

Livermore Site

The 2005 SWEIS analyzed the disturbance of approximately 17 acres of terrestrial habitat due to proposed construction. As described earlier, several facilities were not built, but others have been proposed resulting in a similar acreage of disturbance for building construction within previously developed areas. As described in Chapter 3, California red-legged frogs and California tiger salamanders may be directly impacted by vehicle traffic, equipment use, mowing, grading, and pesticide use. However, conservation measures would continue to be implemented to minimize potential impacts to these species. Disturbance of degraded grasslands for future building construction, construction-related activities, infrastructure improvements, and maintenance operation such as mowing, were similarly analyzed in the 2003 EA prepared for SNL. Therefore, the proposed new and modified projects and modifications to operations could create cumulative impacts to biological resources, but these would be mitigated by the conservation measures listed above and the management activities identified in the SNL EA.

Arroyo Seco Improvement Projects managed by LLNL and SNL include land areas determined to be jurisdictional wetlands at both sites. The construction of functional floodplains and planting of native riparian vegetation associated with this project was

recently completed and is projected to have a positive cumulative impact to biological resources.

Site 300

Soil disturbance was analyzed in the SWEIS as being due to construction activities, and continuing operations such as prescribed burns, D&D, road grading, and culvert maintenance. These continuing activities as well as the proposed erosion control and environmental restoration activities could adversely affect one or more listed species, but as described in Chapter 3, rehabilitation and revegetation of disturbed areas or on-site mitigation in the Conservation Area would benefit conservation and recovery and may have a positive impact on the survival of the listed species.

The types of soil disturbance and their cumulative impact at Site 300 and in the surrounding areas are expected to remain consistent with those described in the SWEIS. However, LLNL is in the initial phase of analyzing the feasibility of a wind and solar renewable energy project at Site 300 as described in Chapter 1, Table 1.1. At this time, the proposal was excluded from consideration on the basis of being premature ("not ripe") for scope definition and analysis. DOE/NNSA plans to perform appropriate environmental reviews and documentation under NEPA once the scope is defined.

5.3 Air Quality

Radioactive air emissions from the LLNL Livermore Site are expected to change as a result of projected increase in tritium emissions from the NIF from 30 Ci per year to 80 Ci per year as discussed in Section 3.4.3 of this document. Building 331 annual tritium emissions projections would remain 210 Ci per year as described in the SWEIS. The projected Sitewide MEI dose (to members of the public) would increase from 0.13 mrem per year (7.8×10^{-8} LCFs per year) to 0.14 mrem per year (8.4×10^{-8} LCFs per year). The population dose would increase from 1.84 person-rem per year (1.10×10^{-3} LCFs per year) to 1.91 person-rem per year (1.15×10^{-3} LCFs per year). These are small increases from the SWEIS projections, and the cumulative impacts analysis in the SWEIS remains valid. The SWEIS projected that there are no adverse impacts from radiological air quality expected from the Proposed Action; and other than background radiation sources, there are no other known contributors to concentrations of radionuclides in air within 50 miles of the Livermore site and Site 300. There are no changes for Site 300 radioactive air emissions and these would therefore remain within the SWEIS projections.

For non-radioactive air emissions, the proposed new and modified projects and modifications in site operations would not significantly impact the emissions of regulated air pollutants. There would be a small increase in the emissions of nitrogen oxides and carbon monoxide and a very small increase in particulates and sulfur oxide emissions. However, nitrogen oxides and carbon monoxide emissions would remain within the Bay Area Air Quality Management District (BAAQMD) enforceable permit conditions of 35 tons per year for nitrogen oxides and 35 tons per year of any other criteria pollutant such as carbon monoxide. To the extent that the proposed new buildings use solvents for research work, there would be a small increase in emissions of precursor organic

compounds. During the construction of the proposed new buildings, there would be some particulate dust generation as a part of the site grading and site preparation, and an increase in regulated pollutants from the operation of gasoline and diesel-fueled construction machinery. Although LLNL's regulated non-radioactive air emissions remain well below their conformity threshold limits, any LLNL emissions may contribute to local air districts' non-attainment status for certain criteria pollutants.

