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DRAFT Environmental Assessment for the Proposed Increase in the Weight of Explosives Detonated at Lawrence Livermore National Laboratory Experimental Test Site, Site 300

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SUMMARY

This Environmental Assessment (EA) 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 Quality Act (NEPA). In this EA. DOE National Nuclear Security Administration (NNSA) considers the agency Proposed Action to increase the weight of explosives used at the Lawrence Livermore National Laboratory (LLNL) Experimental Test Site (Site 300) Building 851 firing table. The California Environmental Quality Act requires state and local agencies to identify and evaluate the significant environmental impacts of their actions and to avoid or mitigate those actions, if feasible. This document has been formatted and the analysis completed to incorporate elements for compliance with CEQA, because the Proposed Action would be subject to permitting by the San Joaquin Valley Air Pollution Control District.

The purpose of this Proposed Action is to perform research vital to stockpile stewardship program, counterterrorism and counterproliferation program missions. DOE/NNSA needs to test non-radioactive explosive materials up to 1,000 lbs./day and no more than 7,500 lbs./yr. at a secure, existing DOE/NNSA testing facility. This EA evaluates the potential for significant impacts to result from implementation of the Proposed Action, within the context of the No Action Alternative (i.e. status quo alternative). This EA also considers cumulative impacts likely to result from implementation of the Proposed Action.

Preliminary analysis indicated that implementation of the Proposed Action would not result in impacts on the following elements of the human environment: land use and aesthetic resources, socioeconomics, environmental justice, community services, prehistoric and cultural resources, traffic and transportation, and utilities and energy. Therefore, these elements are dismissed from further discussion in this EA for the reasons provided in Section 4.1 of this document. The following is a summary of the resource areas considered, the types of analyses completed, and the results of those analyses.

Geology and Soils – The Proposed Action does not include activities that would physically alter the geology or subsurface soils of Site 300. A qualitative analysis of the Proposed Action for soils indicates that a negligible amount of metal fragments would be deposited to surface soils. The types and rates of deposition however would be consistent with operations under the No Action Alternative. Therefore, implementation of the Proposed Action would not result in significant impacts on geology and soils.

Ecological Resources – A qualitative comparison of the potential impacts on protected species, critical habitat, wetlands, and floodplains indicates that implementation of the Proposed Action would not result in significant adverse direct or indirect impacts on these resources over the No Action Alternative.

Air Quality – Quantitative analyses are completed for ambient air quality and the exposure of people to hazardous pollutant concentrations (including potential to emit criteria pollutants, organic compounds, inorganic compounds, acid gasses, metals, greenhouse gases, radiological

emissions, and toxic air contaminants). These analyses involved establishing a conservative upper limit for potential emissions by establishing upper bounds for each of the materials used in an experiment. Emission estimates are based on the Open Burn Open Detonation Model emission factors, AP-42 emission factors, stoichiometric conversion calculations, the Combined Obscuration Model for Battlefield Induce Contaminants simulations and metal release fractions for explosive assemblies. These were used as input to the AERMOD modeling system. AERMOD is a U.S. EPA-preferred steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. AERMOD results were then fed to the California EPA Air Resources Board Hotspots Analysis and Reporting Program (HARP2) software in preparation of a health risk assessment. DOE/NNSA used finely resolved air quality data and methods for this analysis, and has a high confidence in the conservative upper bounds established by this analysis.

Through this analysis, DOE/NNSA determined that estimated annual emissions from the Proposed Action are low compared to the general conformity thresholds. Therefore, emissions anticipated to result from the Proposed Action would not contribute substantially to any air quality violation.

Calculations of the potential emissions for each of the materials used in experiments indicate that there would be a negligible increase in greenhouse gas emissions above the No Action Alternative.

Because there would not be any radionuclides used in the experiments, and because surface scouring and cratering emissions would consist of concrete, (not soils), implementation of the Proposed Action would not result in a change in radiological emissions over the No Action Alternative.

Implementation of the Proposed Action would result in an increase in toxic air contaminant (TAC) emissions over the No Action Alternative. However, even in a worst-case scenario, the Cancer Risk, Chronic Max Hazard and Acute Max Hazard would be below San Joaquin Valley Air Pollution Control District (SJVAPCD) thresholds of significance. Additionally, when other permitted sources at Site 300 are considered along with the Proposed Action, the cumulative potentials are below the SJVAPCD thresholds of significance.

Therefore, implementation of the Proposed Action would not result in significant impacts on air quality.

Water Resources – The Proposed Action would not include activities that would physically or chemically alter the ground and surface water resources at Site 300. Implementation of the Proposed Action would not deplete groundwater resources or interfere with groundwater recharge. A qualitative analysis of potential impacts on storm water runoff indicates that storm water runoff would be minor, localized, and would not impact storm water infiltration in the area. Therefore, implementation of the Proposed Action would not result in significant impacts on water resources.

Noise – Under the Proposed Action, sources of noise at Site 300 would not change from the No Action Alternative. Noise generating activities other than from experimental testing in the Building 851 Complex would not change under the Proposed Action. Therefore, an analysis of continual ambient noise, or site-wide noise sources is not necessary.

A qualitative and quantitative approach considered the potential for the Proposed Action to result in impulse noise impacts. Under the Proposed Action, the length of time for each impulse noise event would remain similar with the duration of impulse noise events under the No Action Alternative. Impulse noise from detonations at Building 851 would continue to occur only from 10:00 am to 8:50 pm.

For the purposes of this impact analysis, potential for structural or other damage and the potential for noise and vibration-related concerns resulting from the Proposed Action was modeled using one second peak sound pressure levels with 15% of exceedance (Pk_{15}). The potential for long-term annoyance or impacts on noise-sensitive land uses from the Proposed Action was modeled using the annual C-weighted day-night average sound level (CDNL). Each of these metrics were calculated using a computer program called Blastnoise2, that was developed by the Department of Defense.

Modeling the Proposed Action impulse noise shows that immediate and long-term impacts on receptors of concern and on land uses near Site 300 would be higher than the No Action Alternative. LLNL's self-imposed one second sound pressure level of 126 dB would not to be exceeded in populated areas, or at the receptors of concern. Implementation of the Proposed Action is not anticipated to result in annual CDNL greater than 57 dB in residential areas. And the Proposed Action is anticipated to be compatible with nearby land uses. Under the Proposed Action impacts on workers from noise exposure would be avoided and would therefore be the same as under the No Action Alternative.

Materials and Waste Management – A combined quantitative and qualitative evaluation of materials and waste management is used in this EA. The Proposed Action could cause the generation of an additional 12 cubic yards of solid waste per year above the No Action Alternative. Existing facilities and processes at Site 300 and Building 851, including materials management and waste management are already in place to handle the implementation of the Proposed Action. Implementation of the Proposed Action would not result in a significant impact on material management infrastructure.

Human Health and Safety – A quantitative approach is taken as part of the Air Quality analysis to determine the potential impacts on human health from air emissions under the Proposed Action. An evaluation of detonation noise levels and potential impacts on workers and the public can be found in Section 4.1.5 of this EA. Impacts on uninvolved workers would be avoided through existing controls. Hearing protection programs, and personal protective equipment (PPE) would continue to be used for involved workers under the Proposed Action.

Accidents and Intentional Destructive Acts – Implementation of the Proposed Action would have the potential to result in impacts on the environment, workers, or the public from accidents or intentionally destructive acts. In this EA, reasonably foreseeable accidents resulting from implementation of the Proposed Action are compared to those under the No Action Alternative. This analysis indicates that implementation of the Proposed Action would not result in significant impacts on the likelihood or outcomes of reasonably foreseeable accidents or intentionally destructive acts over the No Action Alternative.

Climate Change – This EA considers the potential for the Proposed Action to contribute to climate change along with the potential for extreme weather events to interfere with the Proposed Action. Impacts are not identified for either case.

Cumulative Impacts – The cumulative impact analysis for this EA included a review of past, present, and reasonably foreseeable actions for other federal and non-federal agencies in San Joaquin and Alameda counties. The following resource areas are analyzed in relation to cumulative impacts in this EA: ecological resources, air quality, noise, and climate change. Through this evaluation it is determined that aspects of the Proposed Action would have negligible contributions to cumulative impacts in the region.

NOTATION

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

ACRONYMS AND ABBREVIATIONS

ATC/PTO	Authority to Construct / Permit to Operate
BNOISE2	Blastnoise 2 software
CARB	California Air Resources Board
CDNL	C-weighted Day-Night Average Sound Level
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CESA	California Endangered Species Act
CFF	Contained Firing Facility
CFR	Code of Federal Regulations
CNPS	California Native Plant Society
CO	Carbon Monoxide
CO2	Carbon Dioxide
DOE/NNSA	U.S. Department of Energy National Nuclear Security Administration
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EDD	State of California Employment Development Department
EIS	Environmental Impact Statement
EO	Executive Order
EOS	Equation of State
EPA	U.S. Environmental Protection Agency
ESA	federal Endangered Species Act
FONSI	Finding of No Significant Impact
FR	Federal Register

GHG	Greenhouse gas
GSA	General Services Area
HAER	Historic American Engineering Record
HRA	Health Risk Assessment
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
MCL	Maximum Contaminant Level
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOx	Nitrogen Oxides
NRHP	National Register of Historic Places
OHP	Office of Historic Preservation
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PK_{15}	Peak Sound Pressure Level, with 15% expected exceedance
PM	Particulate Matter
PPE	Personal Protective Equipment
REC	Renewable Energy Credit
RDX	Research Department Explosive
ROD	Record of Decision
SA	Supplement Analysis
SF6	Sulfur Hexafluoride
SHPO	California State Historic Preservation Officer
SIP	State Implementation Plan
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO2	Sulfur Dioxide
SOx	Sulfur Oxides

SPEIS	Supplemental Programmatic Environmental Impact Statement
SVRA	State Vehicular Recreation Area
SWEIS	Site-wide Environmental Impact Statement
TAC	Toxic Air Contaminant
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
VOCs	Volatile Organic Compounds

UNITS OF MEASURE

dB	decibels
dBA	A-weighted decibels
dBC	C-weighted decibels
lbs./day	pounds per day
lbs./yr.	pounds per year
mtCO2e	metric tons of carbon dioxide equivalent
pCi/L	picocuries per Liter
µbar	microbar

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1.0 INTRODUCTION

The U.S. Department of Energy National Nuclear Security Administration (DOE/NNSA) prepared this Environmental Assessment (EA) in accordance with the Council on Environmental Quality's (CEQ's) "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act," 40 Code of Federal Regulations (CFR), Title 4, Parts 1500-1508 (CEQ 2005) and the DOE's National Environmental Policy Act (NEPA) Implementing Procedures in 10 CFR 1021. The NEPA requires an assessment of the environmental consequences of federal actions that may affect the quality of the human environment. This EA discusses the Purpose and Need for the Proposed Action, provides a description of the Proposed Action and alternatives, and analyzes the potential environmental impacts of the Proposed Action and alternatives. Based upon the potential for impacts described in this EA, DOE/NNSA would either publish a Finding of No Significant Impact (FONSI) or prepare an environmental impact statement (EIS).

The San Joaquin Valley Air Pollution Control District (SJVAPCD) is required by state law, the California Environmental Quality Act (CEQA), to review discretionary permit project applications for potential air quality and other environmental impacts according to CEQA Guidelines §15060a.

This section generally describes this document, the Proposed Action, and the Purpose and Need for the agency action. The statement of Purpose and Need for the agency action reflects the goals to be achieved by DOE/NNSA stockpile stewardship, counterterrorism and counterproliferation missions. NEPA regulation 40 CFR § 1502.13 requires a description of the underlying Purpose and Need to which the agency is responding in considering an action (CEQ 2005).

1.1 BACKGROUND

The DOE/NNSA analyzed the potential environmental consequences of the Proposed Action to increase the explosives weight for outdoor explosives tests (otherwise known as open detonations) at the Lawrence Livermore National Laboratory (LLNL) Experimental Test Site (Site 300). The Proposed Action would not involve detonation of radioactive materials.

The explosives weight is the actual mass, in pounds, of explosive mixtures or compounds for an experiment. Currently research and development activities at LLNL's Site 300 Building 851 involve detonation of explosives up to 100 pounds per day (lbs./day) and 1,000 pounds per year (lbs./yr.). Under the Proposed Action the cumulative weights of explosives detonated at the Building 851 firing table would increase to 1,000 lbs./day up to 7,500 lbs./yr. A Permit to Operate from SJVAPCD is required for the detonation of explosives for research and development activities that exceed the threshold of 100 lbs./day and 1,000 lbs./yr. at a single stationary source as stated in Rule 2020 Exemptions Section 7.4 (SJVAPCD 2014). Therefore, the Proposed Action would be subject to permitting from SJVAPCD.

Site 300 is a restricted-access LLNL experimental test facility operated for DOE/NNSA by Lawrence Livermore National Security, LLC (LLNS). The facility is used in the research, development, and testing of explosives. Site 300 is located about 15 miles southeast of the LLNL Livermore Site in Livermore, California and 6 miles southwest of Tracy, California (Figure 1). Site 300 has been in operation as an explosives testing and research facility since 1955.

Figure 1. Location of the LLNL Livermore Site and Site 300.

1.2 PURPOSE AND NEED

The purpose of this Proposed Action is to perform research vital to stockpile stewardship program, counterterrorism and counterproliferation program missions. DOE/NNSA needs to test non-radioactive explosive materials up to 1,000 lbs./day and no more than 7,500 lbs./yr. at a secure, existing DOE/NNSA testing facility. Current and ongoing research performed at LLNL Site 300 directly supports these program missions using a range of explosives and explosive devices up to 100 lbs./day and 1,000 lbs./yr. However as scientific understanding supporting the stockpile stewardship program has increased, it has become necessary to reach higher pressures, volumes, and temperatures in experimental testing which requires larger explosives. Additionally, the counterterrorism and counterproliferation programs need the proposed explosives weight increase for experimental testing to address continuously evolving threats and terrorism risks.

The DOE/NNSA is responsible for the management and security of the U.S. nuclear weapons stockpile. DOE/NNSA is also responsible for developing practical tools to detect and analyze weapons that could be lost or stolen, and to provide technically informed policy recommendations with special emphasis on nuclear weapon technology. DOE/NNSA responds to nuclear and radiological emergencies in the U.S. and abroad. The 2010 Nuclear Posture Review Report (U.S. Department of Defense 2010) and the 2011 National Strategy for Counterterrorism describe preventing nuclear terrorism and nuclear proliferation as top priorities for the U.S. nuclear policy agenda. LLNL and Site 300 directly support the DOE/NNSA stockpile stewardship, counterterrorism and counterproliferation priorities with secure facilities, unique capabilities, technical expertise, and scientific experimentation.

Stockpile Stewardship

Since the 1992 U.S. moratorium on nuclear weapons testing DOE/NNSA has had the responsibility of understanding and maintaining existing nuclear weapons without testing those weapons. DOE/NNSA has worked toward the stockpile stewardship program mission through "hydrodynamic" and Equation-of-State (EOS) experimental research. Hydrodynamic tests are non-nuclear scientific experiments that show how materials react to high explosives detonation. "Hydrodynamic" refers to the fluid-like movement of solid materials at the center of an explosion. An EOS explains the relationships between the pressure, volume, and temperature of a given material. DOE/NNSA uses non-radioactive explosive materials that simulate the characteristics of actual nuclear weapons materials to understand how nuclear weapons perform without using radioactive materials. The stockpile stewardship program combines information gathered from these non-radioactive EOS and hydrodynamic experimental tests with advanced computing and highly accurate physics modeling to predict nuclear weapon performance over a wide range of conditions and scenarios. In this way, DOE/NNSA can understand and maintain the existing U.S. nuclear weapons stockpiles without having to conduct nuclear tests of those weapons.

Based on the stockpile stewardship program mission, explosives tests have mostly involved hydrodynamic testing of the weapons stockpile designs that did not require more than 100 lbs. at Site 300. The proposed increase in explosives weights is needed to gather information at higher pressures, volumes, and temperatures than are possible with ongoing activities at Site 300.

Counterterrorism and Counterproliferation

The DOE/NNSA counterterrorism and counterproliferation program mission objectives include understanding nuclear threat devices that range from improvised devices to complex weapons, and effectively reducing and responding to those threats. In a way similar to the stockpile stewardship program, DOE/NNSA must understand weapons and prepare to deal with those weapons without having the actual device in hand. These improvised weapons and devices may use high explosives weights that are larger than, and not as refined as, U.S. technologies because they lack scientific expertise and the complex systems required to produce and use smaller, more refined weapons. DOE/NNSA must evaluate designs that simulate these improvised explosives, explosive devices, and weapons. Simulating potential device designs demands frequent testing operations with ongoing review, work, and daily involvement of a number of LLNL personnel with specialized expertise. These experts work to evaluate continuously evolving threat and terrorism risks and to design effective countermeasures. To evaluate evolving threats and the application of countermeasures to realistic threat devices, DOE/NNSA needs to increase explosive testing at LLNL Site 300 to 1,000 lbs./day and 7,500 lbs./yr.

1.3 COMPLIANCE WITH THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

The CEQA requires state and local agencies to identify and evaluate the significant environmental impacts of their actions and to avoid or mitigate those actions, if feasible. This document has been formatted and the analysis completed to incorporate elements for compliance with CEQA.

Table 1. Summary of NEPA/CEQA Resource Categories and Their Applicability to the Impact Analysis in this EA.

Resource Category		Applicability to Impacts Analysis*
NEPA	**CEQA**	
Land Use and Aesthetic Resources	Land Use/Planning, Aesthetics, Agriculture Resources/Recreation	Section 4.1 not analyzed further
Prehistoric and Cultural Resources	Cultural Resources	Section 4.1 not analyzed further
Socioeconomics and Environmental Justice	Population/Housing and Growth Inducing Impacts	Section 4.1 not analyzed further
Community Services	Public Services	Section 4.1 not analyzed further
Geology and Soils	Geology/Soils/Mineral Resources	Section 4.1.1
Ecological Resources	Biological Resources	Section 4.1.2
Air Quality	Air Quality	Section 4.1.3
Water Resources	Hydrology/Water Quality	Section 4.1.4
Noise	Noise	Section 4.1.5
Traffic and Transportation	Transportation/Traffic	Section 4.1 not analyzed further
Utilities and Energy	Utilities/ Service Systems	Section 4.1 not analyzed further
Materials and Waste Management	Hazards and Hazardous Materials	Section 4.1.6
Human Health and Safety	Human Health and Safety	Section 4.1.7
Accidents and Intentional Destructive Acts	N/A	Section 4.1.8
Climate Change	Climate Change	Section 4.1.9
Cumulative Impacts	Cumulative Impacts	Section 4.1.10

*The sections in which each category can be found in this document are noted, and if the category was not analyzed further.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

CEQ's regulations 40 CFR 1508.9(b) require that an EA include a brief discussion of alternatives to a proposed action (CEQ 2005). This section describes the Proposed Action, the No Action Alternative, and alternatives considered, but eliminated from further analysis.

DOE/NNSA considered action alternatives for meeting its need for explosive testing activities at a secure DOE/NNSA facility that could accommodate detonations up to 1,000 lbs./day. For the action alternatives to be feasible they must accomplish the following:

- Provide the ability to develop, fabricate, and test a range of explosives up to 1,000 lbs.
- Be conducted at an existing DOE/NNSA testing facility with appropriate security capabilities and experience to support classified operations.
- Allow for the design, building, inspection, re-building, analytic deployment, and final testing elements of explosively driven devices at the same facility.
- Provide a testing location that allows permanent installation of unique data collection systems.
- Provide the highest level of facility and staff availability on a year-round basis.

2.1 PROPOSED ACTION

DOE/NNSA proposes to increase the cumulative weight of explosives detonated to 1,000 lbs./day up to 7,500 lbs./yr. at LLNL Site 300 Building 851 firing table. The Proposed Action would be subject to permitting by SJVAPCD and would require the application and acquisition of the appropriate SJVAPCD permit and associated CEQA review.

The Proposed Action would enable ongoing DOE/NNSA research, expansion of experimental research, and development of new technologies as needed by the stockpile stewardship, counterterrorism and counterproliferation programs. The Proposed Action would not involve detonation of radioactive materials.

Site 300 is a DOE/NNSA restricted-access site equipped with protective forces and security systems necessary to ensure safe and secure operations. Existing Site 300 utilities infrastructure would be sufficient to accommodate the proposed increase. Site 300 has year-round, full-time expert staff able to safely create, process, handle, and test explosives and explosive devices. LLNL researchers that directly support DOE/NNSA stockpile stewardship, counterterrorism and counterproliferation programs have year-round access to Site 300. Additionally, Site 300 is only approximately 15 miles from the LLNL Livermore Site, enabling efficient travel for researchers from the drawing board to the test location.

Scientists at LLNL provide unparalleled expertise in threat and risk assessment, detection of threat materials, understanding and mitigating the consequences of attacks, forensic analysis, and more. Site 300 and LLNL have significant historical investments in both infrastructure and multidisciplinary expertise by the DOE/NNSA as well as the Department of Defense and the Department of Homeland Security. The Proposed Action would ensure a single complete process of design, building, inspection, re-building, diagnostic deployment, and final testing elements of explosively driven devices.

2.1.2 Site Preparation Activities

Safely implementing the Proposed Action would require preparing the Building 851 Complex by reinforcing existing structures near the Building 851 firing table with the application of a commercially available shotcrete, or similar material, or gravel. An existing protective berm used to contain blast fragments would be reinforced with approximately 81 cubic yards of wet mix shotcrete, applied approximately 125 feet by 35 feet and 0.5 feet deep. An existing dirt roadway approximately 62 feet long would be covered with gravel to a depth of 0.5 feet for a total of approximately 114 cubic yards of gravel. These modifications would prevent excessive suspension of dust during operations. Additionally, an existing protective enclosure, that houses electrical systems and diagnostic tools necessary for test detonation and analysis, would be reinforced with wood and sandbags.

Site preparation activities would not require installation of water wells, septic, or waste systems. Implementation of the Proposed Action would not require any changes in operations impacting existing utilities infrastructure. Existing systems would be sufficient to accommodate activities under the Proposed Action. No new roads or access routes would be needed. Electrical systems and diagnostic tools necessary for test detonation and analysis are already in place at Building 851 Complex and would remain in place through the duration of research. The existing 4,000 foot muster area is sufficiently sized to accommodate the proposed increase.

2.1.3 Operational Activities

The repetitive nature of experimental research demands ongoing review, work, and daily involvement of a number of personnel with specialized expertise. LLNL personnel define the research questions, test objectives, develop test articles, set up and calibrate test instrumentation, conduct the tests, analyze the results, and feed the results back into understanding the hypotheses and next experiment objectives.

The equipment currently in use to set up and deploy an experiment at Building 851 would continue to be used under the Proposed Action. Existing equipment and equipment used in previous work at Site 300 would be sufficient to accommodate the increase in explosives weight.

Experimental test activities would use a variety of conventional explosive materials, depending on the type of testing being conducted. Typical test assemblies would include concrete blocks, electronic sensors, metals, sand bags, and wood. Testing would include explosives, explosively-driven devices, and firing of non-explosive projectiles. No radioactive materials would be used under the Proposed Action.

Maintenance and operational activities would continue with implementation of the Proposed Action. Maintenance activities would include reinforcements of sandbags and wood to an existing protective enclosure that houses electrical systems and diagnostic tools. Other maintenance activities would include reapplication of shotcrete or similar materials to the existing protective berm as needed to maintain the integrity of the structure. Gravel areas would be inspected periodically to ensure there are no areas of exposed soil, and gravel would be replaced as needed to sufficiently absorb blast shocks. Operations at Site 300 and the Building 851 Complex would require minor modifications in the procedure for monitoring weather conditions and evaluating those conditions to control for noise. Existing LLNL procedures and processes for managing work including housekeeping, materials and wastes management, and worker safety and health management would be sufficient and would continue under the Proposed Action. No other changes in current ongoing processes and procedures at Site 300 would be required.

2.2 NO ACTION ALTERNATIVE

A No Action Alternative must be considered in all DOE/NNSA EAs. The purpose of a No Action Alternative in the NEPA process is to provide a baseline against which impacts of the other analyzed alternatives can be compared. "No action" does not necessarily mean doing nothing. Rather, the No Action Alternative often involves maintaining or continuing the "status quo" of ongoing operations and activities.

Under the No Action Alternative for this EA, DOE/NNSA would not increase explosives weight for open detonations at Site 300. However, under this No Action Alternative, the detonation of explosives up to 100 lbs./day up to 1,000 lbs./yr. for research and development would continue at Building 851 Complex.

Current and ongoing open detonation explosives experiments would continue as planned and as analyzed under NEPA as described in the 2005 Final Site-wide Environmental Impact Statement (SWEIS) for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement (DOE/EIS-0348; 2005 LLNL SWEIS) and the November 2005 Record of Decision (ROD) and the 2011 Supplement Analysis of the 2005 LLNL SWEIS (DOE/EIS-0348-SA-03; 2011 LLNL SWEIS SA). Work would be performed as analyzed under NEPA as described in the 2008 Final Complex Transformation Supplemental Programmatic Environmental Impact Statement (DOE/EIS-0236-S4; 2008 Complex Transformation SPEIS) and the ROD for the Complex Transformation Supplemental Programmatic Environmental Impact Statement – Tritium Research and Development, Flight Test Operations, and Major Environmental Test facilities (73 FR 77656; 2008 Complex Transformation SPEIS ROD).

Subsequently, no permit from SJVAPCD would be pursued under the No Action Alternative and no physical modifications or changes in operations of the Building 851 Complex would be needed.

In other words, DOE/NNSA would continue the "status quo" of operations at Site 300. The No Action Alternative would not meet the criteria to establish feasibility of action alternatives. The No Action Alternative would not support the mission needs of DOE/NNSA. However, it is considered here as is required under NEPA.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

This section describes alternative actions considered by DOE/NNSA but eliminated from further analysis in this document. The alternative actions described in this section have been eliminated from further analysis because they would not be reasonable alternatives and/or they would not support the DOE/NNSA mission needs for the reasons explained below.

2.3.1 Construct a Larger Contained Firing Facility (CFF) at Site 300

Under this alternative, DOE/NNSA would propose to construct a Contained Firing Facility (CFF) at Site 300 large enough to accommodate explosives research up to 1,000 lbs./day. Experimental research would be performed inside the new CFF. This new CFF would be larger than the existing Site 300 CFF Building 801. The existing CFF at Site 300 has a 132 lbs. structural limit and operates under a SJVAPCD air permit (SJVAPCD permit N-472-62-0). The existing CFF would not be capable of the necessary 1,000 lbs./day detonations.

Experiments with relatively long data gathering timeframes cannot reasonably be conducted inside a CFF. One of the primary means of analysis of explosives experiments is by high-speed photography, which records the incremental pathways and interactions of the materials as they are transformed. When the total data collection time needed extends beyond 20 milliseconds, such experiments must be conducted in an unconfined space to avoid reflections and interferences from deflected accelerating materials during the explosion. A permanent or temporary containment of a reasonably achievable size would obscure the experimental data.

The design and construction of a CFF large enough to safely contain an explosives detonation of 1,000 lbs. would be too costly considering it would still not allow for experiments with relatively long data gathering timeframes. Designing, securing funding, and constructing the facility would not meet DOE/NNSA mission timelines. Construction of a new CFF would require congressional approval in the form of a line-item appropriation. Justification for such a line-item appropriation does not exist because the project would not meet DOE/NNSA mission needs and would not be cost-effective. Therefore, this alternative would be infeasible and unreasonable and was dismissed from further analysis in this document.

2.3.2 Lesser Increase at Site 300

Under this alternative, DOE/NNSA would propose to increase explosives weight above the ongoing operations of 100 lbs./day, but less than the Proposed Action of 1,000 lbs./day. The SJVAPCD issues permits for explosives testing activities that exceed 100 lbs. in accordance with Rule 2020. Therefore, under this alternative the proposed increase would be subject to permitting by SJVAPCD and would require the application and acquisition of the appropriate SJVAPCD permit and associated CEQA review.

This alternative would not enable ongoing research and expansion of experimental research as needed by the DOE/NNSA stockpile stewardship program because experiments would not reach the pressures and temperatures required to progress the stockpile stewardship program mission. This alternative would not enable ongoing research and expansion of experimental research and development of new technologies as needed by DOE/NNSA for counterterrorism and counterproliferation missions. Therefore, this alternative would not meet the Purpose and Need and was dismissed from further analysis in this document.

2.3.3 Perform Operations at an Offsite Facility

Under this alternative, the experimental design and partial building of test equipment would occur at LLNL. The testing portion of the research process, detonation of up to 1,000 lbs./day would be performed at another appropriate facility. Examples of potentially appropriate facilities would include the Technical Area 39 High Explosives Testing Facilities at Los Alamos National Laboratory, the Big Explosive Experimental Facility at the Nevada National Security Site, or some other DOE/NNSA facility.

Only the analytic deployment and final testing elements of the research process would be performed at an alternate DOE/NNSA location. This alternative would not allow for the design, building, inspection, re-building, analytic deployment, and final testing elements of explosively driven devices nearby to scientific experts as a single complete process.

Project personnel are engaged in all aspects of research and testing activities at LLNL and are essential and limited resources. Removing those resources from their daily activities and programmatic responsibilities at LLNL to conduct work at a distant location is inefficient and has adverse impacts upon overall program execution. In this option, LLNL personnel travel and transportation of materials and devices would substantially increase associated costs and time required for each experimental test.

This alternative would not provide a testing location that allows for continual deployment of data collection systems. The necessary data collection systems for the magnitude of research proposed are not currently installed at other DOE/NNSA facilities. Semi-permanent infrastructure including tools such as buried data acquisition cables and protective camera boxes that do not presently exist would need to be installed prior to each 1,000 lbs. experiment and dismantled after each 1,000 lbs. experiment. This would be necessary to protect the equipment from other non-related testing, and to prevent the equipment from interfering with non-LLNL testing activities.

This action alternative would result in increased costs, preparation and dismantling time, and reduced quality of the testing data for each experiment. Additionally, LLNL experiments would compete with ongoing activities at the other DOE/NNSA testing facilities, thereby complicating scheduling. Therefore, this action alternative would not meet the Purpose and Need and has been removed from further consideration in this document.

3.0 DESCRIPTION OF THE EXISTING SETTING

This section contains a description of the area potentially impacted by the Proposed Action as required by CEQ's regulations. The extent of the affected environment may not be the same for all potentially affected resource areas. A detailed description of all elements of the existing setting at Site 300 can be found in the 2005 SWEIS (DOE/EIS-0348).

Discussion of the existing setting in this document is limited to existing environmental information that directly relates to the scope of the Proposed Action and alternatives analyzed. Table 1 shows the resources categories for NEPA and CEQA, whether they are applicable to this analysis and in what section they are discussed.

The Building 851 Complex is part of the explosive test facility operations at Site 300. The 13,681-gross-square-foot complex is in the northwest quadrant of Site 300 and houses diagnostic equipment, a laser room, several laboratories, a portable x-ray room, several shop areas and offices. The Building 851 Complex includes the 7,057-square foot open-air firing table where research and development activities involve the detonations of explosives. The Building 851 firing table consists of gravel covered pads with stands of concrete, wood or steel. There is no vegetation on the firing table. Adjacent to the firing table is a protective earthen berm and a dirt roadway. The Building 851 Complex is surrounded by a fence and is previously disturbed due to the buildings, pavement, and other existing infrastructure (including cables and diagnostics).

For the purposes of analysis for some resources in this EA, Building 851 includes a 4,000 foot "muster" area. The muster is a positive accounting method used for control of personnel access to the test area and extends in a 4,000 foot radius from the firing table. Areas within the muster include roadways, fire trails, and non-developed natural landscapes.

Impacts from ongoing activities at Site 300 were previously reviewed in the 2005 SWEIS and the 2008 Complex Transformation SPEIS (DOE/EIS-0236-S4). In the December 2008 ROD DOE selected the No Action Alternative as it relates to LLNL, thus continuing operations at Building 851.

3.1 LAND USE AND AESTHETIC RESOURCES

Site 300 comprises approximately 7,000 acres of largely undeveloped land in Alameda and San Joaquin counties. Site 300 includes the Building 851 Complex, a Department of Toxic Substances Control permitted explosives waste treatment facility, an indoor explosive testing facility known as the CFF, a chemistry processing area, maintenance facilities, and a General Services Area (GSA). All activities at Site 300 are within applicable zoning requirements and are compatible with existing land-use designations surrounding the Site.

No prime or unique farmland protected by the Farmland Protection Policy Act exists at Site 300. No grazing or other agricultural activities occur at Site 300.

Land uses surrounding Site 300 are primarily livestock grazing. Areas south of Site 300 along Corral Hollow Road include recreation and conservation areas. Site 300 is near the City of

Tracy's sphere of influence, including the Tracy Hills planned residential development which is 4.16 miles northeast of the Building 851 firing table.

Site 300 topography ranges from gently rolling hills to steeply sloping ridges and drainages. The majority of Site 300 is grasslands and low shrubs. View sheds in the area around Site 300 are severely constrained by topography. Sensitive views around Site 300 include the Carnegie State Vehicular Recreation Area (SVRA) and scenic routes designated by Alameda County or San Joaquin County. Site 300 is not within the view shed of any of the designated scenic corridors except for a short section of Tesla Road at the eastern end of Alameda County. The Building 851 Complex is not visible from an off-site roadway, other publicly accessible viewpoints, or from sensitive land use areas.

3.2 Prehistoric and Cultural Resources

3.2.1 Prehistoric Resources

Over the past 40 years archaeological surveys have identified 31 prehistoric and historic archaeological sites and isolated artifacts at Site 300. Eight of the 31 sites are prehistoric, (including one that is multi-component, i.e., prehistoric and historic) in nature. These sites indicate that the area was used by early populations for hunting, and for collecting and processing seasonal plant foods. Use is evidenced by small lithic scatters and rockshelters that contain bedrock mortars and possible small midden deposits.

Of the eight prehistoric archaeological resources recorded at Site 300, the DOE/NNSA, as the federal agency responsible for historic properties at LLNL, recommended that two are eligible for listing in the National Register of Historic Places (NRHP) because of their potential to yield information important in prehistory. The California State Historic Preservation Officer (SHPO) in the Office of Historic Preservation (OHP) concurred with this determination in 2005 (OHP 2005a). No known NRHP-eligible prehistoric resources are located within or adjacent to the Building 851 Complex.

3.2.2 Historic Archeological Resources

Twenty-three of the 31 archaeological sites recorded at Site 300 are historic archeological sites (including one that is multi-component). These sites provide evidence that homesteading, ranching, and mining were the predominant activities in the area during the historic period (circa 1846-1930). The historic archaeological sites include an early 20th century homestead site, a shepherd’s shack (since burned down), possible remnants of a small bridge, two small trash dumps, a power/telegraph line, and a mine adit and associated features. Site 300 also contains remnants of the residential section of the former town of Carnegie. At the turn of the 20th century, Carnegie hosted a population of approximately 2,500 inhabitants and supported churches, schools, company stores, a hotel, saloons, pool halls, laundries, ice cream parlors, barber and beauty shops, bunk houses for the single men, and company housing for the married men and their families who worked at the Carnegie Brick and Pottery Plant.

Of the 23 historic archaeological resources recorded at Site 300, DOE/NNSA recommended that three are eligible for listing in the NHRP because of their potential to yield information important in history. SHPO concurred with this determination in 2005 (OHP 2005a). No known NRHP-eligible archaeological historic sites are located within or adjacent to the Building 851 Complex.

3.2.3 Historic Buildings, Structures, Objects, and Districts

An assessment of LLNL's built environment for potential historical significance was undertaken in 2004 (Ulrich and Sullivan 2007). As a result of the assessment, DOE/NNSA, in consultation with the SHPO, determined that one building and two historic districts (encompassing a total of thirteen buildings that are contributing elements to the two districts) at Site 300 were eligible for listing in the NRHP because of their association with important research and development that was undertaken within the context of the Cold War (OHP 2005b). Building 851A was determined eligible for listing in the NRHP as a contributing element to the Hydrodynamic Test Facilities District, which also includes Building 850 (OHP 2005b). However, in 2017 at SHPO's request, DOE/NNSA reevaluated the District and determined it no longer maintained integrity for listing in the NRHP as a result of continuous facility upgrades to ensure a safe work place and environmental compliance. DOE/NNSA prepared a Historic American Engineering Record (HAER) and submitted it to the SHPO, National Park Service, and the Library of Congress.

3.2.4 Paleontological Resources

Several vertebrate fossil deposits have been found at Site 300 and in the vicinity of Corral Hollow Road. Most finds have been a result of road improvement or erosion along stream banks. Nearly all bone fragments found are considered to be Miocene age and are scattered within the Neroly Formation. Several mammalian groups are represented: camelids, mastodon, assorted early horses, shrews, beavers, and squirrels. Fossil finds are generally widely scattered and consist of one or a few fragments of bone, although in 1991 numerous fossil bones and bone fragments were found on the fire trail and road improvement areas along a ridge in the southern portion of Site 300. Invertebrate shells, primarily oysters, have been recovered from the Cierbo Formation. Stem and leaf fossils are found in many places within the finer-grained sediments of the Lower Neroly Formation. No significant invertebrate or botanical fossil locales have been identified on Site 300 or in the surrounding area (DOE/NNSA 2005).

No paleontological resources have been identified within the Building 851 Complex or muster area. There are no paleo-sensitive geological areas within or adjacent to the Building 851 Complex, however paleo-sensitive geological areas are located within the Building 851 muster area. Standard LLNL practice, requires work to be halted if any previously unknown resources are discovered during ground-disturbing activities, and that a qualified Paleontologist be provided an opportunity to assess the find.

3. 3 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND COMMUNITY SERVICES

3.3.1 Socioeconomics

A detailed analysis of socioeconomics was completed in the 2005 SWEIS relating to employment opportunities and expenditures. This analysis was based on September 2002 data that showed 240 LLNL personnel at Site 300 and approximately 10,360 workers across both LLNL Sites (DOE/NNSA 2005). As of September 2016, the actual LLNL-affiliated workforce, including subcontractors, was 6,360 people. As of June 2017, 178 people work at Site 300.

Most of the LLNL workforce resides in Alameda, San Joaquin, and Contra Costa counties. Site 300 overlaps Alameda and San Joaquin counties, but most of the 7,000 acres are in San Joaquin County. The U.S. Census Bureau Quick Facts website and the State of California Employment Development Department (EDD) website were accessed to provide recent socioeconomic information. The population as of April 1, 2010 was 685,306 people in San Joaquin County, 1,510,271 people in Alameda County, and 37,253,956 people in the State of California (U.S. Census Bureau 2017). Alameda County had a labor force of 836,900 people and a 4.0% unemployment rate as of June 2017 (EDD 2017). As of June 2017, San Joaquin County had a labor force of 315,900 people, with a 7.3% unemployment rate (EDD 2017). For comparison, the State of California had a labor force of 19,145,700 and unemployment rate of 4.9% (EDD 2017).

3.3.2 Environmental Justice

Environmental Justice has been defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Ongoing operations were analyzed in the 2005 SWEIS for the potential to result in disproportionately high and adverse health or environmental impacts on low-income or minority populations. No predominately minority or low-income populations reside within a 5-mile radius of concern for Site 300.

Site 300 overlaps Alameda and San Joaquin counties, but most of the 7,000 acres are in San Joaquin County. The U.S. Census Bureau Quick Facts website was accessed in 2017 to provide the following information for the State of California, Alameda, and San Joaquin counties. For the purposes of this EA minority populations are all people of color, which includes all ethnic and racial groups except non-Hispanic or non-Latino whites.

For California, approximately 62.3% of the total population is part of a minority population, while the minority population of Alameda County is 67.9% and San Joaquin County is 67.2% (U.S. Census Bureau 2017). Approximately 15.3% of people live in poverty in California, while 11.5% of people in Alameda County and 17.5% of people in San Joaquin County live in poverty. Median household income (in 2015 dollars) 2011-2015 was $22,645 for San Joaquin County and $37,285 for Alameda County and $30,318 for California (U.S. Census Bureau 2017).

3.3.3 Community Services

For the purposes of this EA, community services include fire protection and emergency services, police protection and security services, school and other public services, and nonhazardous solid waste disposal from operation of LLNL. LLNL has mutual assistance agreements in effect with neighboring jurisdictions for fire protection and emergency services, and police and security services.

The Alameda County Fire department operates two stations at LLNL. Fire Station No. 1 at the Livermore Site and Fire Station No. 2 at Site 300. Fire Station No. 2 is located in Building 890 and personnel are on duty 24 hours a day. The station is equipped with two large pumpers (1,000 and 1,250 gallons per minute), the smaller of which is a four-wheel drive vehicle. An ambulance is also located at the station. The average Site 300 fire response time onsite is 4.5 minutes. Station No. 1 at the Livermore Site can provide backup to Site 300, with a minimum response time to the Site 300 main gate from the Livermore Site of 15 minutes.

The LLNL Protective Force Division provides protection for LLNL personnel and assets as well as emergency response service to the Livermore Site and Site 300. LLNL has contingency plans to cover credible emergencies including, work stoppages, natural disasters, and site-wide evacuations. LLNL maintains a comprehensive emergency management program. LLNL incorporates into its emergency response program a broad range of hazards and environmental aspects, potential consequences, and lessons learned from simulated and actual emergencies.

Nonhazardous solid wastes are collected several times a month at Site 300 and transported offsite for disposal. LLNL implements waste reduction and recycling programs for cardboard, paper, and metal at Site 300.

3.4 GEOLOGY AND SOILS

Site 300 occupies approximately 7,000 acres of steep ridges and canyons. The maximum elevations onsite are found in the northwest portions near Building 851 and range from 1,476 feet to 1,722 feet above mean sea level. The lowest elevation onsite, approximately 500 feet above mean sea level is in the GSA where Corral Hollow Creek follows the Site 300 southern boundary (DOE/NNSA 2005).

A majority of exposed strata onsite are of Tertiary age, including the Miocene Cierbo and Neroly Formations. The Miocene Neroly Formation is exposed over the greatest areal extent of all sedimentary units onsite. Nonmarine sedimentary rocks of Pliocene age overlay the Neroly Formation strata on some isolated hilltops. Additionally, younger Quaternary alluvium occurs in stream channels and landslide deposits are present in limited areas. Site 300 soils have developed on marine shale and sandstones, uplifted river terraces, and fluvial deposits. All Site 300 soil types are potentially useful for limited agriculture but are constrained by location, steepness of the slopes, ongoing operations, and land use controls.

Site 300 is located near the eastern edge of the Coast Range Province, which is characterized by northwest trending, strike-slip faults of the San Andreas Fault system. The boundary between the Coast Ranges and the San Joaquin Valley lies immediately east of Site 300 and is characterized by east-northeast compression, resulting in reverse and thrust faulting and folding (DOE/NNSA 2005).

The principal faults in the vicinity of Site 300 are the Corral Hollow-Carnegie, Black Butte, and Midway. The active Carnegie Fault of the Corral Hollow-Carnegie Fault zone crosses the southern portion of the site. The Elk Ravine Fault, a complex structure composed of pre-Holocene strike-slip faults, reverse faults, normal faults, and local folds, crosses Site 300 from the northwest corner to the southeast corner. No significant recorded earthquakes have occurred on any of the local faults (DOE/NNSA 2005).

A history of site contamination can be found in the 2005 SWEIS and the 2008 Final Site-wide Record of Decision, Lawrence Livermore National Laboratory, Site 300. Site 300 has been divided into nine Operable Units to effectively manage site cleanup in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Building 851 firing table is part of the Operable Unit (OU) 8 at Site 300 that has a monitoring-only remedy. Volatile Organic Compounds (VOCs) and uranium-238 were identified in subsurface soil, and Research Department Explosive (RDX), uranium 238, and metals in surface soil at the Building 851 firing table.

In 2016, soil and rock samples were analyzed for uranium, high explosives compounds, and metals; results were below reporting limits for high explosives and below reporting limits or within background for metals (LLNL 2017). Ground water has not been impacted by uranium, metals or RDX in surface soil or VOCs and uranium in subsurface soil (LLNL 2013). Ground water continues to be monitored to detect any impacts to ground water from depleted uranium in surface soil and subsurface soil and rock (LLNL 2017). No risks or hazards to humans or animal populations or threat to ground water associated with these contaminants in surface soil or subsurface soil has been identified (DOE 2008, LLNL 2013).

3.5 Ecological Resources

Extensive surveys were performed at Site 300 for the 2005 SWEIS and the results were summarized in the 2005 SWEIS (DOE/EIS – 0348). These surveys assessed the presence of species listed as threatened or endangered under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA). These surveys also noted the presence of native species of plants, amphibians, reptiles, and mammals with other special status such as California species of special concern. Since that time, LLNL monitors for changes in occurrences and habitat availability.

3.5.1 Plants

Annual grassland is the prominent landscape feature covering more than 5,000 acres at Site 300. Grassland composed of native plant species is present but less prominent, covering more than 400 acres. Site-wide vegetation surveys conducted at Site 300 have identified a total of 406 plant species. The Building 851 Complex and firing table are previously disturbed and developed areas. The habitat immediately surrounding (within a 700-foot radius) the Building 851 firing table is annual grasslands. Areas within the Building 851 muster are primarily annual grassland but there are also patches of perennial grassland, coastal scrub, and blue oak woodland.

The only federally-protected plant species known to occur at Site 300 is the large-flowered fiddleneck (*Amsinckia grandiflora*). Large-flowered fiddleneck is listed as endangered under both ESA and CESA, and has a status of California Rare Plant Rank 1 B (Plants considered rare and endangered throughout their range by the California Native Plant Society [CNPS]). One hundred sixty acres at Site 300 have been set aside as the "*Amsinckia grandiflora* Reserve" to protect this species' natural habitat. LLNL continues to maintain and monitor an experimental population of large-flowered fiddleneck in the *Amsinckia grandiflora* Reserve at Site 300 and participates in the U.S. Fish and Wildlife Service (USFWS) large-flowered fiddleneck Recovery Team. LLNL is working with the USFWS on continued monitoring of native and experimental large-flowered fiddleneck populations and further development of habitat restoration and maintenance techniques.

Large-flowered fiddleneck is not found within the Building 851 firing table. The northwestern corner of the *Amsinckia grandiflora* Reserve is within the Building 851 4000-foot muster. Only 0.46 acres of the 160 acre *Amsinckia grandiflora* Reserve overlap with the muster area. The Draney Canyon population of the large-flowered fiddleneck is located approximately 4,300 feet southwest of Building 851. No large-flowered fiddleneck plants have been observed at this location since a landslide in the canyon in 1997. Including large-flowered fiddleneck, five rare plant species and three uncommon plant species are known to occur at Site 300.

The big tarplant (*Blepharizonia plumosa*), has a status of California Rare Plant Rank 1B (CNPS 2017). Big tarplant is widespread and common at Site 300 but extremely rare outside of Site 300. The big tarplant is abundant adjacent to the Building 851 perimeter fence and in the burned areas surrounding the building. This species thrives in the disturbed areas created by the annual prescribed burn and herbicide treatments around the perimeter fence.

The round-leaved filaree (*Erodium macrophyllum*), has a status of California Rare Plant Rank 1B (CNPS 2017). This species can thrive in disturbed areas and has been identified at six locations at Site 300. One population is associated with the diamond-petaled California poppy *(Eschscholzia rhombipetala)* in the Round Valley area of Site 300. This species occurs in the fire trails located approximately 1,200 feet west of the Building 851 firing table, and also in fire trails and adjacent grasslands approximately 2,500 feet southwest of Building 851.

The diamond-petaled California poppy has a California Rare Plant Rank of 1B (CNPS 2017). It is present at four locations at Site 300 and the distribution of this species is extremely limited outside of Site 300. There are two populations of the diamond-petaled California poppy within the Building 851 muster: one approximately 2,200 feet west of Building 851 and the second approximately 2,700 feet southwest of Building 851.

Adobe navarretia (*Navarretia nigelliformis* ssp. *radians*) California Rare Plant Rank of 1B (CNPS 2017) was found at Site 300 during the 2009 through 2012 biological review completed in January of 2014. Sitewide surveys for this species have not been conducted, but in the course of other surveys, this species has not been observed at the Building 851 Complex.

The three uncommon plant species, California androsace, stinkbells (*Fritillaria agrestis*), and hogwallow starfish (*Hesperevax caulescens*), occur in isolated locations at Site 300. These plants have a California Rare Plant Rank of 4 (CNPS 2017) that includes plants of limited distribution that are not considered rare or endangered.

The California androsace, occurs in several isolated population at Site 300 where rocky outcrops are found on north facing slopes. The closest known location is 2,500 feet northeast of Building 851. Appropriate habitat for this species occurs on the steep north facing slope just north of the Building 851 Complex. Stinkbells is found in small populations in the northwest corner of Site 300 approximately 4,100 to 7,000 feet northwest of Building 851. The hogwallow starfish is found at a single location approximately 1,450 feet west of Building 851 and just south of the round-leaved filaree population described above.

The gypsum-loving larkspur (*Delphinium gypsophilum*), a spring flowering perennial that also occurs in isolated areas throughout Site 300, was previously assigned California Rare Plant Rank of 4. In 2012, this designation was removed from the gypsum-loving larkspur because the species is now considered too common (CNPS 2017).

3.5.2 Wildlife

No federally-protected brachiopods have been identified at Site 300 as of 2016, based on surveys during 2001-2002, 2002-2003, 2009, 2010 and 2016 (LLNL 2004, 2005, 2010, ESA 2016). Site-wide surveys in 1980, 1986, 1991, and 2002 resulted in zero detection of the San Joaquin kit fox (*Vulpes macrotis mutica*), endangered under ESA and threatened under CESA. Although Site 300 contains potential habitat and occurs within the northern range of the San Joaquin kit fox, the species is not considered a resident species as of 2017.