Cumulative impacts related to greenhouse gas emissions are being addressed through the recent legislation such as Assembly Bill 32, federal regulations, and Executive Order 13514 for Federal agencies and facilities. Greenhouse gas emission targets were issued by the President and are in place for Federal agencies and facilities. LLNL and SNL are in the process of inventorying and identifying and implementing reduction strategies for greenhouse gas emissions. Additionally, the reporting of sulfur hexafluoride emissions and control strategies from research and switchgear would commence in calendar year 2011. Proposed facilities and the resulting growth in electrical energy use would make federal greenhouse gas emission reduction targets very challenging. However it is expected that the national laboratories such as LLNL and SNL would provide leadership in developing innovative and cross-cutting strategies for meeting the federal greenhouse gas reduction targets, supporting the transformation to a low-carbon economy, and addressing the crisis of climate change (DOE 2010b).

The emissions of hazardous air pollutants are anticipated to continue at about the same level, or lower, in future years. The ongoing space consolidation projects involving demolition and renovation of buildings would remove asbestos materials and the number of these asbestos projects would decrease over time.

5.4 Utilities and Energy

5.4.1 Water Consumption

Livermore Site

The SWEIS identified a cumulative impact upon water resources and supply systems based on the proposed action together with other development in the Hetch-Hetchy service area and a projected population increase in Alameda County as well as the other counties in the Hetch-Hetchy service area. As described in the previous chapters, LLNL and SNL propose new facility construction that would incrementally increase the consumption of potable water for industrial cooling process, and sanitary systems, but both LLNL and SNL have also implemented water conservation programs to reduce their use of potable water. Both laboratories use the Hetch-Hetchy systems as their primary water supply system and Zone 7 as a back-up water supply system. Based on a water demand evaluation by the Bay Area Water Supply and Conservation Agency (BAWSCA 2010), the Hetch-Hetchy and Zone 7 system water demands are projected to exceed available supplies after 2018 if strategies to implement water conservation programs are not successful. Zone 7's ability to provide long-term supply reliability is also hampered by uncertainty over the level of future State Water project deliveries and water contamination issues. Therefore, the continued population growth of the surrounding areas together with new development, and the proposed increase in potable water

consumption by LLNL and SNL, continue to constitute a cumulative impact upon water resources.

Site 300

The SWEIS described that because the population in San Joaquin County was projected to increase by 30 percent by the year 2015, and that residential, commercial, industrial, and other water demands in San Joaquin County were expected to increase proportionally, that this increase could constitute an adverse cumulative impact on ground water resources. Similarly, this population growth was expected in the Hetch-Hetchy service area of which Site 300 now receives their water supply. Although Site 300 now relies on Hetch-Hetchy water and uses a quantity less than projected in the SWEIS, increased water use throughout the surrounding areas would still constitute an adverse cumulative impact, especially with the uncertainty of the BAWSCA service area's ability to meet water demands in the near future.

5.4.2 Wastewater Discharges

Livermore Site

Wastewater discharges, as analyzed in Chapter 3, are expected to increase at the Livermore Site as well as SNL, but are still less than those identified in the SWEIS and SNL's EA. The Livermore Water Reclamation Project (LWRP) currently receives 7.1 MGD and has a capacity of 8.5 MGD. However, combined with the projected growth in Alameda County and the accompanying increase in residential, commercial, and industrial use of water, this growth in construction and a proportional increase in wastewater discharges could still constitute a negative cumulative impact on sewage systems in the area.

Site 300

As described earlier, Site 300 has a self-contained wastewater discharge oxidation pond east of the General Services Area and no cumulative impacts are expected as a result of new and modified operations.

5.4.3 Electricity Consumption

Livermore Site

Cumulative impacts were not anticipated in the SWEIS from electrical consumption at the Livermore Site due to the fact that the PG&E service area's generation capacity had plans to increase. The new and modified projects and modification in operations identified in the Chapter 1, Table 1.1, would slightly increase the electrical use projections of the SWEIS, but the LLNL distribution system and existing capacities of service providers are anticipated to adequately meet the projected increase. SNL's EA similarly described impacts of increased operations and electrical consumption. However, because Alameda County's population continues to grow and residential, commercial and industrial electrical consumption would increase proportionally, negative cumulative impacts could occur in the region in the future.