Protected species known to occur at Site 300 that do not occupy the Building 851 Complex, firing table, or muster because the area lacks suitable habitat are: Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), western spadefoot toad (*Spea hammondii*), and tricolored blackbird (*Agelaius tricolor*).

The Valley elderberry longhorn beetle, a threatened species under ESA, and its host species, the blue elderberry plant, are known to occur at Site 300 in Spring 6/Elk Ravine riparian area and in Gooseberry Canyon east of Building 812 and in other isolated areas. Neither the Valley elderberry longhorn beetle, nor its host species occur in the Building 851 Complex, firing table or muster areas.

The Western spadefoot toad, a federal species of concern and state species of special concern, has been observed at the Overflow Pond and Burn Cage Pool located in the GSA and along the southern boundary of the site, but has not been observed in or near the Building 851 Complex, firing table or muster.

The tricolored blackbird is a federal species of concern and state species of special concern that nests at Site 300 in Elk Ravine. In 2014, the tricolored blackbird was provided emergency protection under the CESA and is currently a state candidate for listing as endangered. As of 2015, the USFWS was reviewing the conservation status of the tricolored blackbird in response to a petition to list the species under the ESA (USFWS 2015). Tricolored blackbirds do not nest within the Building 851 Complex, firing table or muster.

Because the Building 851 firing table and Building 851 Complex are highly disturbed, they do not provide quality habitat for wildlife. However, within the Building 851 muster, common and protected wildlife occur that are typical of annual grasslands. Two protected species of amphibian occur in the Building 851 muster: the California red-legged frog (*Rana draytonii*) and the California tiger salamander (*Ambystoma californiense*).

The California red-legged frog, a threatened species under the ESA and a state species of special concern occurs at several locations at Site 300. The upland grassland habitat in the Building 851 muster is within the dispersal distance for California red-legged frogs and provides upland habitat for this species. The current California red-legged frog critical habitat rule (50 CFR Part 17 RIN1018AV90) was finalized in March 2010 and includes all of Site 300 (USFWS 2010). As of 2016, there are seven known breeding locations for California red-legged frogs at Site 300 (Pools A, CP, M1a, M1b, CR, S, and OS) and only four locations (Pool A, CR, M1a, and M1b) provide population recruitment on average rainfall years. The closest California red-legged frog breeding pool to the Building 851 firing table is over 5,500 feet away.

The California tiger salamander is a threatened species under the ESA and a state species of special concern. As of 2016, California tiger salamanders have been reported at Site 300 at pools D, A, H, M2, S, OS, Overflow Pond and M3. In January of 2016, California tiger salamander eggs were observed in Pool HC1. The California tiger salamander is known to spend the majority of each year in upland habitat up to 2 km from breeding pools; the Building 851 muster contains suitable upland habitat for this species. The closest California tiger salamander breeding pools to the Building 851 firing table are Pool M2 and Pool HC1. Both pools are located at the boundary of the Building 851 muster area approximately 4,000 feet from the firing table.

Various species of lizards and snakes occur in the grasslands surrounding the Building 851 Complex and within the muster, including common species such as gopher snakes, northern Pacific rattlesnakes, and western fence lizards. Three protected reptile species have potential to occur in the Building 851 muster: Alameda whipsnake (*Masticophis lateralis*), coast horned lizard (*Phrynosoma (Anota) coronatum*), and San Joaquin coachwhip snake (*Masticophis flagellum ruddocki)*.

The Alameda whipsnake is listed as threatened under both ESA and CESA. This species is known to occur primarily in scrub habitat at Site 300. This species is unlikely to occur at the

Building 851 firing table. However, suitable scrub habitat for the species exists within the Building 851 muster primarily in the southern and western portions. Critical habitat for the Alameda whipsnake was designated in the 2006 critical habitat final rule and encompasses 2,492 acres of Site 300 including portions of the Building 851 muster (USFWS 2006).

The coast horned lizard, a federal species of concern and state species of special concern, occurs in the more open grasslands with sandy or gravelly areas in the northern and eastern portions of Site 300. This species was observed outside of the Building 851 Complex but near the fence line during pre-activity surveys conducted in 2014 and 2015.

The San Joaquin coachwhip snake is a federal species of concern and state species of special concern. It has been observed in grassland and scrub land at Site 300. Site-wide surveys conducted in 2002 documented this species in Gooseberry Canyon and along Linac Road. Upland areas, such as those surrounding Building 851 were not surveyed. No additional surveys for this species have been conducted near Building 851. The San Joaquin coachwhip snake has the potential to occur in the Building 851 muster.

Raptors observed at Site 300 include ferruginous hawk (*Buteo regalis*) a federal species of concern and state species of special concern, Cooper's hawk (*Accipiter cooperii*) a state species of special concern, sharp-shinned hawk (*Accipiter striatus*) a state species of special concern, golden eagle (*Aquila chrysaetos*) a state species of special concern and federally protected under the Bald and Golden Eagle Protection Act, northern harrier (*Circus cyaneus*) a state species of special concern, burrowing owl (*Athene cunicularia*) and white-tailed kite (*Elanus leucurus*) a state fully protected species. Resident and migratory raptors may use the habitats in the Building 851 muster for foraging.

The landscape surrounding Site 300 supports a dense population of golden eagles. The nearest golden eagle nest to Site 300 and the Building 851 Complex occurs offsite to the West on an adjacent property. Monitoring surveys in 2015 and 2016 indicated that this pair of eagles uses Site 300 for foraging; no nesting activity was observed at Site 300 (Garcia and Associates 2014, 2015, 2016).

Other species known to occur at Site 300 include the horned lark (*Eremophila alpestris*) a state species of special concern, the grasshopper sparrow (*Ammodramus savannarum*) a federal species of concern, loggerhead shrike (*Lanius ludovicianus*) a state species of special concern and federal bird of conservation concern, and the yellow warbler (*Dendroica petechia*) a state species of special concern. These special status birds and other birds protected under the Migratory Bird Treaty Act may use the habitats in the Building 851 muster for foraging and dispersal.

Mammals with potential to occur within the Building 851 muster include American badgers, mice, hares, squirrels, skunks, foxes, coyotes, bats, and black-tailed deer.

The American badger (*Taxidea taxus*) is a state species of special concern and generally occurs in the more rolling terrain at the northern segment of Site 300. American badgers have been observed using the hillsides around the developed footprint of Building 851 to forage and dig dens. The San Joaquin pocket mouse (*Perognathus inornatus*) is a federal species of concern and has been observed in annual grasslands and oak savannahs at Site 300. Passive acoustic monitoring for bats at the Site 300 meteorological tower from 2015 to 2016 did not identify any species of bats protected at the state or federal levels. The pallid bat *(Antrozous pallidus)* and western red bat *(Lasiurus blossevillii)*, both state species of special concern, were noted during surveys conducted in 2002. Appropriate habitat exists at Site 300 for several species of bats.

3.5.3 Floodplains and Wetlands

There are no 100-year floodplains on Site 300 and the 100-year base flood event would be contained within all channels. However, due to the steep slopes and high runoff potential, velocities within these channels could be high during a peak flood event (DOE/NNSA 2005).

In August 2001, a wetland delineation study at Site 300 identified 46 wetlands and determined that the total size of wetlands was 8.61 acres. A total of 4.39 acres were found to meet criteria for jurisdictional wetlands. These wetlands are small and include freshwater seeps, vernal pools, and seasonal ponds. Many of the wetlands occur as springs in the bottom of deep canyons in the southern half of the site. They typically range in width from 5 to 30 feet wide with most being 10 to 20 feet wide. Most are relatively short, with lengths of 100 to 600 feet (DOE/NNSA 2005).

No wetlands occur on the Building 851 firing table or within the Building 851 Complex, although wetlands occur within the Building 851 muster area. The Pool HC1 (previously known as Round Valley Pool) Jurisdictional Determination was completed in 2012, resulting in the identification of 0.16 acres of wetlands approximately 4,000 feet away from the Building 851 firing table. This pool is located along an intermittent drainage locally known as Draney Canyon that is tributary to Corral Hollow Creek. A total of 0.044 acres of potential jurisdictional wetlands and 0.074 acres of non-wetland jurisdictional waters were identified at Pool M2 in 2013, approximately 4,000 feet away from the Building 851 firing table. Pool M2 is located along an intermittent drainage channel that flows through the Building 851 muster area and is tributary to Corral Hollow Creek.

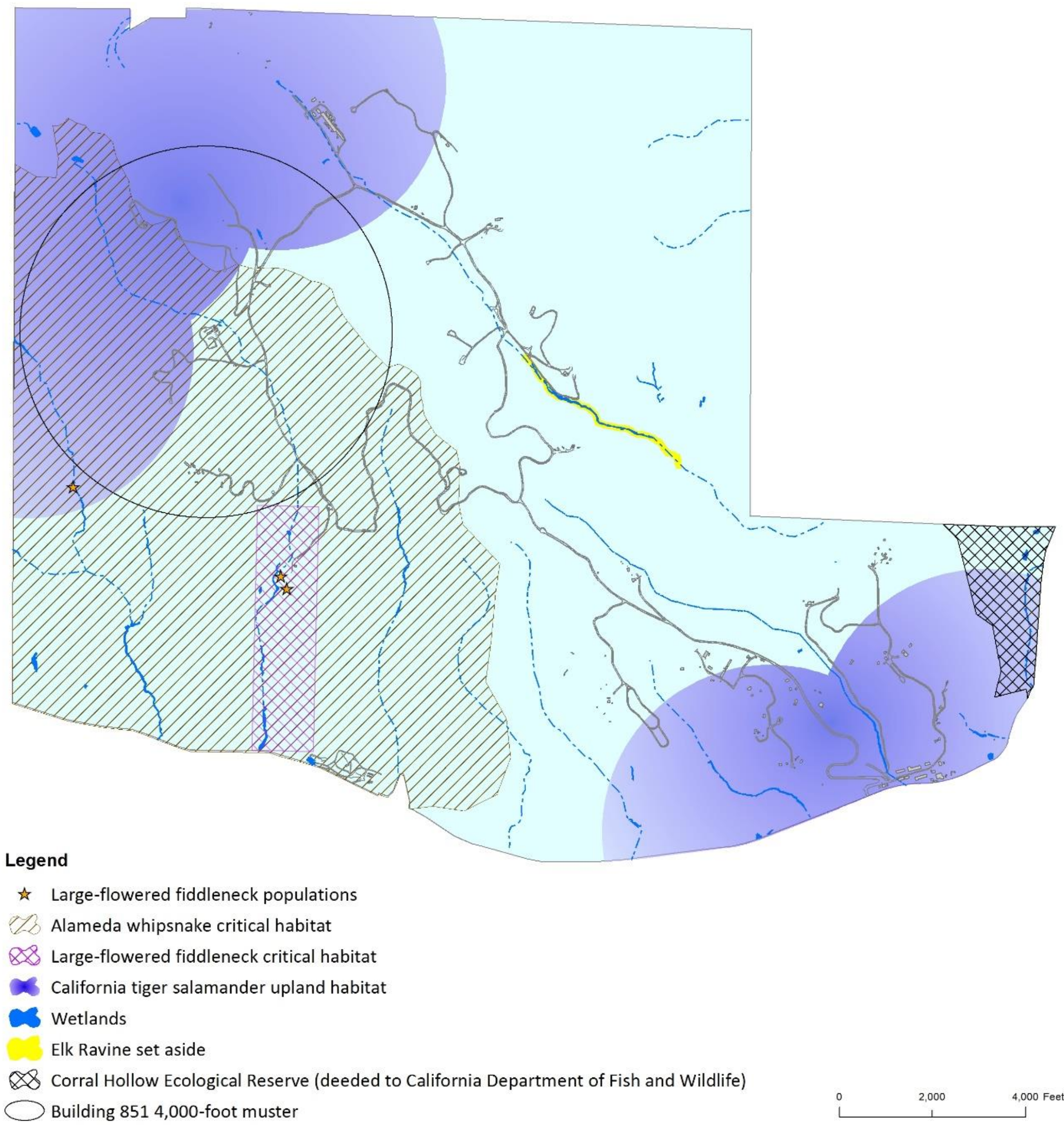

Figure 2. Site 300 Ecological and Wetland Resources.

3.6 AIR QUALITY

LLNL Site 300 activities with the potential to produce air pollutant emissions are evaluated to determine the need for permits and are assessed for continued compliance. Areas of public interest for air quality at Site 300 include criteria air pollutants, toxic and hazardous air pollutants, and radiological emissions. Site 300 activities are subject to air quality regulations and standards established under the Clean Air Act, by the State of California, and under the rules and regulations of the SJVAPCD, the U.S. Environmental Protection Agency (EPA), as well as by internal policies and requirements of DOE/NNSA.

The SJVAPCD grants two types of permits, an Authority to Construct and a Permit to Operate. An Authority to Construct must be obtained before building or installing a new emissions unit or modifying an existing emissions unit that requires a permit. A Permit to Operate is issued after all construction is completed and the emission unit is ready for operation. For the purposes of this EA, the Authority to Construct and Permit to Operate (ATC/PTO) are considered as one permitting process.

LLNL evaluates all activities at Site 300 to determine the need for air permits from the SJVAPCD in accordance with the Clean Air Act. Ongoing Site 300 activities that contribute to the emission of criteria pollutants include internal combustion engines, a gasoline dispensing facility, prescribed burns, paint spray booths, and drying ovens. Activities and equipment that contribute to emissions and require permitting are called sources. There is one source at Site 300, an emergency engine/generator at the West Observation Post that operates in compliance with a permit issued by the Bay Area Air Quality Management District (BAAQMD), because of its location in Alameda County. This source serves a general site security function and is not associated with the Proposed Action. All other sources at Site 300 are operated under SJVAPCD-issued PTOs except for prescribed burns. The annual prescribed burn is subject to a separate joint approval process involving SJVAPCD and California Air Resources Board (CARB). LLNL also compiles an inventory of toxic air contaminants (TAC) under the California Air Toxics “Hot Spots” program. Based on the air toxics inventories, SJVAPCD and BAAQMD have ranked LLNL as a low-risk facility for non-radiological air emissions.

Existing sources of air emissions at the Building 851 Complex are the detonations at the firing table and emissions from vehicles that service the operations. Experiments with up to 100 lbs./day and 1,000 lbs./yr. of explosives are currently performed at the Building 851 firing table. Metals and other materials may be part of an experiment, or may be used to construct the device being detonated (i.e. the assembly). During an experiment, the emissions of air contaminants results from the decomposition of explosives, the destruction of the assembly, and from surface cratering and surface scouring. Surface cratering occurs on the Building 851 firing table immediately below the explosive test from air pressure. Surface scouring results from air pressure changes in the area immediately outside the crater area but within the Building 851 Complex. These existing operations are performed in accordance with SJVAPCD Rule 2020 Section 7.4.

3.6.1 General Conformity

The goal of General Conformity is to demonstrate that a proposed federal action will not:

- Cause or contribute to new violations of a national ambient air quality standard (NAAQS);
- Interfere with provisions in the applicable State Implementation Plan (SIP) for maintenance of any NAAQS;
- Increase the frequency or severity of existing violations of any standard;
- Delay the timely attainment of any standard.

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 SIP. A conformity determination is required for each criteria pollutant or precursor organic compound where the total of direct and indirect emissions of the criteria pollutant or precursor organic compounds is a nonattainment, or maintenance area caused by a federal action would equal or exceed specified emission rates. The specified emission rates are described as de-minimis thresholds. The SJVAPCD is an “extreme” nonattainment area for federal standards ozone. Therefore, a conformity threshold of 10 tons per year are applied separately for emissions of precursor organic compounds and nitrogen oxides (NOx). SJVAPCD is also nonattainment for particulate matter (PM) with a diameter less than 2.5 micrometer (i.e., PM2.5) and is attainment for PM10 with a conformity threshold of 100 tons per year/each.

The PM threshold or 100 tons per year is described in subdivisions as: directly emitted PM10, directly emitted PM2.5, Sulfur dioxide (SO2 as PM2.5 precursor), and NOx (as PM2.5 precursor). However, the role of NOx as an ozone precursor overrides its role as a PM2.5 precursor, therefore the threshold of 10 tons per year applies. The threshold for Carbon Monoxide (CO) is 100 tons per year. There is some potential for ammonia or VOCs to contribute to PM2.5, but there is no conformity threshold for this relatively insignificant contribution. Site 300 conformity is assured on an ongoing basis through compliance procedures, and monitored through the district emission inventory and compliance programs.

In Calendar Year 2016 at Site 300, annual emissions were 269 lbs./yr. PM10, 77 lbs./yr. SOx, 1,512 lbs./yr. NOx, and 354 lbs./yr. CO.

3.6.2 Greenhouse Gases

LLNL’s greenhouse gas (GHG) footprint is defined by three major scopes of GHG emissions. LLNL’s Scope 1 emissions are the result of direct emissions associated with fuel combustion or fugitive emissions. LLNL’s Scope 2 emissions are a result of indirect emissions associated with consumption of purchased or acquired electricity. All other potential Scope 2 emissions are not applicable to LLNL. Scope 3 emissions include all indirect emissions not included in Scopes 1 and 2.

Scopes 1 and 2 GHG emissions are offset by the estimated annual GHG emissions avoided by purchased renewable energy credits (RECs). LLNL's largest contributor to Scope 1 and 2 GHG emissions is electrical energy use. Because there are many types of gases that contribute to total GHG emissions, and each gas has a different global warming potential, GHG emissions are reported in metric tons of CO2-equivalents (mtCO2e). In a typical fiscal year, LLNL's Scope 1 and 2 GHG emissions together are approximately 130,000 MtCO2e.

Employee commuting and business air travel, along with transmission and distribution losses associated with electricity use continue to account for the majority of LLNL's Scope 3 emissions. In a typical fiscal year, LLNL's Scope 3 GHG emissions are approximately 40,000 mtCO2e. LLNL's Scope 3 emissions are offset by REC purchases.

Under the authority of Assembly Bill 32, signed on September 27, 2006, the State of California adopted several new regulations regarding emissions of greenhouse gases. For facilities like LLNL, California requires mandatory reporting of greenhouse gases from stationary source combustion of natural gas that exceeds 10,000 mtCO2e. There is no natural gas service at Site 300 and no heating with fuel oil. There is a small amount of heating with propane at Site 300. The EPA mandatory reporting regulation, 40 CFR 98, for stationary emission sources is similar to California's regulation. However, the annual reporting threshold for the EPA's mandatory reporting regulation is 25,000 mtCO2e.

California also has regulations pertaining to sulfur hexafluoride (SF6), because of its high greenhouse-gas potential. LLNL must submit an annual report describing the research uses of SF6, the measures taken to control SF6 emissions, and must demonstrate that emissions from gas insulated switchgear are below the maximum allowable rate. Since 2010, LLNL has significantly raised the awareness on environmental issues with the continued use of SF6, and as a result, has successfully reduced GHG emissions through aggressive reduction and management of fugitive emissions from equipment using SF6.

3.6.3 Radiological Emissions

Radiological emissions are an area of public interest. LLNL is required to monitor certain air release points and evaluate all potential sources of radionuclide air emissions to determine the maximum possible dose to the public in accordance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) for radiological emissions. These evaluations include modeling based on radionuclide inventory data, air effluent (source emission) monitoring, and air surveillance monitoring. At Site 300, the CFF is monitored at the facility for radiological emissions. Air surveillance monitoring is performed at Site 300 to account for emissions Site-wide. Any radiological emissions detected must be reported. The results of monitoring and modeling are submitted annually to the EPA and are available in the Site Annual Environmental Reports located at https://www-envirinfo.llnl.gov/siteAnnualReports.php. Radiological emissions are consistently very low in comparison to allowable limits.

3. 7 WATER RESOURCES

3.7.1 Ground Water

Most groundwater from Site 300 flows toward the San Joaquin Valley. Runoff that concentrates in the Elk Ravine and Corral Hollow Creek recharges local bedrock aquifers. Two regional aquifers have been identified at Site 300: an upper water table aquifer in the sandstones of the lower Neroly Formation and a deeper confined aquifer within sandstone at the base of the Neroly Formation. Both aquifers have permeable zones layered with lower permeability claystones, siltstones, or tuffs. The deep confined Neroly aquifer occurs about 400 to 500 feet beneath the southern part of Site 300 and provides the Site 300 water supply. Pumping tests performed in Site 300 water supply wells affirm the integrity of the aquitard separating the shallow and deeper aquifers within the lower Neroly Formation. In addition to the regional aquifers, local perched aquifers containing small amounts of water occur in some deposits within the Neroly Formation and the marine Tertiary sequence. Because the water quality in the perched water-bearing zones is generally poor and yields are low, these zones do not meet the State of California criteria for aquifers that are potential water supplies.

In the Building 851 area, the vadose (unsaturated) zone consists of approximately 100 to 150 feet of unconsolidated Quaternary alluvial and colluvial deposits and landslide deposits, and underlying unsaturated lower Neroly Formation sandstone and siltstone/claystone bedrock. The underlying saturated zone is confined and occurs within Cierbo Formation sandstone, claystone, pebble conglomerate, and shale. Depth to water varies from 100 to 150 feet below ground surface, and the saturated thickness varies from 5 to 10 feet.

The 2005 SWEIS and the 2008 Final Site-wide ROD Site 300, describe the locations of groundwater contamination at Site 300. The Site has been divided into nine OUs to effectively manage site cleanup in accordance with CERCLA. Building 851 firing table is part of OU 8. The 2008 ROD specifies that the remedy for Building 851 is monitoring-only. Groundwater monitoring is conducted in accordance with requirements for wells in the Building 851 area. New monitoring wells are drilled as needed to adequately perform monitoring, the most recent of which were constructed in 2016. Uranium has been detected in ground water beneath Building 851 but at concentrations well below the 20 picocuries per Liter (pCi/L) Maximum Contaminant Level (MCL) cleanup standard (LLNL 2017). No risks to human or ecological receptors have been associated with this contamination (DOE 2008, LLNL 2013).

3.7.2 Surface Water

Surface water at Site 300 consists of seasonal runoff, springs, and natural and man-made ponds. The canyons that dissect the hills and ridges at Site 300 drain into intermittent streams. The majority of intermittent streams at Site 300 drain south to Corral Hollow Creek, also intermittent, which runs along the southern boundary of Site 300 toward the east into the San Joaquin Valley. Elk Ravine, a major drainage channel for most of Site 300, extends from the northwest portion of the site to the east-central area and drains the center of the site into Corral Hollow Creek. Some of the canyons in the northeast section of Site 300 drain to the north and east toward the city of Tracy in the San Joaquin Valley.

Naturally occurring springs are shown by the presence of flowing water or wet soils where the water table is close to the surface and the presence of distinct hydrophytic vegetation (i.e. plants that have adapted to grow in water such as cattails and willows). There are at least 22 springs at Site 300. Natural surface water in the Building 851 area is the result of surface runoff from precipitation. Natural surface runoff is rarely observed, and only occurs briefly during more significant or prolonged storms. There are no surface water bodies at the Building 851 firing table. The closest pond is within the Building 851 muster area, but is over 3,800 feet away from the firing table and is not in the line of sight of the Building 851 facility.

Storm water at Site 300 is monitored to achieve compliance with the Storm Water Industrial General Permit (2014-0057-DWQ) that took effect July 1, 2015. Storm water monitoring also follows the requirements in the DOE handbook *Environmental Radiological Effluent Monitoring and Environmental Surveillance* and meets the applicable requirements of DOE Order 458.1.

3.8 NOISE

This section describes the existing conditions at Site 300 as they relate to noise and vibrations.

Sounds are vibrations that travel through the air (or other medium) and are heard by a person’s ear. Noise includes any sounds that are perceived as loud, disruptive, unpleasant, or otherwise unwanted. Noise is measured in units of sound pressure levels called decibels (dB). The decibel scale is a nonlinear scale of measurement. The decibel scale simplifies the presentation of data that have a wide range of variation. Decibels cannot be added together without conversion, i.e., 1 dB + 1 dB does not equal 2 dB. Because the human ear is not equally sensitive to all audible sound frequencies, weighting systems are used to match the perception of loudness by the human ear. These noise weighting systems include A-weighted decibels (dBA) and C-weighted decibels (dBC).

3.8.1 Ambient Noise

Noise sources at Site 300 that contribute to ambient noise include vehicle traffic, pumps, motors, and equipment. Ambient noise is often measured in dB or dBA. The contribution of these onsite activities to ambient noise levels offsite is small. Sensitive noise receptors at Site 300 include workers and wildlife. In general, noise from ongoing operations at Site 300 is limited to the areas where the noise is created.

Table 2. Typical Sound Levels for Ambient Noises in A-weighted decibels (dBA).

Ambient Noise Source	Typical Sound Levels (dBA)*
Conversation (3 feet away)	60
Freight Train (100 feet away)	80
Construction Site	100
Operating Heavy Equipment	120
Jet Taking Off (200 feet away)	130

*A-weighted decibels closely match the perception of loudness by the human ear. This table is intended to provide context for ambient noises with which the public may be familiar. These noises do not relate directly to impulse noise. These noises are not associated with the Proposed Action. Source: (OHSA 2017).

3.8.2 Impulse Noise

Impulse noise is a discrete noise event that typically lasts less than 2 seconds (often less than one second) and produces a rapid increase in sound pressure level (EPA 1974). Impulse noise events consist of low-frequency noise (i.e. noise containing components less than 200 Hertz). Because A-weighted decibels de-emphasize low-frequency noise, they are not often used to measure impulse noise. C-weighted decibels are often used to measure impulse noise, because impulse noise contains more low-frequency noise energy. Unweighted decibels may also be used in the context of impulse noise. Examples of impulse noises that may be familiar to the general public include gunshots and fireworks.

Explosives tests are conducted regularly at Site 300, within the CFF and on the Building 851 firing table. Occasionally, noise may be heard offsite from the pistol and rifle firing range. These activities are not in conflict with land use compatibility guidelines.

Sound pressure level is the principal damage criterion used at Site 300 for assessing impulse noise impacts (LLNL 1991). To limit nuisance to nearby residents and preclude damage to property from airborne vibrations, LLNL self-imposes one second averaged sound pressure level of 126 dB (400 µbar), not to be exceeded in nearby populated areas (DOE/NNSA 2005). This value is considerably lower than some known damage thresholds, for example an overpressure level of about 1,000 µbar is needed to break large windows, and about 10,000 µbar to break small windows (LLNL 1991, Reed 1959). To limit nuisance to nearby residents, impulse noise events at Site 300 occur only between the hours of 10:00 am to 8:50 pm.

Sounds dissipate more and more rapidly as the distance from the source of the sound increases. Ground surface conditions, topographic features, and structural barriers can absorb, reflect, or scatter sound waves (resulting in lower noise levels). The Building 851 firing table has been positioned to take advantage of the natural terrain barrier of the surrounding ridges. Noise propagation is highly influenced by meteorological conditions such as temperature, wind speed, wind direction, and turbulence. LLNL has studied the propagation of noise in an attempt to limit noise impacts on adjacent land uses and nearby communities (Pfeifer, Odell, and Arganbright 1980, LLNL 1991, 1993). Scientists at LLNL continue to study the fundamental science of sound wave propagation as it has other scientific applications as well. LLNL performs blast forecasting with meteorological data and specifically designed computer codes prior to experiments to avoid noise-related impacts on nearby populated areas.

3.8.3 Ground-borne Vibrations

Ground-born vibrations resulting from experimental detonations are absorbed by the firing table gravel. It is generally accepted that vibration attenuates at a rate of approximately 50% for each doubling of distance from the source of the vibration. The firing table gravel layer impedes the transfer of vibrations to the soils below in this way preventing the spread of ground-born vibrations.

3.8.4 Worker Exposures

The Occupational Safety and Health Administration (OSHA) sets the legal limits for workers exposure to noise in the workplace. LLNL implements practices to reduce noise and protect workers who may be exposed to excessive noise levels based on 29 CFR 1910.95 “Occupational Noise Exposure” and 29 CFR 1926.52 “Occupational Exposure to Noise in Construction”. Under 29 CFR 1910.95, exposure to impulsive noise should not exceed 140 dB peak sound pressure level.

3.9 TRAFFIC AND TRANSPORTATION

Regional access to Site 300 is from I-580 to Corral Hollow Road. Travel between the Livermore Site and Site 300 is by way of Tesla Road in Alameda County. The name of Tesla Road changes to Corral Hollow Road in San Joaquin County. The main access gate to Site 300 is on Corral Hollow Road approximately 15 miles east of Greenville Road. The Site 300 pistol range access gate is also on Corral Hollow Road. Tesla Road and Corral Hollow Road receive increased usage during commute periods because of congestion on I-580 through the Altamont Pass.

Roads onsite at Site 300 are restricted to use by government vehicles and contractor's company vehicles. Personal vehicles are only allowed in the parking areas in the GSA just beyond the Site 300 main gate. Site 300 roads and infrastructure are maintained by LLNL. Parking availability is adequate to meet Site 300 demand. Traffic on Site 300 roads is extremely light.

Most of the LLNL hazardous shipments to and from Site 300 are explosives shipments. Approximately 200 explosives shipments arrive per year, and 100 are sent per year. The outgoing shipments include explosive waste that cannot be treated at the Site 300 Explosive Waste Treatment Facility. All Site 300 shipment operations are conducted within established LLNL and DOE safety requirements and are conducted in accordance with U.S. Department of Transportation (DOT) regulations. There have been no explosions or fires resulting from accidents with explosive shipments from Site 300.

3.10 UTILITIES AND ENERGY

The Western Area Power Administration supplies primary electrical power to Site 300, and Pacific Gas and Electric provides backup power. Electricity consumption at Site 300 has been relatively stable since 2005. Site 300 uses between 11 and 16 million kilowatt-hours/year. In 2016, Site 300 consumed 13 million kilowatt-hours. Unleaded gasoline is consumed at Site 300 in vehicles for transportation of personnel, equipment and materials. Natural gas is not used at Site 300. Operations at the Building 851 Complex are not energy or water resources intensive.

3.11 MATERIALS AND WASTE MANAGEMENT

3.11.1 Materials

Explosives used in research activities are stored at Site 300. The explosives storage includes earth-covered explosive storage magazines, magazettes (i.e. a small, temporary, movable magazine, grounded for temporary storage of small quantities of explosive materials), and a packaging/receiving building. Other facilities include those for explosives formulation, machining, assembling, pressing, testing, and firing explosives. The quantities of explosive material maintained onsite are restricted by the approved explosive capacity of various storage areas.

An explosives safety program is used to manage explosives at LLNL in accordance with DOE Explosives Safety Standard 1212. The LLNL Explosives Safety Committee provides continual review, interpretation, and necessary revision to the explosives safety program. As part of its explosive material management strategy, LLNL uses facility-based explosives inventory systems to track and manage explosive inventories. The inventory systems maintain information on material composition, characteristics, and shipping requirements, life-cycle cost information, plan of use, security and hazard classifications, and compatibility codes. When an explosive material is moved, the system requires a safety check to ensure that the intended storage location can accept the type and quantity of material received. The facility-based inventory systems flag any storage capacity overages and incompatible explosive items. Additionally, inspections are conducted at explosives facilities as part of the safety program to ensure safe operations. Explosives from Site 300 and the Livermore Site are shipped in a manner that complies with DOT, DOE/NNSA, and LLNL requirements.

Other materials used in testing and operational activities at Site 300 include concrete, wood, steel plates, sandbags, and electronic sensors. No radioactive materials are currently used in open detonations at Building 851 Complex.

3.11.2 Waste Management

Waste management activities at Site 300 consist of managing, treating, storing, and preparing for offsite disposal of wastes in accordance with applicable federal and state regulations, permits obtained under these regulations, and DOE orders. Several waste categories are routinely generated at Site 300 under normal ongoing operations. Radioactive waste (low-level waste and mixed low-level waste) may be generated from experiments in the CFF. Hazardous waste, which includes Resource Conservation and Recovery Act hazardous [chemical and explosives] waste, state-regulated waste, and Toxic Substances Control Act waste [primarily asbestos, polychlorinated biphenyls, and lead based paint]) are generated at facilities across the Site. California Medical Waste Management Act waste (medical waste) is routinely generated at the Alameda County Fire Station. Nonhazardous solid waste, and process wastewater are generated from activities Site-wide. LLNL Site 300 hazardous and mixed waste storage and explosives waste treatment facilities operate under a hazardous waste facility permit issued by the Department of Toxic Substances Control. Most of these types of wastes are not generated at the Building 851 Complex.

Wastes generated at the Building 851 Complex from current ongoing activities include firing table debris and photo processing wastes. Firing table debris consists of gravel, wood, concrete, metals, and glass. Current operations at the Building 851 Complex do not include radioactive materials. While tritium and other radioactive materials were used at the Building 851 firing table prior to 2008, the firing table gravel that contained these materials was removed and replaced with clean gravel. However, because the protective berm may still contain these materials, LLNL conservatively manages firing table debris as low-level waste.

All wastes at Site 300 are characterized and segregated according to waste type. Uncontaminated metals are recycled in accordance with LLNL procedures. All other wastes are managed appropriately and in accordance with regulatory and DOE requirements for each waste type. Hazardous waste from photo processors is accumulated at the Building 851 satellite accumulation area and is subsequently transferred to the Livermore Site for treatment and/or disposal at offsite facilities.

3.12 HUMAN HEALTH AND SAFETY

It is the policy of DOE/NNSA and LLNL to operate in a manner that protects the health and safety of employees and the public, preserves the quality of the environment, and prevents property damage. LLNL complies with applicable environmental, safety and health laws, regulations, and requirements. LLNL also complies with directives promulgated by DOE regarding occupational safety and health. Through the Integrated Safety Management System and Work Planning and Control Process, LLNL systematically integrates safety into all work practices.

LLNL employs workplace evaluations and establishments of controls, training, and medical surveillance as needed to maintain worker safety and health. Most workplace injuries at LLNL are sprains and strains associated with everyday activities. The Health Services Department at LLNL maintains a nurse on site at Site 300 during operating hours. Prevention programs are implemented at Site 300 for hazards including Valley Fever and worker exposure to noise.

LLNL has a long history of working safely with explosives. LLNL works closely with the DOE explosive safety experts to support the design, testing, and safety of explosives. LLNL implements the DOE Standard 1212 into procedures and work activities involving explosives. Explosives operating facilities and storage facilities are regularly inspected by explosive safety engineers and industrial safety professionals. LLNL employs administrative, physical, and engineered controls in explosives operations. Only certified explosives handlers are authorized to work directly with explosives at LLNL. Explosives accidents are uncommon at Site 300.

Air pollutant emissions have the potential to impact human health and safety. A description of air pollutant emissions can be found in Section 3.6 of this document.

3.13 ACCIDENT SCENARIOS AND INTENTIONAL DESTRUCTIVE ACTS

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An evaluation of reasonably foreseeable accidents for LLNL was described in the 2005 SWEIS. The bounding explosive accident as described in the 2005 SWEIS is an accidental detonation at the Site 300 CFF or on an open-air firing table. This accident would result in severe or fatal injury to personnel (normally 2 to 20) and at the CFF would result in significant building and equipment damage (DOE/NNSA 2005). The number of personnel assumed involved in an accidental detonation is independent of the weight of explosives.

Other accidents analyzed in the 2005 SWEIS include accidental detonations at storage facilities, or in a test building with personnel present. All accident scenarios involving explosives could result in severe or fatal injury to personnel if they are present. As of 2017, no severe or fatal injuries have resulted from accidental explosives detonations at Site 300.

Potential risks associated with wildland fires are currently lessened at Site 300 through implementation of the annual prescribed burn. Completed in coordination with the SJVAPCD and performed by the Alameda County Fire Department, the prescribed burn strategically reduces the fuel load at Site 300, preventing the uncontrolled spread of wildfire. Stationing the Fire Department at Site 300 further reduces risks associated with accidental wildfire by decreasing emergency response times and increasing personnel familiarity with the area.

The 2005 SWEIS did not discuss the potential environmental impacts of intentionally destructive acts; this approach was consistent with the DOE policy and requirements in effect at that time. Since publication of the 2005 SWEIS, DOE and LLNL have analyzed intentional destructive acts involving biological agents and nuclear materials as bounding scenarios. Maintaining 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.

3.14 CLIMATE CHANGE

Since completion of the 2005 SWEIS, several Executive Orders (EO) relating to GHG emissions and climate change were issued and revoked, including EO 13514 "Federal Leadership in Environmental, Energy, and Economic Performance," in 2009, and EO 13693 in 2014. In 2015, the CEQ published Implementing Instructions for EO 13693 Planning for Federal Sustainability in the Next Decade. The Order included requirements for federal agencies to support preparations for the impacts of climate change, including climate change preparedness and resilience planning which considers the effects of climate change on the agency's operations and programs.

For climate change, the CEQ released "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews." on August 5, 2016 (81 FR 51866). This guidance discussed methods to appropriately analyze reasonable foreseeable direct, indirect, and cumulative GHG emissions and climate effects. The CEQ withdrew this guidance on April 5, 2017 (82 FR 16576).

For GHG emissions, LLNL has not been required to report under the EPA's regulations because LLNL's carbon dioxide-equivalent emissions have remained below the regulatory threshold of 25,000 metric tons/year. LLNL continues to implement reductions and controls, such as using electricity generated by solar energy and improving ventilation systems to reduce electricity use that should reduce GHG emissions in future years. LLNL also continues to pursue boiler temperature setbacks, among other efficiency projects.

California also has regulations pertaining to SF6, because of its high GHG emissions potential. LLNL has reduced the amount of SF6 in the inventory and uses alternative gases, as practical, in in x-ray radiography equipment, accelerators, and switchgear to reduce emissions of SF6. LLNL reports annually on the research uses of SF6 and the measures taken to control their SF6 emissions. LLNL must also report the amount of SF6 contained in electrical switchgear, and the amount of SF6 that leaks from that switchgear.

LLNL has operational goals relating to climate change resiliency detailed in its Site Sustainability Plan. LLNL operations generate GHG emissions that contribute to local, regional, and global climate change. Regional climate change projections, including prolonged drought and temperature-rise, have the potential to impact LLNL operations through decreased water availability, increased risk of wildfires, and increased electricity demand for facility cooling.

4.0 POTENTIAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

This section evaluates the potential impacts of the Proposed Action and No Action Alternative. Alternatives considered but eliminated from further analysis are discussed in Section 2.3 of this document.

The CEQ regulations for implementing NEPA require that the environmental consequences discussion shall address both direct and indirect effects and their significance (40 CFR § 1502.16). Direct effects are caused by the action and occur at the same time and place (40 CFR § 1508.8). Indirect effects are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR § 1508.8). This section provides an analysis of potential direct and indirect environmental impacts resulting from implementation of the Proposed Action, as well as potential cumulative impacts.

4.1 PROPOSED ACTION

Preliminary analysis indicated that implementation of the Proposed Action would not result in impacts on the following elements of the human environment: land use and aesthetic resources, socioeconomics, environmental justice, community services, prehistoric and cultural resources, traffic and transportation, and utilities and energy. Therefore, these elements are not further analyzed in this EA for the reasons provided in the following paragraphs:

Land Use and Aesthetic Resources – Implementation of the Proposed Action would not introduce a new land use at Site 300. Activities associated with the Proposed Action would be consistent with current land uses for Site 300. The Building 851 Complex is not visible from an off-site roadway, other publicly accessible viewpoints, or from sensitive land uses. Implementation of the Proposed Action would not degrade the existing visual character or quality of the site and its surroundings. Therefore, implementation of the Proposed Action would not impact land use or aesthetic resources.

Prehistoric and Cultural Resources – No known NRHP-eligible prehistoric resources are located within or adjacent to the Building 851 Complex. The closest NRHP-eligible archaeological site to the project area is more than ¾ miles away. It would not be directly or indirectly affected by the Proposed Action. Contributing elements to the historical significance of Building 851A no longer maintain integrity for listing on the NRHP. DOE/NNSA prepared a HAER and submitted it to the SHPO, National Park Service, and Library of Congress in 2017. Therefore, implementation of the Proposed Action would not adversely impact a historic property. No paleontological materials or paleontologically-sensitive geology are in the vicinity of the Building 851 Complex. Implementation of the Proposed Action would not involve excavations in the Building 851 muster. Potential for impacts on previously undiscovered resources in the Building 851 muster area are unlikely as no new activities are proposed for the muster area. No impacts on paleontological, archaeological, or historical resources are anticipated.

Socioeconomics – Because implementation of the Proposed Action would not require hiring new employees, potential impacts on the local economy, housing demand, and population growth would be negligible. No additional off-site services would be needed to implement the Proposed Action and no other changes in Site 300 operations are proposed. Therefore, implementation of the Proposed Action would not result in impacts on socioeconomics.

Environmental Justice – Site 300 is in a remote area of San Joaquin and Alameda counties. No predominately minority or low-income populations reside within 5 miles of Site 300. Disproportionate impacts on minority or low-income populations do not currently exist from ongoing operations at Site 300 (i.e. under the No Action Alternative). No impacts on community services have been identified for the Proposed Action. The potential for elevated emissions of pollutants is analyzed in Section 4.1.3 Air Quality of this EA, including a human health risk assessment associated with the ATC/PTO application. Potential adverse health or environmental effects are analyzed in the Air Quality Section 4.1.3, Noise Section 4.1.5, and Human Health and Safety Section 4.1.7 of this EA. No significant adverse human health or environmental effects have been identified for the Proposed Action in these areas. No significant impacts have been identified for land uses, aesthetics, prehistoric and historic cultural resources. Therefore, the Proposed Action would not result in disproportionately high and adverse human health or environmental effects on minority populations and/or low-income populations.

Community Services – Because ongoing operations at Site 300 would not change under the Proposed Action, and because the types and quantities of materials proposed for use are presently available at Site 300, existing fire protection and emergency services would be sufficient to accommodate the Proposed Action. Under the Proposed Action, the need for assistance from LLNL's fire protection and emergency services and police and security services would not noticeably increase. Accidents and intentional destructive acts are considered in Section 4.1.8 of this document, and have not been found to result in impacts on community services. Because the Proposed Action would not impact socioeconomics or environmental justice, implementation of the Proposed Action would not likely affect schools, parks, or other off-site services. Non-hazardous solid waste would be generated from the Proposed Action, in types and amounts consistent with current ongoing activities at Building 851 Complex (i.e. the No Action Alternative). Therefore, the Proposed Action would not result in significant impacts on community services.

Traffic and Transportation – Implementation of the Proposed Action would not require additional explosives shipments to or from Site 300. The Proposed Action is consistent with ongoing activities at Site 300. Onsite vehicle use would continue to be restricted to use by government vehicles and contractor's company vehicles. There would be no change in parking demand or general onsite road use under the Proposed Action. All Site 300 shipment operations would continue to be conducted within established LLNL and DOE safety requirements and in accordance with DOT regulations. Approximately 8-10 truck trips would be needed in the first year of implementing the Proposed Action due to the initial application of wet mix shotcrete to the protective berm. Reapplication of shotcrete would be performed as needed to maintain the berm, requiring approximately one truck trip per year. Implementation of the Proposed Action would not result in a significant number of truck trips, and would not otherwise impact ongoing Site 300 operations.

Utilities and Energy – Implementation of the Proposed Action would not introduce a new demand on electricity, water consumption, sewer discharges, or fossil fuel consumption. The primary use of electricity at Building 851 is for diagnostic equipment. Existing facilities, infrastructure and capacity of utilities systems are sufficient to support ongoing operations and implementation of the Proposed Action. No impacts on utilities and energy have been identified.

Discussion and analysis are provided in the following sections for Geology, Soils, Biological Resources, Air Quality, Noise, Materials and Waste Management, Human Health and Safety, Accidents, Intentionally Destructive Acts and Climate Change.

4.1.1 Geology and Soils

This section reviews the changes resulting from the Proposed Action that would have the potential to affect geology and soils. The Proposed Action does not include activities that would physically alter the geology of Site 300. Aspects of the Proposed Action have the potential to result in impacts on soils within the existing 4,000 foot muster area, similar to the No Action Alternative, but would not result in impacts on soils outside of the muster area.

Gravel and shotcrete would be applied only to existing developed areas and would not be applied to previously undisturbed locations. The shotcrete used to reinforce an existing protective berm (used to contain blast fragments) would not introduce contaminants to the soil. Periodic replacement of existing firing table gravel, to absorb shocks and minimize suspension of soils, would not negatively impact soils.

Deposition of small amounts of metal fragments (such as steel, aluminum, and copper) to surface soils within the Building 851 muster area occurs under current operations. Implementation of the Proposed Action would potentially result in continued deposition of a small amount of metal fragments from explosive assemblies to surface soils within the muster area. Because shot energies can be directed, and physical barriers can be placed to contain blast fragments (in addition to the existing protective berm), most of the fragments would not leave the firing table despite the increased explosives weights. Existing LLNL procedures would be followed as applicable and practical to avoid deposition of metals to soils. Therefore, the increased explosives weight would not result in a significant change in the amount of metal deposition to surface soils. The impacts on soils from metal fragments deposition would be consistent with operations under the No Action Alternative.

There would be no impact to subsurface soils from implementation of the Proposed Action. Ground-born vibrations are considered in Section 4.1.5 Noise of this EA.

Therefore, implementation of the Proposed Action would not result in significant impacts on geology and soils.

4.1.2 Ecological Resources

This section reviews the changes resulting from the Proposed Action that would affect or have the potential to affect biological and wetland resources. For the purposes of this EA, direct impacts on biological resources are defined as mortality of individuals of a species or of a population, resulting from open detonations. Indirect impacts are defined as changing conditions such that over time individuals or populations significantly decline. Cumulative impacts are considered in Section 4.1.10 of this document.

Plants

The northwestern corner of the *Amsinckia grandiflora* reserve is within the Building 851 4000-foot muster. Only 0.46 acres of the 160-acre *Amsinckia grandiflora* Reserve overlap with the muster area. Because *Amsinckia* plants are not found within the Building 851 firing table or within the muster, implementation of the Proposed Action would not directly impact *Amsinckia*. Implementation of the Proposed Action would not inhibit maintenance or monitoring activities of the experimental population of *Amsinckia* or LLNL's participation in the USFWS large-flowered fiddleneck Recovery Team. LLNL would continue to work with the USFWS in the development of habitat restoration and maintenance techniques. Therefore, indirect impacts on Amsinckia are not anticipated to occur as a result of the Proposed Action.

Of all the special status plants occurring within the Building 851 muster, the big tarplant occurs closest to the firing table along the Building 851 Complex fence line. While this species is rare throughout California it is relatively abundant at Site 300. These plants are buffered from shock wave effects and potential blast fragments by the protective berm that is between the firing table and the fence line. Detonations are restricted to the firing table, which is at a lower elevation than the fence line, further reducing the potential for direct impacts on these plants. Implementation of the Proposed Action would not adversely impact big tarplant located adjacent to the Building 851 Complex perimeter fence. Activities associated with continued operations would not result in direct impacts on big tarplant.

Because special status plant species do not occur on the Building 851 firing table, implementation of the Proposed Action would not result in direct impacts on special status plants. Although special status plant species occur within the Building 851 muster, the steep topography and distance from the firing table makes it unlikely that special status plants would be directly impacted. Indirect impacts such as buildup of particulate on plants over time would be unlikely and negligible because these special status plants are all annuals (i.e. they complete their lifecycle from germination to the production of seed within one year) detonations would occur infrequently, and air emissions would be managed in accordance with requirements of the SJVAPCD ATC/PTO. Implementation of the Proposed Action would not result in significant adverse impacts on any special status plant species.

Wildlife

The potential for noise to harm wildlife is an ongoing natural resource management issue. Incidental evidence indicates that wildlife at Site 300 is not adversely affected by the existing ambient and impulse noise conditions. Impulse noise events occur only between the hours of

10:00 am to 8:50 pm, but are more likely to occur in the mid-afternoons. Animals with nocturnal (i.e., typically active at night) or crepuscular (i.e., typically active at twilight) tendencies would be unlikely to be active during this time. Therefore, disruption of nocturnal or crepuscular individuals' normal behaviors including foraging and breeding would be negligible. Impulse noise would be unlikely to result in direct mortality of wildlife because of the short duration (typically less than one second) of each event. Diurnal (i.e., active during the daytime) wildlife in the area surrounding the Building 851 Complex would likely have a startle reaction to impulse noise events. This reaction could result in the temporary interruption of individuals' normal behaviors including foraging and breeding. However, because the impulse noise is of short duration and events are relatively infrequent it is unlikely to result in significant adverse impacts on wildlife populations.

The Proposed Action is not likely to adversely affect the California red-legged frog and California tiger salamander. Although Site 300 contains Critical Habitat for these species, the Building 851 firing table doesn't contain primary constituent elements for either species. Because detonations occur during daylight hours when the species are not typically active aboveground, implementation of the Proposed Action is unlikely to result in direct mortality of California red-legged frogs or California tiger salamanders.

An isolated rock outcrop approximately 1,000 feet from the firing table is not suitable habitat for the Alameda whipsnake. The nearest suitable scrub habitat for the Alameda whipsnake is over 2,000 feet from the firing table. The Alameda whipsnake may travel up to 500 feet into grasslands surrounding scrub habitat. Because the Building 851 Complex does not have suitable habitat for the Alameda whipsnake and the closest suitable habitat is over 500 feet away, explosives testing would be unlikely to result in direct mortality of the Alameda whipsnake. Implementation of the Proposed Action would be unlikely to result in impacts on the Alameda whipsnake.