Site 300

Although Site 300's electrical consumption is anticipated to remain stable through 2015, the increase in residential, commercial and industrial electrical consumption in San Joaquin County could produce negative cumulative impacts in the region.

5.4.4 Fuel Consumption

The SWEIS did not anticipate any cumulative impacts from fuel consumption at the Livermore Site or Site 300. Because the Livermore Site's anticipated use of natural gas is well below the use projected in the SWEIS and that Site 300 activities are anticipated to remain stable, no cumulative impacts are expected in this resource area.

5.5 Materials and Waste Management

Hazardous materials usage would be consistent with SWEIS projections, which stated that LLNL hazardous material use would not result in critical shortages or other cumulative impacts. For radioactive materials, LLNL would continue the ongoing De-Inventory Project to decrease the amount of SNM in long-term storage onsite through the end of 2012. NIF would change its maximum tritium inventory from 0.05 g (500 Ci) to 0.8 g (8,000 Ci), which would remain within the radiological classification of the facility (see Section 3.7.3 of this document for additional detail). Other LLNL facilities would use radioactive materials consistent with the SWEIS projections. Overall, the cumulative impacts from radioactive materials usage would remain consistent with the SWEIS projections, and may actually be reduced due to the De-Inventory Project.

Most of the waste generation rates are not projected to increase significantly for the 2010 to 2015 time period; however, fluctuations within the annual generation rates for the various waste types are anticipated. Increases above the SWEIS projections are expected for routine radioactive LLW, and temporary increases in FY 2010 and FY 2011 for non-routine LLW and non-routine MLLW. Small quantities of non-routine MTRU waste could also be generated from decontamination and repackaging activities. Even with these fluctuations and temporary increases, the cumulative impacts from waste generation would remain consistent with the SWEIS projection, which stated that the impact would be generally small as compared to DOE/NNSA operations nationally or total wastes in California annually. The projected volumes for LLW and MLLW would not exceed existing waste management capacities; therefore, no additional waste storage, treatment, handling capacity, or security requirements would be needed. An increase in LLW and MLLW generation would require an increase in the number of shipments to disposal sites. However, the number of shipments would remain within the SWEIS projections.

5.6 Human Health and Safety

Implementation of new and modified projects and modifications in site operations would involve one accelerator project in the 2010 to 2015 time period. Although the worker doses are expected to slightly increase from the 2005 to 2009 period, they would remain within the SWEIS projections. Existing ES&H programs and ALARA principles

would continue to be implemented to address worker and general population protection measures to control, reduce, or eliminate operational hazards. The SWEIS projected that the worker health and safety at LLNL is site-specific and would not be affected by other activities occurring within the area. Therefore, cumulative impacts to workers would be the same as those presented in Chapter 3, Section 3.8. See discussion in Air Quality for cumulative impacts to the public.

6.0 CONCLUSION

The contents in this SA have considered whether the 2005 SWEIS should be supplemented, a new EIS should be prepared, or no further NEPA documentation is required. To do so, each environmental resource area has been examined, looking at the 2005 SWEIS projections, what has transpired in the 2005-2010 period, and the current projections for the 2010-2015 period.

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 are likely to be implemented through the year 2015. For most environmental resources, the 2010-2015 projections remain consistent with impacts analyzed in the 2005 SWEIS. For the few instances where the 2010-2015 projections differ from the 2005 SWEIS analysis, the changes in environmental impact are not significant.

In conclusion, a supplement to the 2005 SWEIS or a new SWEIS is not needed, and therefore, no further NEPA documentation is needed for the new and modified projects and modifications in site operations considered in this SA.