Blast fragments would be unlikely to result in direct or indirect impacts on wildlife because of the combined conditions from Site 300 topography, distances to suitable habitat from the firing table, the ability of researchers to direct shots, and the protective berm and other measures to contain blast fragments. Because potential for direct impacts on individuals is low, and because LLNL maintains habitat to the benefit of protected species onsite, population level effects from the Proposed Action would be negligible.

Because testing would be performed only on the existing Building 851 firing table and no changes in activities are proposed for the Building 851 muster, there would not be impacts on habitat features at Site 300. Despite the proposed increase in the amount of explosives being tested, the existing infrastructure is sufficient to accommodate the increase. There would be no impact on Critical Habitat because no changes in Critical Habitat containing primary constituent elements are proposed.

Implementation of the Proposed Action would not result in significant impacts on wildlife.

Floodplains

There are no 100-year floodplains on Site 300 and the 100-year base flood event is contained within all channels. Implementing the Proposed Action would not create or contribute runoff water that would exceed the capacity of drainage systems. Because there are no 100-year floodplains at Site 300, the Proposed Action would not affect 100-year floodplains. Because the 100-year storm event is contained within the channels of the canyons and ravines at Site 300, activities at Site 300 would not be affected by the 100-year storm event.

Wetlands

The Proposed Action would not involve any dredge or fill of any wetlands or other water bodies. Blast fragments would be unlikely to result in direct or indirect impacts on wetlands because of the combined conditions from Site 300 topography, distances to pools from the firing table, the ability for researchers to direct shots, and the protective berm and other measures to contain blast fragments. There would be no impact on wetlands from implementation of the Proposed Action.

4.1.3 Air Quality

This section reviews the changes resulting from the Proposed Action that would have the potential to affect air quality. This section addresses the impacts of the Proposed Action on ambient air quality and the exposure of people to hazardous pollutant concentrations (including criteria pollutants and toxic air contaminants). Neither the No Action Alternative nor the Proposed Action would result in objectionable odors.

Implementation of the Proposed Action would increase weights of explosives detonated to levels that would exceed SJVAPCD Rule 2022 Section 7.4 and would therefore be subject to permitting by SJVAPCD. Because LLNL would continue to comply with air quality requirements, implementation of the Proposed Action would not result in violations of air quality standards. Implementation of the Proposed Action would result in air emissions that could include criteria pollutants, toxic and hazardous air pollutants, and greenhouse gases.

Approximately 8-10 truck trips would be needed in the first year of implementing the Proposed Action due to the initial application of wet mix shotcrete to the protective berm. Reapplication of shotcrete would be performed as needed to maintain the berm, requiring approximately one truck trip per year. Therefore, implementation of the Proposed Action would result in a negligible increase in vehicle traffic emissions over the No Action Alternative.

DOE/NNSA evaluated the Proposed Action for the potential to emit criteria pollutants, organic compounds, inorganic compounds, acid gasses, metals, greenhouse gases and toxic air contaminants. Under the Proposed Action, metals and other materials may be part of an experiment, or may be used to construct the device being detonated (i.e. the assembly). During an experiment, the emissions of air contaminants results from the decomposition of explosives, the destruction of the assembly, and from surface cratering and surface scouring. Surface cratering results from air pressure on the Building 851 firing table immediately below the explosive test. Surface scouring from air pressure occurs in the area immediately outside the crater area but remains within the Building 851 Complex and the existing protective berm.

Implementation of the Proposed Action would result in surface cratering on the gravel firing table and surface scouring in the firing table area and on the protective berm. To avoid making soils airborne, an 8-10-inch-thick concrete pad or a three-inch-thick steel plate would be placed on the firing table. Additionally, the existing protective berm would be encased in shotcrete. Therefore, cratering and scouring emissions would consist of concrete, not soils.

In evaluating the Proposed Action, DOE/NNSA used worst-case scenarios and inputs to establish a conservative upper limit. DOE/NNSA used the AERMOD modeling system to model the transport of emission through time and space. AERMOD is a U.S. EPA-preferred steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. DOE/NNSA then used the California EPA Air Resources Board Hotspots Analysis and Reporting Program (HARP2) software in preparation of a health risk assessment. DOE/NNSA used finely resolved air quality data and methods for this analysis, and has a high confidence in the conservative upper bounds established by this analysis.

See Appendix A for a copy of the air permit application, which includes the types and quantities of expected air emissions used in modeling the Proposed Action. Emission estimates are based on the Open Burn Open Detonation Model (OBODM) emission factors, AP-42 emission factors, stoichiometric conversion calculations, the Combined Obscuration Model for Battlefield Induce Contaminants (COMBIC) simulations and metal release fractions for explosive assemblies. A summary of the results of the modeling are provided in this section.

Table 3. Comparison of the No Action Alternative and Proposed Action for Air Quality Pollutants of Concern.

Air Quality Pollutant of Concern	Site 300 Actuals for Calendar Year 2016 No Action Alternative lbs./yr. (tons/yr.)	Estimated Upper Limit of New Emissions from Proposed Action lbs./yr. (tons/yr.)	Conformity Threshold tons/yr.
CO	354 (0.177)	36 (0.018)	100
NO_x	1,512 (0.756)	233 (0.1165)	10
PM10	269 (0.1345)	1,140 (0.57)	100
PM2.5	Not Monitored	1,040 (0.52)	100
SO_x	77 (0.0385)	30 (0.015)	100
VOC	250 (0.125)	117 (0.0585)	No Threshold

General Conformity

The estimated annual emissions from the Proposed Action are low compared to the conformity thresholds. The emissions were conservatively calculated assuming maximum use of materials and reaching the maximum of 7,500 pounds per year of high explosives at the Building 851 firing table. Under this bounding scenario approach, the estimated new PM emissions per year would be 1,140 lbs./yr. PM10 and 1,040 PM2.5. The upper bound of other emissions would be 36 lbs./yr. CO, 233 lbs./yr. NOx, 30 lbs./yr. SOx and 117 lbs./yr. VOC. Actual emissions are anticipated to be below these levels.

The facilities and infrastructure supporting the larger detonations are the same as for the existing smaller detonations. There would be no significant increase in vehicle trips or other indirect emission sources. Emissions of PM10, PM2.5 and precursors anticipated to result from the Proposed Action would not contribute substantially to emissions in the San Joaquin Valley nonattainment area. Since the proposed new emissions do not exceed the de-minimis thresholds, a conformity determination would not be required.

Radiological Emissions

Because there would not be any radionuclides used in the experiments, and because surface scouring and cratering emissions would consist of concrete, (not soils), implementation of the Proposed Action would not result in a change in radiological emissions over the No Action Alternative.

Under the Proposed Action, LLNL would continue to comply with the NESHAP for radiological emissions. LLNL would continue to monitor the CFF and at the fence line. LLNL would continue to evaluate all potential sources of radionuclide air emissions to determine the maximum possible dose to the public. LLNL would continue to submit the results of the monitoring and modeling to the EPA. The results would continue to be made available in the Site Annual Environmental Reports located at https://www-envirinfo.llnl.gov/siteAnnualReports.php. Radiological emissions are expected to remain low in comparison to allowable limits.

Toxic Air Contaminants and Health Risk Assessment

DOE/NNSA evaluated the Proposed Action for the potential to emit toxic air contaminants and expose sensitive receptors to substantial pollutant concentrations. In accordance with SJVAPCD requirements, DOE/NNSA modeled a worst-case scenario for TAC emissions using HARP2. The modeling approach and results, including a Health Risk Assessment (HRA), is included in the air permit application in Appendix A of this document.

A cumulative HRA includes risks associated with:

- TAC emissions from new sources proposed in the application under review,
- Increases in TAC emissions from modification to existing sources proposed in the application under review, and
- TAC emissions from previously approved projects for which the District required a health risk evaluation as part of the project’s approval.

For an ATC/PTO application to be approved, the cumulative HRA for the project must show that:

- The cancer risk is less than 20 in one million
- The non-carcinogen acute hazard index is less than 1
- The non-carcinogen chronic hazard index is less than 1

As demonstrated in the HRA, implementation of the Proposed Action would be below cancer risk and hazard indices requirements for the Carnegie SVRA, Connolly, and RISI/Teledyne receptors. The Tracy Hills planned residential development was considered for the purposes of NEPA because it is reasonably foreseeable, however because it is not yet built, it does not constitute an existing receptor.

Table 4. Proposed Action Health Risk Assessment Results.

Receptor	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Carnegie SVRA Ranger Residence	1.52E-09	0.00018	0.70
Connolly Ranch	2.64E-10	0.000032	0.21
RISI/Teledyne Industrial Facility	3.22E-10	0.000039	0.11
Tracy Hills Planned Residential Development	3.29E-10	0.000039	0.048

Table 5. Cumulative Risk Results.

Risk	Proposed Action Maximum	No Action Alternative	Cumulative	SJVAPCD Significance Thresholds
Cancer	1.52E-09	1.54E-05	1.54E-05	2.00E-05
Chronic Hazard Index	0.0002	0.0051	0.0053	1
Acute Hazard Index	0.70	0.0025	0.70	1

GHG

Under the Proposed Action the largest contributor to GHG emissions would be SF6. LLNL would continue to use SF6 in experiments only when necessary, and would continue to develop reduction and capture methods as practicable. Under the Proposed Action, the estimated upper limit of Scope 1 and 2 GHG emissions combined would be 9,000 lbs./yr. CO2e. This would be a negligible increase above the No Action Alternative in which typical years result in emission of 130,000 mtCO2e. Under the Proposed Action, Scope 3 GHG emissions would not change above the No Action Alternative.

Summary

Implementation of the Proposed Action would not conflict with or obstruct implementation of an air quality plan. Emissions anticipated to result from the Proposed Action would not contribute substantially to any air quality violation. Implementation of the Proposed Action would not involve radionuclides. Implementation of the Proposed Action would not result in any change in radiological emissions over the No Action Alternative.

Implementation of the Proposed Action would result in an increase in TAC emissions over the No Action Alternative. However, even in a worst-case scenario, the Cancer Risk, Chronic Max Hazard and Acute Max Hazard would be below SJVAPCD thresholds of significance. Additionally, when other permitted sources at Site 300 are considered along with the Proposed Action, the cumulative potentials are below the SJVAPCD thresholds of significance.

Implementation of the Proposed Action would result in an increase in GHG emissions above the No Action Alternative. However, this increase is small in the context of overall LLNL emissions, and would not exceed the CARB reporting threshold. Climate change impacts associated with GHG emissions are considered in Section 4.1.9 Climate Change of this document.

Therefore, implementation of the Proposed Action would not result in significant impacts on air quality.

4.1.4 Water Resources

The Proposed Action would not include activities that would physically or chemically alter the ground and surface water resources at Site 300. Implementation of the Proposed Action would not deplete groundwater resources or interfere with groundwater recharge. As discussed in the geology and soils analysis of this document, the Proposed Action may result in deposition of metal fragments. However, in the Building 851 area, the depth of groundwater is approximately 100 to 150 feet below ground surface. The closest surface body to Building 851 firing table is not within range to receive metal fragments. Existing LLNL procedures would be followed to limit the deposition of metal fragments to soils and enable ongoing ground water monitoring. Activities associated with the Proposed Action would not stop or otherwise conflict with the ongoing remedy for OU 8 under CERCLA. Ground water would continue to be monitored in accordance with the CERCLA remedy to detect any impacts on ground water from depleted uranium in surface soil, subsurface soil, and rock.

Implementation of the Proposed Action would include application of shotcrete to an existing protective berm, this could result in a minor change in the storm water runoff pattern for the berm. While the earthen berm is permeable, the current slope of the berm prevents substantial storm water infiltration. The slope of the berm would not change substantially with the application of the shotcrete. The immediate vicinity at the base of the berm includes the Building 851 gravel firing table and relatively level undeveloped grasslands. Therefore, changes in storm water runoff would be minor, localized to the immediate vicinity of the berm, and would not impact storm water infiltration in the area. Existing LLNL procedures would be followed to limit storm water runoff and to enable ongoing storm water runoff monitoring.

Therefore, the implementation of the proposed project would not impact water resources.

4.1.5 Noise

This section reviews the changes in noise and vibrations that are likely to result under the Proposed Action. The human reaction to noise and vibration is subjective and may vary from person to person. Generally, human responses to noise and vibrations can depend on factors including: loudness, number and duration of events, time of day, ambient background noise levels, interference with sleep and a person's previous experiences.

Under the Proposed Action, sources of noise at Site 300 would not change from the No Action Alternative. Noise generating activities other than from experimental testing in the Building 851 Complex would not change under the Proposed Action. Therefore, an analysis of continual ambient noise, or site-wide noise sources is not necessary.

Under the Proposed Action, the length of time for each impulse noise event would remain similar with the duration of impulse noise events under the No Action Alternative. By definition, impulse noise events are not sustained, because each detonation event typically lasts less than one second. Impulse noise from experiments at Building 851 would continue to occur only from 10:00 am to 8:50 pm. Potential impacts on wildlife from noise are considered in the biological resources section of this document.

Noise Metrics

The National Research Council recommended criteria for analyzing impulse noise impacts are the potential for structural damage and the potential annoyance due to auditory stimulation and building vibration (NRC 1977). For the purposes of this impact analysis, potential for structural or other damage and the potential for noise and vibration-related concerns resulting from the Proposed Action was modeled using peak sound pressure levels. The potential for long-term annoyance or impacts on noise-sensitive land uses from the Proposed Action was modeled using the annual C-weighted Day-Night Average Sound Level (CDNL). Each of these metrics were calculated using computer codes for the purposes of this impacts analysis.

Peak sound pressure levels

LLNL Site 300 monitors weather conditions and plans experiments for when conditions would be least likely to generate a one second sound pressure level of 126 dB in populated areas. A person in the area of the 126 dB level may describe the noise as noticeable and distinct. This sound pressure level therefore has potential for generating expressions of concern in the community (See Table 7). For comparison, peak sound pressure levels of 125-160 dB may be experienced at a person's ear when detonating a firecracker, and 140-170 dB at a shooter's ear when firing a hand gun (U.S. EPA 1974). The threshold for permanent damage to unprotected ears due to impulse noise is approximately 140 dB peak sound pressure level based on 100 exposures per day (Pater 1976). Under 29 CFR 1910.95, worker exposure to impulsive noise should not exceed 140 dB peak sound pressure level.

DOE/NNSA assessed the Proposed Action for the potential to generate community noise and airborne vibration-related concerns generally for the region, and for local receptors of concern. Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. For the purposes of this analysis, sensitive land uses include residences, livestock farming, and recreational uses near Site 300. DOE/NNSA identified four local receptors of concern because they are noise-sensitive land uses adjacent to Site 300 (See Table 6).

DOE/NNSA evaluated one second peak sound pressure levels with 15% of exceedance (Pk_{15}) under the Proposed Action against the potential to generate concern in the community for impulsive events (shown in Table 7). The Pk_{15} contour is a line on a map that shows where the sound level reported is expected to be exceeded by 15% of all impulse noise events. In other words, 85% of all impulse noise events would be less than the calculated Pk_{15} number. The Pk_{15} is calculated using a computer model to simulate anticipated outcomes of the Proposed Action, and is not measured directly. In other words, the Pk_{15} represents the highest instantaneous un-weighted sound level expected for a 1,000 lb. detonation at any time.

In addition to sound pressure levels, the potential for noise-related concerns depends on frequency of occurrence, time of day, and the noise sensitivity of individuals in these areas. People in an area experiencing peak sound pressure levels between 115 and 130 dB may describe events as noticeable and distinct. Peak sound pressure levels above 130 dB are generally objectionable, and are often described as very loud and startling.

Peak sound pressure levels are directly related to airborne vibration. Peak sound pressure levels above 120 dB may rattle loose windows or pictures on walls, in this way causing annoyance, but will not cause structural damage. It is widely recognized that structural damage is unlikely when peak sound pressure levels remain below 140 dB. Peak sound pressure levels do not correlate directly with ground-borne vibrations.

C-weighted Day-Night Average Sound Level

The day-night sound level (DNL) is a uniform way to describe the effects of environmental noise (EPA 1974). This metric cannot be measured directly, rather it is calculated as an average noise level occurring over a 24-hour period, with a 10 dB penalty applied to sound levels occurring from 10:00 pm to 7:00 am. Most federal agencies and administrations use DNL when assessing environmental noise (Schomer 2005). The U.S. EPA recommended a DNL of 55 dB as the "level requisite to protect health and welfare with an adequate margin of safety" (U.S. EPA 1974)). The National Research Council committee on Hearing, Bioacoustics and Biomechanics recommend using DNL level of 55 dB to represent the beginning of noise impact in residential areas (National Research Council 1977).

The annual CDNL is the cumulative metric to define high-energy impulsive sounds. The CDNL considers the average impulse noise level of a 24-hour period, even though impulse noise under the Proposed Action would continue to occur only from 10:00 am to 8:50 pm and events would last less than 2 seconds. Annual average noise levels are a tool for long-term land use planning. For the purposes of this analysis, the annual CDNL was conservatively calculated assuming a cumulative total of 8,000 lbs./yr. of explosives even though the Proposed Action is a total of 7,500 lbs./yr. The yearly CDNL was used to analyze the land-use compatibility with the receptors of concern defined in Table 6, assuming ranges of CDNL (dB) as shown in Table 8.

Table 6. Receptors of Concern for Noise Impacts Modeling.

Receptor of Concern	Distance from Building 851 firing table (miles)
Carnegie SVRA Ranger Residence	2.06
Connolly Ranch	3.70
RISI/Teledyne Facility	3.43
Tracy Hills Planned Residential Development	4.16

Table 7. Peak Sound Pressure Level and the Likelihood of Noise-Related Concerns.

Human Perception*	Modeled Peak Sound Pressure Level (Pk_{15} dB)	Likelihood of Noise-related Concerns
May be Audible	< 115	Low
Noticeable, Distinct	115 – 130*	Moderate
Very Loud, May Startle	> 130	High

Source:(Department of the Army 2007)

*The human reaction to noise (i.e. perception) is subjective and may vary from person to person. The classifications are based on how a typical person might describe the event. The human response to noise can depend on factors including: loudness, number and duration of events, time of day, ambient background noise levels, interference with sleep and an individual's previous experiences.

Table 8. Impulse CDNL ranges (dB) and Thresholds of Compatibility.

Noise Zone	Impulsive CDNL (dB) range	Noise-Sensitive Land Use	Potential Impact on the Area
0	≤ 57	Compatible	Negligible
I	57-62	Generally Compatible	Minimal
II	62-70	Generally Not Compatible	Moderate
II	>70	Not Compatible	Substantial

Source: (Department of the Army 2007)

Noise Modeling Results

An evaluation of noise was completed using Blast Noise Version 2 (BNOISE2). BNOISE2 is a DoD noise impact assessment software that enables modeling of high-energy impulsive noise impacts. BNOISE2 is a federal-standard application used by federal agencies to assess potential for Proposed Agency Actions to result in impacts on communities. This computer program calculates noise values from explosive detonations, those values are displayed as noise contours on a map. Noise contours are lines on a map that join points of equal noise level. BNOISE2 is used as an environmental planning tool to address unwanted noise and to avoid siting noise-sensitive land uses in regions of the adjacent community. Inputs to the model include structures, geographical coordinates of the firing table, landscape information, and standard meteorological profiles. BNOISE2 was used to compute the Pk_{15} for the Proposed Action and No Action Alternative. BNOISE2 was also used to calculate a conservative upper limit annual CDNL for the Proposed Action.

Ambient Noise

As previously stated in this section, sources of noise at Site 300 would not change under the Proposed Action. The Proposed Action does not include substantial changes in vehicle traffic or use of pumps, motors, and other noise-generating equipment above the No Action Alternative. Therefore, implementation of the Proposed Action would not increase ambient noise levels from these activities above the No Action Alternative.

Impulse Noise Peak Sound Pressure Levels

Model results show that implementation of the Proposed Action would result in a change in impulse noise sound pressure levels heard at Building 851 and the surrounding environment above the No Action Alternative. Results of Pk_{15} modeling are shown in Figures 3 and 4.

Implementation of the Proposed Action would change where the Pk_{15} 126 dB contour would occur with relation to the No Action Alternative. Under the Proposed Action detonations would be audible and noticeably distinct at offsite locations as shown in Figure 3. Results of the modeling show that LLNL’s self-imposed one second sound pressure level of 126 dB would not be exceeded in populated areas, or at the receptors of concern for 85% of all detonations. A person in the area of the 126 dB level may describe the noise as noticeable and distinct. Model results show that portions of these offsite areas include the Carnegie SVRA and the SRI International Corral Hollow Experiment Site remote test facility. The SVRA receptor of concern is the permanent residence occupied by one SVRA staff member (and family), and this location would not be on the Pk_{15} 126 dB contour.

Modeling results shown in Figure 4, indicate that implementation of the Proposed Action would result in peak sound pressure levels of 115 dB audible at offsite locations. The Pk_{15} 115 dB contour would cross land used for livestock farming to the north and west of Site 300. The largest section of the Pk_{15} 115 dB contour would extend into the mountainous region south of Site 300 that is zoned for livestock farming and is largely uninhabited. Several single-family residences along both sides of Corral Hollow Creek between Mitchell Ravine and the Tesla Coal Mine Site are owned by State Parks and occupied by State Park employees and would experience peak sound pressure levels of less than 115 dB. Modeling results show the area north and east of

Site 300 proposed for development in the Tracy Hills Specific Plan would experience peak sound pressure levels less than 115 dB under the Proposed Action.

Modeling results show that implementation of the Proposed Action would result in peak sound pressure levels of 130 dB occurring offsite, in the southern portion of the Carnegie SVRA (See Figure 4). Vehicle traffic on corral hollow and off highway vehicles are currently the primary source of noise at this location. Because detonations at weights of 1,000 lbs. would occur infrequently and because this offsite area is not populated, the high peak sound pressure levels are not anticipated to result in impacts on members of the public who may incidentally be in this area. Modeling results show that the Pk_{15} 130 dB contour would not occur at any of the receptors of concern.

Under the Proposed Action, LLNL would continue to monitor meteorological conditions and to conduct blast forecasting prior to explosives detonations. LLNL would avoid potential noise impacts by delaying or canceling experiments based on meteorological conditions and simulated outcomes.

C-weighted Day-Night Average Sound Level

Activities associated with the Proposed Action would not conflict with land use compatibility guidelines. As shown in Figure 5, CDNL was evaluated conservatively assuming a total of 8,000lbs./yr. explosives. Zones II and III, which are generally considered not compatible with sensitive land uses, (including residential, livestock farming, and recreational uses) are contained within Site 300 boundaries. Implementation of the Proposed Action is not anticipated to result in annual CDNL greater than 57 dB in residential areas. Because Zones II and III are contained to Site 300, the Proposed Action would continue to be compatible with the land uses at the receptors of concern (as shown on Figure 5 and listed in Table 6) and with other ranching and recreational land uses that occur in the vicinity of Site 300.

LLNL Worker Exposure

Exposure to high noise levels can cause irreversible hearing loss or impairment and can also create physical and psychological stress on workers. Site 300’s robust work planning, control, and release process ensures compatibility of work Site-wide and that uninvolved workers would not be exposed to hazards. Therefore, it would be unlikely that uninvolved workers would be exposed to high noise levels from detonations. Impacts on all workers would be avoided through existing controls such as moving away from the noise source and having workers stay inside buildings. The use of Personal Protective Equipment (PPE) for involved workers would continue to be implemented in accordance with existing LLNL procedures. Existing LLNL procedures and hearing protection programs would continue to be implemented under the Proposed Action, and would be sufficient to protect worker safety and health from noise-related impacts. Continuation of these existing practices and procedures would avoid noise impacts on workers under the Proposed Action.

Ground-borne vibrations

Existing LLNL work practices would continue to be implemented to minimize and to mitigate the potential for noticeable ground-born vibrations, including lifting charges off the firing table surface. Because the firing table gravel layer impedes the transfer of vibrations to the soils below, the spread of ground-born vibrations from impulse events is unlikely. Under the Proposed Action, vibrations would not be likely to spread beyond the firing table. Calibration experiments have shown that potential seismic signals from detonations have the potential to generate magnitude 1 to 3 events at the source or Maximum Modified Mercalli Intensity I. Events on the Mercalli Intensity scale I are not typically noticeable by humans (U.S. Geological Survey 2017).

Summary

Implementation of the Proposed Action would not increase ambient noise levels above the No Action Alternative. Modeling of the Proposed Action for impulse noise shows that peak sound pressure levels with the potential to generate public concern would extend offsite into unpopulated areas. LLNL's self-imposed one second sound pressure level of 126 dB would not to be exceeded in populated areas, or at the receptors of concern. Implementation of the Proposed Action is not anticipated to result in annual CDNL greater than 57 dB in residential areas. The Proposed Action is also anticipated to be compatible with nearby land uses. Therefore, although the Proposed Action would have a higher impulse noise impact than the No Action Alternative, it is not anticipated to be significant. Additionally, under the Proposed Action impacts on workers from noise exposure would be avoided and would therefore be the same as under the No Action Alternative.

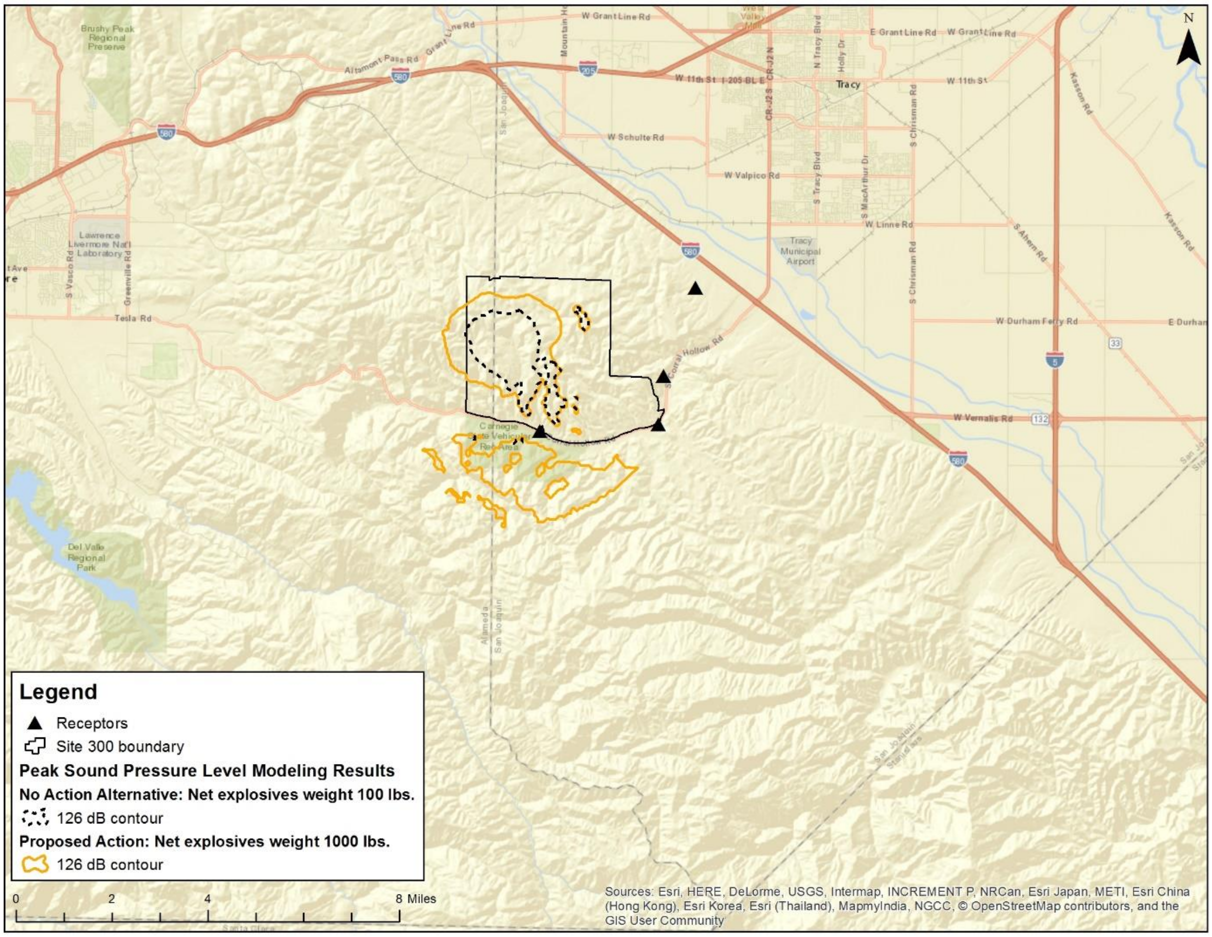

Figure 3. Results of Blastnoise2 Modeling to Compare the Proposed Action and the No Action Alternative for Pk_{15} 126dB. LLNL's self-imposed one second sound pressure level of 126 dB would not be exceeded in populated areas, or at the receptors of concern for 85% of detonations. A person in the area of the 126 dB-level may describe the noise as noticeable and distinct.

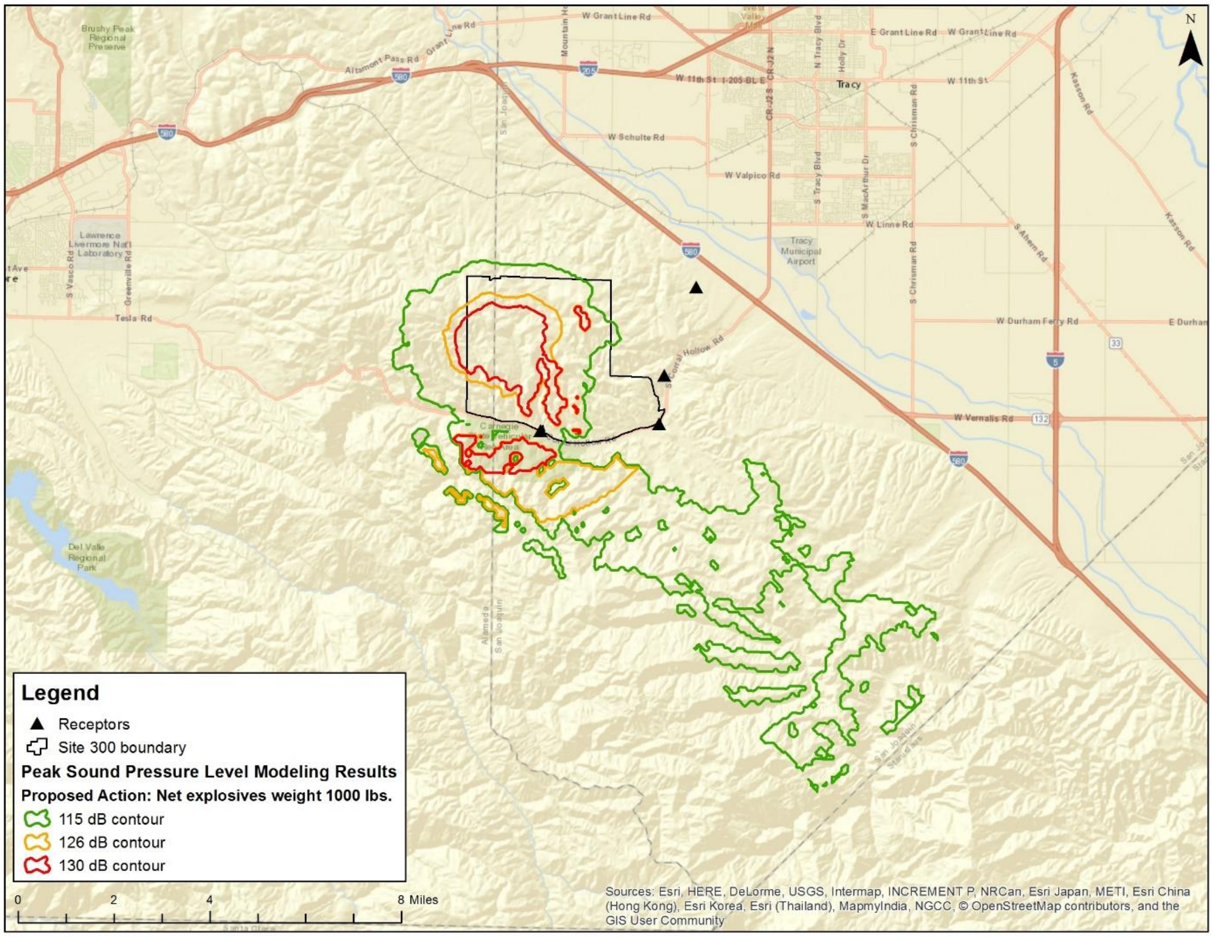

Figure 4. Results of Blastnoise2 Pk_{15} Modeling for the Proposed Action. DOE/NNSA evaluated the one second peak sound pressure levels with 15% of exceedance (Pk15) under the Proposed Action against the potential to generate concern in the community for impulsive events (shown in Table 7). The Pk15 contour is a line on a map that shows where the sound level reported is expected to be exceeded by 15% of all impulse noise events. In other words, 85% of all impulse noise events would be less than the calculated Pk15 number. Local receptors of concern would hear the event, and the event would have low risk for generating noise-related concerns. In addition to sound pressure levels, the potential for concerns depends on frequency of occurrence, time of day, and the noise sensitivity of individuals in these areas. People in an area experiencing peak sound pressure levels between 115 and 130 dB may describe events as noticeable and distinct. Peak sound pressure levels above 130 dB are generally objectionable, and are often described as very loud and startling.

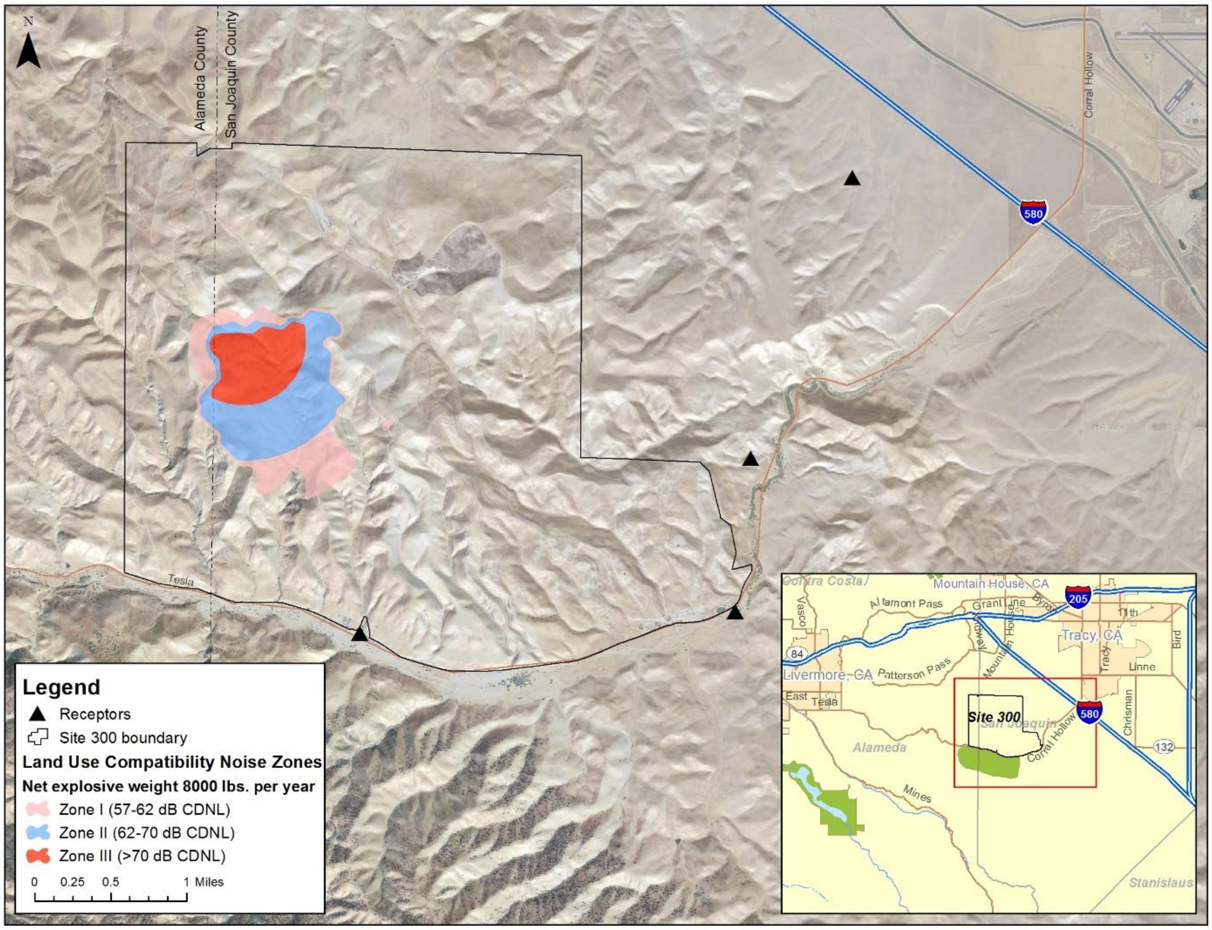

Figure 5. Results of Blastnoise2 CDNL Modeling for the Proposed Action. The CDNL is the cumulative metric to define high-energy impulsive sounds. The CDNL considers the average noise level of a 24-hour period, even though impulse noise would occur only from 10:00 am to 8:50 pm and a single event would last less than 2 seconds. For the purposes of this analysis, annual CDNL was conservatively calculated assuming a cumulative total of 8,000 lbs./yr. of explosives. CDNL was used to analyze the land-use compatibility of the Proposed Action using zones found in Table 8.

4.1.6 Materials and Waste Management

The Proposed Action could cause the generation of an additional 12 cubic yards of solid waste per year above the No Action Alternative. The solid waste would include concrete, gravel, wood, and glass. Depending on the types of experiments, the solid waste could be contaminated with traces of heavy metals such as lead and copper. The additional 12 cubic yards of solid waste would not significantly impact the waste management processes currently in place at Site 300. Existing facilities and processes at Site 300 are prepared to accommodate an increase in solid wastes. Metals from assemblies and casings would continue to be recycled in accordance with LLNL procedures as practicable. Under both the Proposed Action and the No Action Alternative, firing table debris would be characterized and managed in accordance with existing LLNL procedures and all applicable requirements.

The Proposed Action would not cause the generation of additional photo processing waste waters over the No Action Alternative. The Proposed Action would not alter the processes that currently generate the photo processing waste.

Implementation of the Proposed Action would result in a minimal increase in explosives wastes. Although larger quantities of explosives may be placed for each experiment, detonation of explosives at the firing table would be complete. Explosives wastes associated with fabrication and other processing activities at Site 300 would not change substantially from the No Action Alternative. Existing facilities and processes at Site 300 are prepared to handle any potential increase in explosives wastes resulting from implementation of the Proposed Action and would do so in accordance with the existing permit. Therefore, there would not be a significant impact on waste management facilities or processes.

Existing facilities and processes at Site 300 and Building 851, including materials management and waste management are already in place to handle the implementation of the Proposed Action. Implementation of the Proposed Action would not result in a significant impact on material management infrastructure.

4.1.7 Human Health and Safety

Implementation of the Proposed Action would not result in impacts on worker safety and health relating to explosives above the No Action Alternative. LLNL would continue to implement the DOE Standard 1212 into procedures and work activities involving explosives. Explosives operating facilities and storage facilities would continue to be regularly inspected by explosive safety engineers and industrial safety professionals under the Proposed Action. Only certified explosives handlers would be authorized to work directly with explosives at LLNL. Existing facilities and procedures at LLNL to manage worker safety and health would continue to be sufficient under the Proposed Action.

An evaluation of detonation noise levels and potential impacts on workers and the public can be found in Section 4.1.5 of this EA. Impacts on uninvolved workers would be avoided through existing controls. Hearing protection programs, and PPE would continue to be used for involved workers under the Proposed Action.

An evaluation of impacts on human health and safety resulting from reasonably foreseeable accidents is included in Section 4.1.8 of this EA.

4.1.8 Accidents and Intentional Destructive Acts

Implementation of the Proposed Action would have the potential to result in impacts on the environment, workers, or the public from accidents or intentionally destructive acts. Reasonably foreseeable accidents resulting from implementation of the Proposed Action could involve accidental detonation resulting from a transportation accident or accidental detonation at various Site 300 facilities.

Although LLNL does ship explosives offsite, the majority of shipments with quantities sufficiently large to create a bounding accident are between Site 300 and the Livermore Site (DOE/NNSA 2005). LLNL uses packaging and operational controls to limit the probability of an accident occurring. Implementation of the Proposed Action would not result in an increase in explosives shipments between the Livermore Site and Site 300 or between Site 300 and any other offsite location. Therefore, under the Proposed Action, the potential for and extent of explosives transportation accidents offsite would not increase over the No Action Alternative.

Under the No Action Alternative, transportation of explosives on roadways within Site 300 is controlled through existing work planning and control requirements and explosive safety requirements. The types of equipment used, vehicles driven, roadways used, and distances traveled onsite would be the same under the Proposed Action and No Action Alternatives. Requirements for safe onsite transportation of explosives would not change with implementation of the Proposed Action.

Under the Proposed Action, procedures and operations involving explosives would not change from current operations. Existing work planning and control requirements and explosive safety requirements would continue to be followed under the Proposed Action. These controls ensure that accidental detonation at the firing table would be a rare occurrence. Only the weight of explosives being used would increase in some circumstances. The probable frequency of accidents is independent of the weight of explosives used. Therefore, the potential frequency per year of accidents for the No Action Alternative, as established in the 2005 SWEIS as 10^{-6} to 10^{-4} (DOE/NNSA 2005), would not increase under the Proposed Action.

The DOE/NNSA strategy for the prevention of environmental impacts resulting from intentional destructive acts would not change under the Proposed Action. The fundamental element of the DOE/NNSA strategy is to prevent and deter terrorists from executing successful attacks. 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. 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.

DOE/NNSA also maintains the capability for timely and adequate response to an attack as well as to other emergency situations. Under the Proposed Action the comprehensive emergency management system would not change. Planning and preparing to respond to a variety of emergency situations would continue at Site 300 under the Proposed Action.

Implementation of the Proposed Action would not result in significant impacts on the likelihood or outcomes of reasonably foreseeable accidents or intentionally destructive acts over the No Action Alternative.

4.1.9 Climate Change

Implementation of the Proposed Action would result in a negligible increase in the direct emissions of GHG from experiments as described in Section 4.1.3 of this EA. Implementation of the Proposed Action would not result in a significant contribution to GHG emissions in the region, as described in Section 4.1.10 Cumulative Impacts.

DOE/NNSA and LLNL have considered the immediate impacts on mission, workers, and physical property projected to result from climate change. LLNL currently incorporates into its emergency response program a broad range of hazards and environmental aspects, potential consequences and lessons learned from simulated and actual emergencies. Existing LLNL procedures would be adequate to protect workers from potential extreme weather events including lightning events and extreme heat days. Implementation of the Proposed Action would not result in demands on facilities above the No Action Alternative. Therefore, ongoing maintenance and routine upgrades work would serve to protect existing assets against current extreme weather events, and begin to prepare LLNL for climate-related changes that may stress aging facilities.

4.1.10 Cumulative Impacts

In accordance with the 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 EA included a review of past, present, and reasonably foreseeable actions for other federal and non-federal agencies in San Joaquin and Alameda counties. The following resource areas are analyzed in relation to cumulative impacts in this EA: ecological resources, air quality, noise, and climate change. Past, present, and probable future projects considered in this cumulative impacts analysis include urban and residential developments and wind turbine projects in the Altamont Pass Wind Resource Area. Table 9 lists the geographic scope of cumulative impacts and the method of evaluation.

Table 9 Geographic Scope of Cumulative Impacts and the Method of Evaluation

Resource Issue	Geographic Area	Method of Evaluation
Ecological Resources	Site 300 and Regional area	Projections
Air Quality	Local and Air Basin (i.e. SJVAPCD)	Projections
Noise	Site 300 and local area	Projections
Climate Change	Regional	Projections

Ecological Resources

Reasonably foreseeable actions in the region that would contribute to impacts on ecological resources include developments for urban and residential use and renewable energy generation. Urban and residential developments can remove land from use by wildlife and create barriers to wildlife movement between habitats. Infrastructure associated with renewable energy generation can result in direct mortality of wildlife from collisions and electrocutions. Under the Proposed Action, no new developments would occur at Site 300. Site 300 would continue to contain designated Critical Habitat for the California red-legged frog and Alameda whipsnake. Existing conservation areas would continue to be managed at Site 300 to the benefit of protected species. Site 300 would continue to serve as a relatively undisturbed open space corridor for wildlife movement across the landscape. The Proposed Action would not contribute to habitat degradation or disturbance across the region. Because the Building 851 muster is protected from development and the annual prescribed burn bolsters native plant populations, operations at Site 300 provide a net benefit impact on native plant populations. Because potential for direct impacts on individuals is low, and because LLNL maintains habitat to the benefit of protected species onsite, population level effects from the Proposed Action would be negligible.

Air Quality

Reasonably foreseeable actions in the region that would contribute to air quality issues include increased urban and residential development, increased traffic congestion, and increased industrial activities. Implementation of the Proposed Action would result in increased emissions of air pollutants above the No Action Alternative. These emissions would contribute to air emissions in the region.

The Proposed Action would not result in an increase in workers at LLNL above the No Action Alternative because only the weight of explosives detonated would change. Implementation of the Proposed Action would not involve building new facilities or in demands on facilities above the No Action Alternative. Therefore, implementation of the Proposed Action would not contribute to air quality emissions from increased development or traffic.

DOE/NNSA completed a HRA in analyzing the Proposed Action for TAC emissions and potential pathways and sensitive receptors (See Appendix A). When the Proposed Action is considered in the context of other permitted sources at Site 300, the cumulative impacts are within SJVAPCD-established thresholds of significance for TACs as detailed in Section 4.1.3

Air Quality of this EA and in Appendix A. As described in Section 4.1 Proposed Action, implementation of the Proposed Action would not result in impacts on socioeconomics or community services. Therefore, increases in air emissions from the Proposed Action would not result in disproportionate impacts on minority or low-income populations.

Noise

A primary source of ambient noise surrounding Site 300 is traffic on roadways and at the Carnegie State Vehicular Recreation Area. Under the Proposed Action, there would be no change in sources of noise, general ambient noise, or the length of time of each impulse noise event above the No Action Alternative. Therefore, implementation of the Proposed Action would not contribute to cumulative impacts on noise sources or ambient noise above the No Action Alternative.

Other sources of impulse noise occur locally to Site 300. SRI International operates a remote test site called the Corral Hollow Experiment Site south of Corral Hollow Road. Impulse noise events have occurred at the Corral Hollow Experiment Site and are reasonably likely to continue to contribute to cumulative impacts on noise in the area. However, under the Proposed Action only the weight of explosives detonated at Site 300 would change, there would be no change in the relative frequency of events or length of time of each event. Therefore, cumulative noise impacts under the Proposed Action would be similar to those under the No Action Alternative.

Climate Change

Reasonably foreseeable actions in the region that would contribute to impacts on climate change include development and repowering of wind turbines in the Altamont Pass. Wind-generated electricity arguably has a net-benefit impact on climate change over fossil fuel-generated electricity through decreased GHG emissions. Because implementation of the Proposed Action would not result in changes in electricity consumption at Site 300 over the No Action Alternative, the Proposed Action would not contribute to cumulative impacts on GHG emissions from electricity generation.

Because the Proposed Action would not result in impacts on traffic or transportation, cumulative changes in transportation-related GHG emissions in the region would be negligible. Implementation of the Proposed Action would result in a negligible increase in LLNL’s GHG emissions. Therefore, implementation of the Proposed Action would not substantially change LLNL’s contribution to regional climate change over the No Action Alternative.

Reasonably foreseeable impacts on LLNL operations from projected changes in regional weather patterns and extreme weather events from climate change include stress on aging facilities, and decreased reliability on regional water supplies. The Proposed Action would not result in substantial changes in facility demands or water resource requirements over the No Action Alternative. LLNL’s existing emergency response program is adequately able to address immediate climate-related and extreme-weather related threats. No other changes in Site 300 operations are currently under consideration. Therefore, cumulative impacts on LLNL operations from climate change would be negligible.

4.2 NO ACTION ALTERNATIVE

A No Action Alternative must be considered in all DOE/NNSA EAs. The purpose of a No Action Alternative in the NEPA process is to provide a baseline against which impacts of the other analyzed alternatives can be compared. For the purposes of this EA, the No Action Alternative would continue current and ongoing open detonation explosives experiments at the Building 851 Complex and Site 300.

The No Action Alternative would not result in impacts on the human environment outside of those previously analyzed under NEPA as described in the 2005 SWEIS (DOE/EIS-0348), the 2011 Supplemental Analysis (SA) (DOE/EIS-0348-SA-03), and the 2008 Complex Transformation SPEIS (DOE/EIS-0235-S4).

The No Action Alternative would not meet the necessary criteria nor would it support the mission needs of DOE/NNSA.

5.0 LIST OF AGENCIES AND PERSONS CONSULTED

In the process of preparing material for this EA, DOE/NNSA had discussions with organizations and federal agencies including Department of Defense and Lawrence Livermore National Laboratory.

No project-specific consultation with the U.S. Fish and Wildlife Service was conducted in compliance with the *Endangered Species Act (ESA)*, as the Proposed Action and alternatives would not be expected to affect either individuals of threatened or endangered species or their critical habitat.

No consultation with the State Historic Preservation Office was conducted in compliance with the *National Historic Preservation Act (NHPA)* (16 U.S.C. § 470, 36 CFR 800.5), as the Proposed Action and alternatives would not be expected to affect any cultural resource.

6.0 LIST OF PREPARERS

Abri, Mohammad, Abri Environmental Engineering Inc.

Culver, Daniel. NEPA Compliance Officer, DOE/NNSA Livermore Field Office.