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APPENDIX A

Listing of DOE/NNSA NEPA Documents at LLNL

2005-2010

DOE Identification Number	Type of NEPA Document	Title of NEPA Document
NA-05-02	Categorical Exclusion	Construction and Operation of Building 583
NA-05-03	Categorical Exclusion	Drinking Water System Upgrades at Site 300
NA-05-05	Categorical Exclusion	Construction and Operation of Communications and Software Development Building 161A
NA-05-06	Categorical Exclusion	LLNL Secure Air Optics Transport and Routing Network Short Air Optic Link Project at California Water Service Property, Livermore, CA
NA-05-07	Categorical Exclusion	Demolition of Trailer 3629
NA-05-12	Categorical Exclusion	Soil Removal Project at Building 855, Site 300
NA-05-13	Categorical Exclusion	High-Throughput Mobile Laboratory (HTML)
NA-05-14	Categorical Exclusion	California Tiger Salamander Mitigation Pond at Lower Ambrosino Pond, Site 300
NA-05-15	Categorical Exclusion	Culvert Installation and Construction of a Pond at Upper Round Valley, Site 300
NA-05-17	Categorical Exclusion	Decommissioning and Demolition of Lab Pool
NA-05-18	Categorical Exclusion	Proposal to Develop a Forensic Evidence Curatorial Facility
NA-05-19	Categorical Exclusion	Offsite Well Modification for LLNL EM-05-19
NA-05-20	Supplement Analysis	Construction and Operation of Evidence Receiving and Temporary Storage Facilities in Support of Nuclear and Radiological Attribution Program and Forensic Science Center's Analyses Programs at the Livermore Site and Site 300, DOE/EIS-0348-SA-01
NA-05-21	Categorical Exclusion	Special-Status Species Protection in the Drainage Retention Basin

DOE Identification Number	Type of NEPA Document	Title of NEPA Document
NA-06-01	Categorical Exclusion	FY 2006, 2007, 2008 Tank and Oil-Filled Equipment Maintenance, Repairs, Replacements, Minor Upgrades, and Removals
NA-06-02	Categorical Exclusion	LLNL Secure Air Optics Transport and Routing Network Short Air Optic Link Project at Doolan Canyon Road, Livermore, CA
NA-06-03	Categorical Exclusion	Temporary Siting and Erecting of a Sun Collector
NA-06-04	Categorical Exclusion	Decommissioning and Demolition of Buildings 811 and 830, Site 300
NA-06-05	Categorical Exclusion	Installation and Operation of Treatment Facility Building 812, Site 300
NA-06-06	Categorical Exclusion	Installation of E85 Fueling Station North of Building 611
NA-06-07	Categorical Exclusion	Characterization of Biological Materials in Building 282
NA-06-08	Environmental Assessment	Environmental Remediation at Site 300 Pit 7 Complex, DOE/EA-1569
NA-06-12	Categorical Exclusion	Construction and Operation of Building 178
NA-06-13	Categorical Exclusion	Decommissioning and Demolition of Building 377
NA-07-03	Categorical Exclusion	Long-Range Detection of Radiation Sources at Offsite Locations
NA-07-04	Categorical Exclusion	Beryllium Coating Operations in Building 153
NA-07-09	Environmental Assessment	Construction and Operation of a Biosafety Level-3 (BSL-3) Facility at Lawrence Livermore National Laboratory, Amendment, DOE/EA-1442R
NA-07-16	Categorical Exclusion	Outdoor Short-Pulse Laser Propagation Experiment
NA-07-21	Categorical Exclusion	Removal of Boulders from Arroyo Mocho
NA-07-25	Categorical Exclusion	Offsite Emergency Response Training and Equipment Storage
NA-08-01	Categorical Exclusion	Erosion Control Maintenance Activities at Arroyo Mocho
NA-08-04	Supplement Analysis	Building 850 Soil Remediation Project, Site 300, DOE/EIS-0348-SA-02
NA-08-05	Categorical Exclusion	2008 Site 300 Sediment Control Project

DOE Identification Number	Type of NEPA Document	Title of NEPA Document
NA-09-09	Categorical Exclusion	Offsite Compact Proton Therapy
NA-09-12	Categorical Exclusion	Lead Removal at Small Firearms Training Facility, Site 300
NA-09-16	Categorical Exclusion	Cooling Tower Cell Additional for Building 453
NA-10-10	Categorical Exclusion	Mobile Hydrogen-Fueling Station and use of Hydrogen Buses