Dancy, Lisa. NEPA Document Manager, DOE/NNSA Livermore Field Office.

Fratanduono, Meg Lawler. Environmental Functional Area, LLNL.

Quinly, Crystal. Environmental Functional Area, LLNL.

APPENDIX A

ATC/PTO APPLICATION PACKAGE SUBMITTED TO SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT

San Joaquin Valley Air Pollution Control District

www.valleyair.org

Checklist for Permit Applications:

To avoid unnecessary delays, please review the following checklist before submitting your Authority to Construct/Permit to Operate application.

☒	**Include a signed Authority to Construct/Permit to Operate Application**
☒	1. Include a vicinity map, and identify the location(s) where the new/modified units will operate.
☒	2. Equipment listing (including a list of electric motors with hp rating)
☒	3. Include a short project description, including a process flow schematic identifying emission points.
☒	4. Process parameters (describe throughout, operating schedule, fuel rate, raw material usage, etc.).
☒	5. Identify control equipment/technology.
☒	6. Any applicable supplemental application forms. Supplemental application forms can be found here: http://www.valleyair.org/busind/pto/ptoforms/1ptoformidx.htm
☒	7. Any additional information required to calculate emissions.
☒	8. $79 filing fee for each permit unit

Detailed Authority to Construct (ATC) and Permit to Operate (PTO) Application Instructions can be found here:

PDF Format: http://www.valleyair.org/busind/pto/ptoforms/atcappinstruct.pdf
Word Format: http://www.valleyair.org/busind/pto/ptoforms/WordDocs/atcappinstruct.doc

Applications may be submitted either by mail or in person at any of the following locations. The District is pleased to provide businesses with assistance in all aspects of the permitting process. Any business is welcome to call the **Small Business Assistance (SBA) Hotline** or to visit the SBA Office located in each of the regional offices. No appointment is necessary. For more information, please call the SBA Hotline serving the county in which your business is located.

Northern Region Office
(Serving San Joaquin, Stanislaus, and Merced Counties):

4800 Enterprise Way
Modesto, California 95356-8718
(209) 557-6400
FAX: (209) 557-6475
SBA Hotline: (209) 557-6446

Central Region Office
(Serving Madera, Fresno, and Kings Counties):

1990 E Gettysburg Avenue
Fresno, California 93726-0244
(559) 230-5900
FAX: (559) 230-6061
SBA Hotline: (559) 230-5888

Southern Region Office
(Serving Tulare and Kern Counties):

34946 Flyover Court
Bakersfield, California 93308
(661) 392-5500
FAX: (661) 392-5585
SBA Hotline: (661) 392-5665

San Joaquin Valley Air Pollution Control District
Authority to Construct/Permit to Operate Application Form

www.valleyair.org

1. PERMIT TO BE ISSUED TO: Lawrence Livermore National Laboratory

2. MAILING ADDRESS:
STREET or P O BOX: 7000 East Ave., Mail Drop: L-627
CITY: Livermore STATE: CA ZIP CODE (9-digit): 94550-9698

3. LOCATION WHERE THE EQUIPMENT WILL BE OPERATED:
☐ *Check box if same as mailing address and skip to next section.*
STREET: Corral Hollow Road CITY: Tracy
If a physical address is not available:
1/4 SECTION: 20 TOWNSHIP: 3S RANGE: 4E

4. IS EQUIPMENT WITHIN 1,000 FT OF A SCHOOL?
☐ YES ☒ NO

5. GENERAL NATURE OF BUSINESS:
Research and Development

6. S.I.C. CODE OF FACILITY:
8733,9711, 4953

7. TITLE V PERMIT HOLDERS ONLY: Do you request a COC (EPA Review) prior to receiving your ATC?
☐ YES *If yes, please complete and attach a Compliance Certification form (TVFORM-009)*
☒ NO

8. DESCRIPTION OF EQUIPMENT OR MODIFICATION FOR WHICH APPLICATION IS MADE:
(*Please include permit #'s if known, a Supplemental Application Form if available, and use additional sheets if necessary*)
Increase in R & D explosives weight for open detonation above the exemption levels of Rule 2020 Exemption, Section7.0, Sub-section 7.4 for B851 Detonation Pad.

9. IS THE EQUIPMENT OR MODIFICATION ALREADY INSTALLED OR COMPLETED?
☒ YES *Please provide date of installation:*1962
☐ NO *Please provide expected date of installation or modification:*____________

10. DO YOU REQUEST A PERIOD TO REVIEW THE DRAFT AUTHORITY TO CONSTRUCT (ATC) PERMIT PRIOR TO ATC ISSUANCE?
Please note that requesting a review period will delay issuance of your final permit by a corresponding number of working days. See instructions for more information on this review
☐ 3-day review
☐ 10-day review
☒ No review requested

11. IS THIS APPLICATION FOR THE CONSTRUCTION OF A NEW FACILITY?
☐ YES *If "Yes", please complete the CEQA Information form:* http://www.valleyair.org/busind/pto/ptoforms/CEQAInformationForm.doc.
☒ NO *If "No", is the proposed equipment or project allowed by either:*
- the Conditional Use Permit or other Land Use Permit? ☒ YES ☐ NO
- or by Right? ☐ YES ☐ NO

12. IS THIS APPLICATION SUBMITTED AS THE RESULT OF EITHER A NOTICE OF VIOLATION (NOV) OR A NOTICE TO COMPLY (NTC)?
☐ YES *If yes, NOV/NTC #:*____________________
☒ NO

13. APPLICANT NAME: Sav Mancieri
TITLE: Group Leader, Env Support & Programmatic Outreach
DATE: November 2, 2017
SIGNATURE:

14. APPLICANT CONTACT INFORMATION:
PHONE #: (925) 422-6920
CELL PHONE #: (925) 784-3814
E-MAIL: mancieri1@llnl.gov

15. ***Optional Section:*** *DO YOU WANT TO RECEIVE INFORMATION ABOUT EITHER OF THE FOLLOWING VOLUNTARY PROGRAMS?*
☐ *"**H**EALTHY **A**IR **L**IVING (**HAL**) BUSINESS PARTNER"* ☐ *"**I**NSPECT"*

FOR APCD USE ONLY:

DATE STAMP:

FILING FEE RECEIVED:$ CHECK #: DATE PAID:

PROJECT #: FACILITY ID #:

San Joaquin Valley Air Pollution Control District
Supplemental Application Form

CEQA Information

The San Joaquin Valley Air Pollution Control District (District) is required by state law, the California Environmental Quality Act (CEQA), to review discretionary permit project applications for potential air quality and other environmental impacts. This form is a screening tool to assist the District in clarifying whether or not the project has the potential to generate significant adverse environmental impacts that might require preparation of a CEQA document (CEQA Guidelines §15060(a).

PERMIT TO BE ISSUED TO: Lawrence Livermore National Laboratory
LOCATION WHERE THE EQUIPMENT WILL BE OPERATED: LLNL Experimental Test Site (Site 300), Corral Hollow Road.

<u>Section 1</u>:	**Agency Approvals**		
	Check "Yes" or "No" as applicable.	**Yes**	**No**
1.	Has a Lead Agency prepared an environmental review document (Environmental Impact Review, Mitigated Negative Declaration, Negative Declaration, or Notice of Exemption) for this project?	☒ Note 1	☐
2.	Is a Lead Agency in the process of preparing an environmental review document (Environmental Impact Review, Mitigated Negative Declaration, Negative Declaration, or Notice of Exemption) for this project?	☐ Note 1	☐
	*If "**Yes**" is checked for <u>either</u> question 1 or 2, please provide the following information:* - *Lead Agency name : U.S. Department of Energy / National Nuclear Security Administration (DOE/NNSA)* - *Name of Lead Agency contact person: Lisa Dancy, Document Manager* - *Type of CEQA document prepared:* NEPA document: Environmental Assessment - *Project reference number:* *DOE-NEPA-EA-2076* - *If a CEQA Environmental Review document has been prepared for this project,* ***please attach a <u>copy of the Notice of Determination or the Notice of Exemption</u>*** *If "**No**" is checked for <u>both</u> questions 1 and 2, please attach an explanation*:		

<u>Note 1</u>: If you answered YES to question 1 OR 2 do not complete Section 2 of this form, and please return the completed form to the Air Pollution Control District.

Section 2: Project Information

Note: If you answered YES to question 1 OR 2 of Section 1 do not complete this section, and please return the completed form to the Air Pollution Control District.		**Yes**	**No**
1.	Would this project result in more than 47 heavy-duty truck (HD) one-way trips per day to and from the facility? (23 heavy-duty truck (HD) round trips per day).	☐	☐
2.	Would this project result in a need for more than 350 new employees?	☐	☐
3.	Would this project result in more than 700 customer trips per day to and from the facility?	☐	☐
4.	Would this project increase the demand for water at the facility by more than 5,000,000 gallons per day?	☐	☐
5.	Would this project require construction of new water conveyance infrastructure *Post-project facility water demand exceeding the capacity of local water purveyor.*	☐	☐
6.	Would this project create a permanent need for new or additional public services for Solid Waste Disposal or Hazardous Waste Disposal? *Post-project waste discharge exceeding the capacity of the local Solid Waste Disposal or Hazardous Waste Disposal.*	☐	☐
7.	Would this project result in noticeable off-site odors that have the potential to generate nuisance complaints?	☐	☐
8.	Would this project include equipment with a noise specification greater than 90 decibels (db)?	☐	☐
9.	Has this project generated any known public concern regarding potential adverse impacts? *Public concern may be interpreted as concerns by local groups at public meetings, adverse media attention such as negative newspapers or other periodical publications, local news programs, environmental justice issues, etc.*	☐	☐
10.	Would this project result in any demolition, excavation, and/or grading/construction activities <u>outside</u> the perimeter of the existing facility?	☐	☐
11.	Would this project result in any demolition, excavating, and/or grading construction activities that encompass an area exceeding 20,000 Square feet (<u>inside</u> or <u>outside</u> the perimeter of the existing facility)?	☐	☐
12.	Is this project part of a larger development activity at the facility that collectively would result in answering YES to any of the questions listed above?	☐	☐

FOR DISTRICT USE ONLY – CEQA ANALYSIS REQUEST

PERMIT	**TECHNICAL SERVICES**
AQE Name:	AQS Name:
Facility Name:	PAS #: CEQA #:
Facility #: Project #:	Project with potential public concern? ☐ Yes ☐ No
Is this an RO project? ☐ Yes ☐ No	Detailed CEQA analysis required? ☐ Yes ☐ No
Project subject to Public Notice? ☐ Yes ☐ No	Indemnification Agreement (IA) required? ☐ Yes ☐ No ☐ N/A Letter of Credit (LOC) required? ☐ Yes ☐ No ☐ N/A
Please summarize or attach the following: - ☐ Copy of application form - ☐ CEQA Analysis Request form - ☐ GHG Determination (>230MT-CO_2e/yr? BPS?) - ☐ Expected date of ATC(s) issuance: __________	- ☐ IA/LOC received - ☐ CEQA paragraph sent to permit engineer - ☐ NOD prepared - ☐ County filing fees District check prepared - ☐ Game and Fish fees District check or proof of payment *(District check prepared after receiving applicant check)* - ☐ CEQA Ready and ok to issue ATC
Date form is forwarded to Tech. Services SVr:	Date form is forwarded back to permit engineer:

Supplemental Information

In support of the Authority to Construct/Permit to Operate application for the proposal to increase the weight of explosives detonated at Lawrence Livermore National Laboratory's Experimental Test Site (Site 300) Building 851

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1.0 Purpose of this Document

This Supplemental Information Document contains data and specifications relevant to the Authority to Construct/Permit to Operate application for the proposal to increase the weight of explosives detonated at Site 300. As described in the SJVAPCD ATC/PTO Instructions Revised Oct. 2016, data, specifications, plans and drawings must be submitted with each application for ATC and PTO. Table 1 shows where the required information can be found in this document or other attachment to the ATC/PTO application.

Table 1. Locations of Required Supplemental Information.

Supplemental Information Required	Notes	Where the information can be found
Supplemental Application Forms	CEQA Information Supplemental Application	Attached to the ATC/PTO application along with the Draft NEPA Environmental Assessment.
Equipment Location Drawing or Plot Plan	"Equipment" is the Building 851 firing table	Figures 1, 2, and 3 of this document
Equipment Description	"Equipment" is the Building 851 firing table	Section 2.2 of this document
Description of Operation	Operational activities relating only to the proposed detonations, not including other Site 300 operations	Section 2.3 and 3.0 of this document
Expected Emission of Air Contaminants	None	Health Risk Assessment found in Section 3.0 of this document
Operating Schedule	None	Section 2.4 of this document
Health Risk Assessment	Includes expected emission of air contaminants	Section 3.0 of this document
Process Weight	None	Section 3.3 of this document and as part of the Health Risk Assessment
Fuels and Burners Used	Includes gaseous fuels, liquid fuels and solid fuels	Not Applicable
Process and instrumentation flow diagram	None	Not Applicable
Equipment drawings	None	See Figure 3 of this document

Additionally, this document contains a discussion of Best Available Control Technology (BACT) as applicable to this permit application. This information is not intended to act as a complete review of the Proposed Action for NEPA or CEQA. A detailed description of the Proposed Action and an analysis of the Proposed Action as required by NEPA can be found in the attached Draft Environmental Assessment (EA).

2.0 Background Information

2.1 Equipment Location Drawing or Plot Plan

Site 300 is a secure DOE/NNSA facility in San Joaquin County California. Site 300 is located about 15 miles southeast of the LLNL Livermore Site in Livermore, California and 6 miles southwest of Tracy, California Figure 1 shows the locations of LLNL Livermore Site and Site 300 on a regional map. Figure 2 shows the Site 300 property lines, and the location of the Building 851 firing table (the proposed emissions unit) with respect to streets and all adjacent properties. The Carnegie State Vehicular Recreation Area (SVRA) ranger residence is the nearest receptor to the B851 firing table, at a distance of 2.06 miles. The industrial RISI/Teledyne Facility is the next nearest receptor at 3.43 miles away. The Connolly Ranch residential receptor is 3.7 miles from the B851 firing table. The area planned for residential development called Tracy Hills is 4.16 miles away from the B851 firing table. As the Tracy Hills area has not yet been developed, it is not an existing sensitive receptor. However, for the purposes of a complete impacts analysis under the National Environmental Policy Act (NEPA), DOE/NNSA has considered this location for potential impacts.

2.2 Equipment Description

The emissions unit is an open detonation firing table at the Site 300 Building 851 Complex. No make, model, or serial numbers is available for this facility. For this analysis, the Building 851 firing table location is described in Universal Trans Mercator (UTM)) coordinates at 627604 UTME, 4169059 UTMN, (referenced to North American Datum 1983 [NAD83]) and has an elevation of 394 m. Figure 3 shows an aerial photograph of the Building 851 Complex.

The Building 851 Complex is part of the explosive test facility operations at Site 300. The 13,681-gross-square-foot complex is in the northwest quadrant of Site 300 and houses diagnostic equipment, a laser room, several laboratories, a portable x-ray room, several shop areas and offices. The Building 851 Complex includes the 7,057 square-foot open-air firing table.

The Building 851 firing table consists of gravel. An approximately 3-inch-thick steel plate or an 8 to10-inch-thick concrete pad would be placed between the explosives and the gravel prior to detonations. The explosives may also be detonated on a stand a few feet above the protective concrete and steel. There is no vegetation on the firing table. Adjacent to the firing table is a protective earthen berm and a dirt roadway. Under the Proposed Action, the protective berm would be reinforced with wet mix shotcrete or similar material, applied approximately 125 feet by 35 feet and 0.5 feet deep. The dirt roadway, approximately 62 feet long, would be covered with gravel to a depth of 0.5 feet.

2.3 Description of Operation

Operational activities as they relate to the Proposed Action can be found in Section 2.1.3 of the Draft EA. Specifics on the operations as they relate to air emissions can be found in the Health Risk Assessment section of this document.

2.4 Operating Schedule

Explosive open detonations would be performed at Building 851 between the hours of 10:00 am and 8:50 pm Monday-Friday in accordance with existing LLNL procedures.

Figure 1. Location of the LLNL Livermore Site and Site 300.

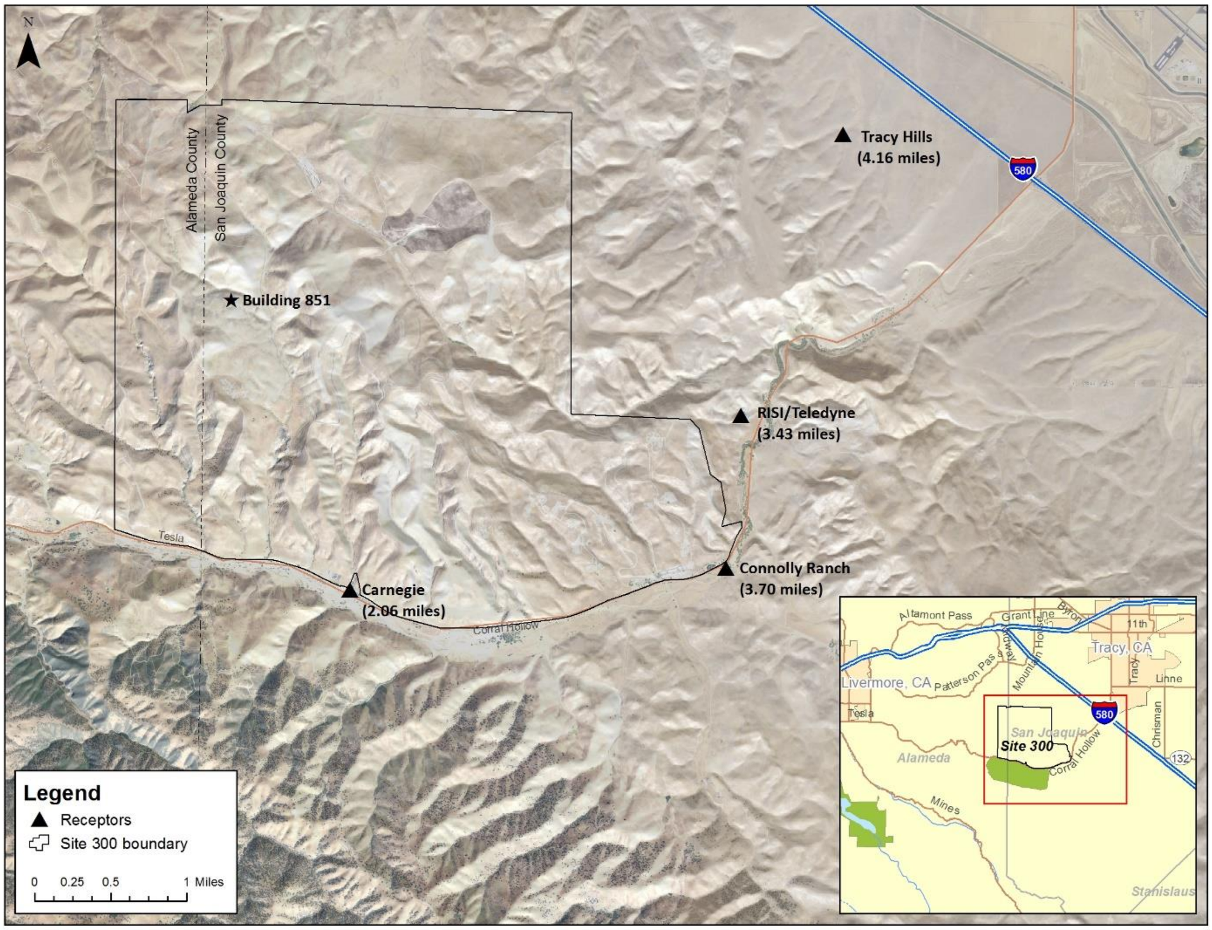

Figure 2. Site 300 and the Building 851 firing table with respect to streets, adjacent properties and receptors.

Figure 3. Aerial Photograph of the Building 851 Complex.

3.0 Health Risk Assessment

The SJVAPCD Risk Management Policy for Permitting New and Modified Sources Policy APR 1905 (SJVAPCD, 2015) provides risk management guidance for evaluating permit applications for new and modified sources of toxic air contaminants (TACs). Per Policy APR 1905, all new projects that emit TACs must undergo a public health risk evaluation as part of the permit review process prior to a final decision on issuing the ATC/PTO. The health risk evaluation process begins with cumulative prioritization using the California Air Pollution Control Officers Association's (CAPCOA) Facility Prioritization Guidelines. Projects with a cumulative prioritization score greater than one, require a cumulative Health Risk Assessment (HRA) performed in accordance with guidelines issued by the Office of Environmental Health Hazard Assessment (OEHHA).

A HRA includes risks associated with:

- TAC emissions from new sources proposed in the application under review,
- Increases in TAC emissions from modification to existing sources proposed in the application under review, and
- TAC emissions from previously approved projects for which the District required a health risk evaluation as part of the project's approval.

For an ATC/PTO application to be approved, the cumulative HRA for the project must show that:

- The cancer risk is less than 20 in one million
- The acute hazard index is less than 1
- The chronic hazard index is less than 1

DOE/NNSA considered the cumulative risk from the Proposed Action and risks from previously approved Site 300 projects as provided by the SJVAPCD. It does not include risks from modifications to existing sources proposed in the ATC/PTO application because there are not modifications to existing sources proposed in the ATC/PTO application.

A HRA has four main components: hazard identification, exposure assessment, dose-response assessment, and risk characterization. Hazard identification identifies pollutants that can be emitted and whether a pollutant is a carcinogen or a non-carcinogen with chronic or acute adverse health effects.

An exposure assessment estimates the extent of public exposure to emitted pollutants. It includes quantifying emissions, modeling pollutant transport through the air, evaluating environmental fate (e.g., deposition onto soil, surface waters and plants), identifying exposure routes (e.g., inhalation, ingestion, dermal absorption, etc.) and exposed populations (e.g., residents, off-site workers, sensitive populations, etc.) and estimating short-term and long-term exposure levels (e.g., one-hour average and annual average concentrations). A dose-response assessment describes the quantitative relationship between the amount of exposure to substance (i.e., the dose) to the incidence or occurrence of an adverse health impact (i.e., the response). The quantitative relationship is presented in the form of dose-response toxicity factors such a cancer potency slope factor (CSF) for carcinogens and reference exposure level (REL) for non-carcinogens. Risk characterization uses the information developed through the exposure assessment combined with the dose-response assessment to quantify the cancer risk in probability terms and non-cancer adverse health impacts in terms of the hazard index.

The methodology used in this HRA is based on the Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (OEHHA, 2015).

Air pollutant emission rates are calculated using the Open Burn Open Detonation Model (OBODM) emission factors, AP-42 emission factors, stoichiometric conversion calculations, the Combined Obscuration Model for Battlefield Induce Contaminants (COMBIC) simulations, emission factors for melting plastic, and metal release fractions for explosive assemblies. Conservative emission factors were selected to ensure modeling an upper bound, as individual experiments may have variable components. Expected Emissions of Air Contaminants are discussed in Section 3.1 of this document.

Pollutant transport through air and the resulting maximum one-hour and annual average ambient air concentrations are calculated using USEPA's AERMOD modeling system. These details can be found in section 3.2 of this document.

Environmental fate calculations, use of dose-response toxicity factors, and cancer risk and non-cancer hazard index calculations are implemented using the California Air Resources Board's (CARB) Hot Spots Analysis Reporting Program (HARP version 2). HARP2 implements the latest OEHHA (2015) HRA methodology and is recommended for use by the SJVAPCD. The methods of calculating risk used here are based on a "worst-plausible" situation and are conservative in nature. They predict the upper limits of risk and the real risks are not expected to be any higher than the predicted numbers and may be substantially lower. These methods and results are discussed in Sections 3.3 and 3.4 of this document.

3.1 Expected Emission of Air Contaminants

Air emissions associated with the proposed Site 300 open detonations can result from (1) combustion (decomposition) of explosive material contained in the device being detonated, (2) destruction and fragmentation of materials used to construct the device being detonated (i.e., the assembly), (3) purging the interior assembly volume with small amounts of sulfur hexafluoride (SF6) and (4) surface cratering and surface scouring due to the blast. The types of pollutants that can be emitted include criteria pollutants, organic compounds, inorganic compounds, acid gases and metals. Expected maximum hourly and annual air emissions are shown in Table 2.

3.1.1 Combustion (decomposition) of Explosives Emissions

The combustion of explosive material may produce criteria pollutants, organic compounds and inorganic/acid gases. Air emissions of these pollutants depend on the amount of and type of explosive being detonated. Most of the explosives used at Site 300 involve high explosives, such as the compounds LX-04, LX-14, LX-17, LX-21, LLM-104, Composition B, Composition C-4, hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

(HMX), nitromethane, and pentaerythritol tetranitrate (PETN), in a variety of formulations. However, any type or mixture of high or low explosives may be used.

Criteria Pollutant Emission Rate Calculations

Criteria pollutant emission rates due to combustion are calculated using emission factors found in AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-1 for TNT (USEPA, 2009a). The maximum hourly and annual criteria pollutant emission rates are calculated by multiplying the emission factor (lb./lb. explosive) by the weight of explosives detonated. For the proposed B851 detonations, 1,000 lbs./hr. is the maximum rate of explosives detonated per hour and 7,500 lbs./yr. is the maximum detonated per year.

Organic Compound Emission Rate Calculations

As with criteria pollutants, organic compound emission rates are calculated using emissions factors. Two sources were used to determine emission factors: (1) AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-2 for TNT (USEPA, 2009b) and (2) OBODM emission factor database (SERDP, 1998c).

OBODM was developed expressly for modeling OB/OD operations and is available from the United States Environmental Protection Agency's Support Center for Regulatory Atmospheric Modeling (https://www3.epa.gov/scram001/dispersion_alt.htm). The OBODM model provides a database file of air pollutant emission factors. The emission factors are based on a series of air emission studies conducted by the United States Army at Dugway Proving Grounds in Dugway, UT. The studies encompassed the open burning of 16 energetic materials and open detonation of 23 energetic materials. The types of explosives that could be open detonated at Site 300 were compared with the materials contained in the OBODM database. Ten materials in the OBODM database represent the types of explosives open detonated at Site 300 and are listed in Table 3. The pollutant-specific emission factors for the ten materials in the OBODM database were examined and only the highest emission factor for each pollutant are used to conservatively calculate emissions.

Inorganic Compound and Acid Gas Emission Rate Calculations

Air emission rates of some inorganic compounds and acid gases from combustion are calculated using emission factors found in AP-42 and the OBODM emission factor database as follows:

- For Nitric acid: AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-2, TNT (USEPA, 2009b)
- For Carbon dioxide, total suspended particulate: AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-1, TNT (USEPA, 2009a)
- For Ammonia: AP-42 Section 13.3 (Explosives Detonation), RDX (USEPA, 1995a)
- For Hydrogen Cyanide: AP-42 Section 13.3 (Explosives Detonation), TNT (USEPA, 1995a)
- For Nitric Oxide: OBODM emission factor database (SERDP, 1998c)

Air emission rates for other inorganic compounds and acid gases such as hydrogen chloride (HCl), hydrogen fluoride (HF), hydrogen sulfide (H2S) and phosphine (PH3) are calculated using emission factors developed by assuming complete stoichiometric conversion of chlorine, fluorine, sulfur and phosphorous in explosive binders and in sulfur hexafluoride (SF6) which is used as a dielectric in large experiment assemblies. For upper bound SF6 to H2S and HF conversion calculations, 1 lb. of SF6 per experiment assembly is used as further described in Section 3.1.3 Assembly Purging Emissions, of this document.

3.1.2 Assembly Destruction and Fragmentation Emissions

Under the Proposed Action, metals and other materials such as plastics may be part of an experiment, or may be used to construct the device being detonated (i.e. the assembly). Materials used to construct the assembly would include metal casings, electrical wiring, plastics and electronic equipment. During an experiment, the emissions of air contaminants results from destruction and fragmentation of the assembly, immediately after detonation of the explosive, (NAWCWD, 2004). Most of the metal fragments are relatively large and will fall out on-site. Only a small fraction of the metal fragments are small enough to remain suspended and be transported off-site (i.e., the release fraction). Similarly, most plastics will remain onsite but a small fraction of plastics will melt and emit some organic compounds.

Detonations at the B851 firing table will be well designed experiments and the upper bound mass of metals and plastics in the assemblies can be estimated. The metal emission rates due to destruction and fragmentation are calculated by multiplying the upper bound mass of metals in the assembly prior to detonation by the release fraction of the metal. The organic compound emission rates emitted due to melting plastics are calculated by multiplying the upper bound mass of plastics in the assembly prior to detonation by the fraction melted multiplied by the organic-specific emission factor found in Barlow et. Al (1996).

A LLNL report documents recommended release fractions for metals based on analysis of data obtained from a series of seven classified integrated weapon experiments and focused material evaluation tests that were performed at LLNL's S-300 in 2003 – 2006 (Ingram 2007). The experiments were designed to improve the release fraction estimates for the unique experimental configurations being tested by LLNL. The experiments and the release fraction analysis were motivated by the need to improve release fraction estimates based on more conservative chemical concentrations rules governing updates to the 1996 SAR. Experiments used dynamic gas/particulate sampling systems and post experiment residuals analysis to inform the evaluation of appropriate release fractions.

Based on this report LLNL uses the following release fractions in our air permit modeling:

- Any metal completely surrounded by explosive – release fraction is 0.09 lb.(released)/lb.(metal) (except Pb which is 0.19 lb./lb.) – these are referred to as INSIDE metals
- Any metal not completely surrounded by explosives but that is within 1.5 charge radii (or 1.5 times the explosive thickness) – release fraction is 0.00285 lb./lb. (except Pb which is 0.1875 lb./lb.) – these are referred to as NEAR metals
- Any metal outside of 1.5 charge radii (or 1.5 time the explosive thickness) – release fraction is negligible – these are referred to as FAR metals

For plastics, approximately 25% of the total plastics will be near the NEAR explosive and assumed to be melted.

3.1.3 Assembly Purging Emissions

Experimental assemblies may require purging with small amounts of SF6. The SF6 is used as a dielectric within the assembly. During the purging process, up to 2 lbs. of SF6 will be vented to the atmosphere and up to 1 lb. will remain in the assembly prior to detonation. After detonation, the SF6 remaining in the assembly will be briefly exposed to high temperatures and may decompose to H2S and HF. H2S and HF emissions are calculated assuming that the sulfur and fluorine in 1 lb. of SF6 completely converts to H2S and HF. However, because it is unknown how much of the 1 lb. of SF6 will convert to H2S and HF, for SF6 emissions it is conservatively assumed that the entire 3 lbs. of SF6 used will be emitted per experiment.

3.1.4 Surface Cratering and Surface Scouring Emissions

Explosive energy that is directed toward the ground may result in emissions due to surface cratering. The crater ejecta consists mostly of large and ballistic agglomerates, and large particles that will fall out on-site. A small fraction of crater ejecta are small particulate (e.g., particles less than or equal to 20 microns in diameter (PM-20)) that rise, remain suspended and can be transported off-site. Additionally, PM-20 from the edge of the crater and scoured from the ground surface impacted by solid fragments and the shock wave (called the "skirt emissions") remain suspended near ground-level and can also be transported off-site. The amount of PM-20 emissions due to surface cratering and ground scouring depends on the amounts of explosives, the ground surface type, the height of detonation above or below ground surface, whether the explosives are cased, and the orientation of the shell. The chemical composition of the surface cratering emissions and surface scouring emissions depend on the impacted surface.

PM-20 emissions from surface cratering and the surface scouring are calculated using COMBIC. COMBIC was developed by the Army Research Laboratory. It was used to calculate cratering emissions in the "Burro Canyon Open Burn/Open Detonation Health Risk Assessment for Naval Weapons Air Station China Lake" and the particulate emissions were reported to the Great Basin Unified Air Pollution Control District (NAWS, 2007).

Detonations at the B851 firing table would take place on a concrete pad approximately 8-10 inches thick or a steel plate approximately 3-inches thick that would prevent cratering of the gravel firing table below. Only the concrete pad would be cratered; the steel plate will only be dented with no emissions. Surface cratering emissions at B851 will only consist of concrete particles (i. e., PM-20). Beyond the crater area (i.e., the concrete pad), and within the surface scouring area lies gravel and shotcrete (i.e., concrete conveyed through a hose). Surface scouring emissions at B851 will only consist of gravel and concrete particles (i. e., PM-20).

Because COMBIC calculates PM-20 emissions, surface cratering and surface scouring PM-10 and PM-2.5 emissions at B851 are calculated by scaling the COMBIC PM-20 emission results using the particle size distribution found in AP-42, Section 11.6 (Portland Cement Manufacturing) Table 11.6-6 (USEPA, 1995b) because the cratered and surface scoured material will consist primarily of concrete particles.

Table 2 Expected Maximum Hourly and Annual Air Emissions.

CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate	
						(lbs./hr.)	(lbs./yr.)
Combustion of Explosives							
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	Organic	1.80E-12	lb./lb. Explosive	AP-42[1]	1.80E-09	1.35E-08
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	Organic	1.50E-11	lb./lb. Explosive	AP-42[1]	1.50E-08	1.13E-07
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	Organic	5.50E-13	lb./lb. Explosive	AP-42[1]	5.50E-10	4.13E-09
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	Organic	4.40E-13	lb./lb. Explosive	AP-42[1]	4.40E-10	3.30E-09
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	Organic	5.40E-13	lb./lb. Explosive	AP-42[1]	5.40E-10	4.05E-09
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran	Organic	3.40E-12	lb./lb. Explosive	AP-42[1]	3.40E-09	2.55E-08
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	Organic	2.20E-10	lb./lb. Explosive	AP-42[1]	2.20E-07	1.65E-06
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	Organic	7.00E-13	lb./lb. Explosive	AP-42[1]	7.00E-10	5.25E-09
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	Organic	8.60E-13	lb./lb. Explosive	AP-42[1]	8.60E-10	6.45E-09
106-99-0	1,3-Butadiene	Organic	9.00E-06	lb./lb. Explosive	OBODM[2]	9.00E-03	6.75E-02
106-98-9	1-Butene	Organic	3.10E-05	lb./lb. Explosive	OBODM[2]	3.10E-02	2.33E-01
592-41-6	1-Hexene	Organic	2.40E-05	lb./lb. Explosive	OBODM[2]	2.40E-02	1.80E-01
109-67-1	1-Pentene	Organic	1.40E-05	lb./lb. Explosive	OBODM[2]	1.40E-02	1.05E-01
121-14-2	2,4-Dinitrotoluene	Organic	1.50E-06	lb./lb. Explosive	AP-42[1]	1.50E-03	1.13E-02
83-32-9	Acenaphthene	Organic	9.20E-09	lb./lb. Explosive	AP-42[1]	9.20E-06	6.90E-05
208-96-8	Acenaphthylene	Organic	1.00E-07	lb./lb. Explosive	AP-42[1]	1.00E-04	7.50E-04
75-07-0	Acetaldehyde	Organic	1.22E-04	lb./Experiment	Footnote [14]	1.22E-04	9.77E-04
74-86-2	Acetylene	Organic	1.30E-04	lb./lb. Explosive	OBODM[2]	1.30E-01	9.75E-01
107-02-8	Acrolein	Organic	1.93E-06	lb./Experiment	Footnote [14]	1.93E-06	1.54E-05
79107	Acrylic acid	Organic	5.51E-07	lb./Experiment	Footnote [14]	5.51E-07	4.41E-06
107-13-1	Acrylonitrile	Organic	3.10E-07	lb./lb. Explosive	AP-42[1]	3.10E-04	2.33E-03
120-12-7	Anthracene	Organic	1.20E-08	lb./lb. Explosive	AP-42[1]	1.20E-05	9.00E-05
71-43-2	Benzene	Organic	1.10E-04	lb./lb. Explosive	OBODM[2]	1.10E-01	8.25E-01
117-81-7	bis(2-Ethylhexyl)phthalate	Organic	9.90E-06	lb./lb. Explosive	AP-42[1]	9.90E-03	7.43E-02
85-68-7	Butylbenzylphthalate	Organic	1.70E-06	lb./lb. Explosive	AP-42[1]	1.70E-03	1.28E-02
56-23-5	Carbon Tetrachloride	Organic	4.50E-06	lb./lb. Explosive	OBODM[2]	4.50E-03	3.38E-02
67-66-3	Chloroform	Organic	3.80E-07	lb./lb. Explosive	OBODM[2]	3.80E-04	2.85E-03
627-20-3	cis-2-Pentene	Organic	8.30E-07	lb./lb. Explosive	OBODM[2]	8.30E-04	6.23E-03
110-82-7	Cyclohexane	Organic	7.50E-06	lb./lb. Explosive	OBODM[2]	7.50E-03	5.63E-02
287-92-3	Cyclopentane	Organic	1.70E-06	lb./lb. Explosive	OBODM[2]	1.70E-03	1.28E-02
142-29-0	Cyclopentene	Organic	3.70E-06	lb./lb. Explosive	OBODM[2]	3.70E-03	2.78E-02
84-74-2	Dibutyl phthalate	Organic	2.90E-06	lb./lb. Explosive	AP-42[1]	2.90E-03	2.18E-02

CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate	
						(lbs./hr.)	(lbs./yr.)
75-71-8	Dichlorodifluoromethane	Organic	1.00E-09	lb./lb. Explosive	AP-42[1]	1.00E-06	7.50E-06
74-84-0	Ethane	Organic	3.00E-05	lb./lb. Explosive	OBODM[2]	3.00E-02	2.25E-01
75-00-3	Ethyl chloride	Organic	6.90E-07	lb./lb. Explosive	OBODM[2]	6.90E-04	5.18E-03
100-41-4	Ethylbenzene	Organic	2.50E-06	lb./lb. Explosive	OBODM[2]	2.50E-03	1.88E-02
74-85-1	Ethylene	Organic	3.90E-04	lb./lb. Explosive	OBODM[2]	3.90E-01	2.93E+00
86-73-7	Fluorene	Organic	2.10E-08	lb./lb. Explosive	AP-42[1]	2.10E-05	1.58E-04
50-00-0	Formaldehyde	Organic	5.80E-05	lb./lb. Explosive	AP-42[1,12]	5.82E-02	4.37E-01
75-28-5	i-Butane	Organic	1.60E-06	lb./lb. Explosive	OBODM[2]	1.60E-03	1.20E-02
115-11-7	i-Butene	Organic	2.40E-05	lb./lb. Explosive	OBODM[2]	2.40E-02	1.80E-01
78-78-4	i-Pentane	Organic	9.10E-06	lb./lb. Explosive	OBODM[2]	9.10E-03	6.83E-02
98-82-8	i-Propylbenzene	Organic	7.30E-07	lb./lb. Explosive	OBODM[2]	7.30E-04	5.48E-03
74-82-8	Methane	Organic	2.40E-03	lb./lb. Explosive	OBODM[2]	2.40E+00	1.80E+01
74-87-3	Methyl Chloride	Organic	7.50E-07	lb./lb. Explosive	OBODM[2]	7.50E-04	5.63E-03
71-55-6	Methyl chloroform	Organic	3.80E-07	lb./lb. Explosive	OBODM[2]	3.80E-04	2.85E-03
108-87-2	Methylcyclohexane	Organic	7.00E-06	lb./lb. Explosive	OBODM[2]	7.00E-03	5.25E-02
96-37-7	Methylcyclopentane	Organic	9.10E-06	lb./lb. Explosive	OBODM[2]	9.10E-03	6.83E-02
75-09-2	Methylene Chloride	Organic	8.70E-04	lb./lb. Explosive	OBODM[2]	8.70E-01	6.53E+00
78933	MEK	Organic	1.45E-04	lb./Experiment	Footnote [14]	1.45E-04	1.16E-03
620-14-4	m-Ethyltoluene	Organic	4.80E-07	lb./lb. Explosive	OBODM[2]	4.80E-04	3.60E-03
91-20-3	Naphthalene	Organic	2.60E-07	lb./lb. Explosive	AP-42[1]	2.60E-04	1.95E-03
106-97-8	n-Butane	Organic	3.10E-06	lb./lb. Explosive	OBODM[2]	3.10E-03	2.33E-02
124-18-5	n-Decane	Organic	5.20E-06	lb./lb. Explosive	OBODM[2]	5.20E-03	3.90E-02
142-82-5	N-Heptane	Organic	5.00E-06	lb./lb. Explosive	OBODM[2]	5.00E-03	3.75E-02
110-54-3	n-Hexane	Organic	1.90E-05	lb./lb. Explosive	OBODM[2]	1.90E-02	1.43E-01
111-84-2	n-Nonane	Organic	1.90E-06	lb./lb. Explosive	OBODM[2]	1.90E-03	1.43E-02
109-66-0	n-Pentane	Organic	1.30E-05	lb./lb. Explosive	OBODM[2]	1.30E-02	9.75E-02
111-65-9	Octane	Organic	3.60E-06	lb./lb. Explosive	OBODM[2]	3.60E-03	2.70E-02
78-11-5	Pentaerythritol tetranitrate (PETN)	Organic	5.60E-04	lb./lb. Explosive	OBODM[2]	5.60E-01	4.20E+00
622-96-8	p-Ethyltoluene	Organic	7.60E-06	lb./lb. Explosive	OBODM[2]	7.60E-03	5.70E-02
85-01-8	Phenanthrene	Organic	1.30E-07	lb./lb. Explosive	AP-42[1]	1.30E-04	9.75E-04
74-98-6	Propane	Organic	4.70E-06	lb./lb. Explosive	OBODM[2]	4.70E-03	3.53E-02
115-07-1	Propylene	Organic	7.30E-05	lb./lb. Explosive	OBODM[2, 13]	7.30E-02	5.48E-01
121-82-4	RDX	Organic	7.40E-03	lb./lb. Explosive	OBODM[2]	7.40E+00	5.55E+01
100-42-5	Styrene	Organic	4.20E-05	lb./lb. Explosive	OBODM[2]	4.20E-02	3.15E-01
127-18-4	Tetrachloroethylene	Organic	1.80E-05	lb./lb. Explosive	OBODM[2]	1.80E-02	1.35E-01
108-88-3	Toluene	Organic	2.60E-05	lb./lb. Explosive	OBODM[2]	2.60E-02	1.95E-01
N/A	Total Alkanes (Paraffins)	Organic	1.60E-04	lb./lb. Explosive	OBODM[2]	1.60E-01	1.20E+00
N/A	Total Alkenes (Olefins)	Organic	6.90E-04	lb./lb. Explosive	OBODM[2]	6.90E-01	5.18E+00
N/A	Total Aromatics	Organic	1.00E-04	lb./lb. Explosive	OBODM[2]	1.00E-01	7.50E-01

CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate	
						(lbs./hr.)	(lbs./yr.)
N/A	Total Non-Methane Hydrocarbons	Organic	2.00E-03	lb./lb. Explosive	OBODM[2]	2.00E+00	1.50E+01
N/A	Total Unidentified Hydrocarbons	Organic	2.50E-04	lb./lb. Explosive	OBODM[2]	2.50E-01	1.88E+00
624-64-6	trans-2-Butene	Organic	4.50E-06	lb./lb. Explosive	OBODM[2]	4.50E-03	3.38E-02
646-04-8	trans-2-Pentene	Organic	5.00E-06	lb./lb. Explosive	OBODM[2]	5.00E-03	3.75E-02
75-69-4	Trichlorofluoromethane	Organic	5.80E-10	lb./lb. Explosive	AP-42[1]	5.80E-07	4.35E-06
75-01-4	Vinyl Chloride	Organic	1.30E-06	lb./lb. Explosive	OBODM[2]	1.30E-03	9.75E-03
124-38-9	Carbon Dioxide	Inorganic	1.20E+00	lb./lb. Explosive	AP-42[3]	1.20E+03	9.00E+03
630-08-0	Carbon Monoxide	Criteria Pollutant	4.80E-03	lb./lb. Explosive	AP-42[3]	4.80E+00	3.60E+01
10102-43-9	Nitric Oxide	Inorganic	1.80E-02	lb./lb. Explosive	OBODM[2]	1.80E+01	1.35E+02
10102-44-0	Nitrogen Dioxide	Criteria Pollutant	1.30E-02	lb./lb. Explosive	AP-42[3]	1.30E+01	9.75E+01
N/A	PM-2.5	Criteria Pollutant	1.40E-02	lb./lb. Explosive	AP-42[3]	1.40E+01	1.05E+02
N/A	PM-10	Criteria Pollutant	2.50E-02	lb./lb. Explosive	AP-42[3]	2.50E+01	1.88E+02
N/A	Total Suspended Particulate	Inorganic	3.20E-02	lb./lb. Explosive	AP-42[3]	3.20E+01	2.40E+02
7446-09-5	Sulfur Dioxide	Criteria Pollutant	4.00E-05	lb./lb. Explosive	AP-42[3]	4.00E-02	3.00E-01
7664-41-7	Ammonia	Inorganic \Acid Gas	2.20E-02	lb./lb. Explosive	AP-42[4]	2.20E+01	1.65E+02
7647-01-0	Hydrogen Chloride	Inorganic \Acid Gas	2.60E-02	lb./lb. Explosive	Stoichiometric Conversion[6]	2.60E+01	1.95E+02
74-90-8	Hydrogen Cyanide	Inorganic \Acid Gas	1.35E-02	lb./lb. Explosive	AP-42[5]	1.35E+01	1.01E+02
7697-37-2	Nitric acid	Inorganic \Acid Gas	4.50E-04	lb./lb. Explosive	AP-42[1]	4.50E-01	3.38E+00
7803-51-2	Phosphine	Inorganic \Acid Gas	3.57E-03	lb./lb. Explosive	Stoichiometric Conversion[6]	3.57E+00	2.68E+01
7664-39-3	Hydrogen Fluoride	Inorganic \Acid Gas	Footnote(6)	Footnote(6)	Stoichiometric Conversion[6]	3.87E+01	2.91E+02
7783-06-4	Hydrogen Sulfide	Inorganic \Acid Gas	2.33E-01	lb./Experiment	Stoichiometric Conversion[6]	2.33E-01	1.87E+00

CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate	
						(lbs./hr.)	(lbs./yr.)
Destruction and Fragmentation of the Assembly							
7429-90-5	Aluminum	Metal	5.21E+00	lb./Experiment	Release Fraction [7,14]	5.21E+00	4.17E+01
1344-28-1	Aluminum Oxide	Metal	3.14E-01	lb./Experiment	Release Fraction [7,14]	3.14E-01	2.51E+00
7440-41-7	Beryllium	Metal	3.78E-03	lb./Experiment	Release Fraction [7,14]	3.78E-03	3.02E-02
7440-47-3	Chromium	Metal	3.30E+00	lb./Experiment	Release Fraction [7,14]	3.30E+00	2.64E+01
7440-50-8	Copper	Metal	2.44E+01	lb./Experiment	Release Fraction [7,14]	2.44E+01	1.95E+02
N/A	Glass	Glass	1.57E+00	lb./Experiment	Release Fraction [7,14]	1.57E+00	1.26E+01
7440-57-5	Gold	Metal	3.97E-03	lb./Experiment	Release Fraction [7,14]	3.97E-03	3.18E-02
7440-58-6	Hafnium	Metal	1.89E-01	lb./Experiment	Release Fraction [7,14]	1.89E-01	1.51E+00
7439-89-6	Iron	Metal	6.28E+00	lb./Experiment	Release Fraction [7,14]	6.28E+00	5.03E+01
7439-89-6	Lead	Metal	2.27E-01	lb./Experiment	Release Fraction [7,14]	2.27E-01	1.82E+00
7439-95-4	Magnesium	Metal	1.89E-01	lb./Experiment	Release Fraction [7,14]	1.89E-01	1.51E+00
7439-96-5	Manganese	Metal	9.57E-01	lb./Experiment	Release Fraction [7,14]	9.57E-01	7.66E+00
7439-98-7	Molybdenum	Metal	1.19E+00	lb./Experiment	Release Fraction [7,14]	1.19E+00	9.50E+00
7440-02-0	Nickel	Metal	5.57E-02	lb./Experiment	Release Fraction [7,14]	5.57E-02	4.46E-01
7723-14-0	Phosphorus	Inorganic	9.29E-01	lb./Experiment	Release Fraction [7,14]	9.29E-01	7.43E+00
N/A	Plastic		2.76E+01	lb./Experiment	Release Fraction [7,14]	2.76E+01	2.20E+02
7440-21-3	Silicon	Metal	1.10E+00	lb./Experiment	Release Fraction [7,14]	1.10E+00	8.81E+00
7440-22-4	Silver	Metal	3.97E-03	lb./Experiment	Release Fraction [7,14]	3.97E-03	3.18E-02
7704-34-9	Sulfur	Inorganic	1.95E-01	lb./Experiment	Release Fraction [7,14]	1.95E-01	1.56E+00

CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate	
						(lbs./hr.)	(lbs./yr.)
7440-25-7	Tantalum	Metal	8.32E+00	lb./Experiment	Release Fraction [7,14]	8.32E+00	6.66E+01
7440-32-6	Titanium	Metal	1.05E+00	lb./Experiment	Release Fraction [7,14]	1.05E+00	8.41E+00
7440-33-7	Tungsten	Metal	2.28E+01	lb./Experiment	Release Fraction [7,14]	2.28E+01	1.82E+02
12070-12-1	Tungsten Carbide		3.14E-01	lb./Experiment	Release Fraction [7,14]	3.14E-01	2.51E+00
7440-62-2	Vanadium	Metal	6.03E+00	lb./Experiment	Release Fraction [7,14]	6.03E+00	4.82E+01
7440-66-6	Zinc	Metal	2.94E-02	lb./Experiment	Release Fraction [7,14]	2.94E-02	2.35E-01
7440-67-7	Zirconium	Inorganic	2.79E+00	lb./Experiment	Release Fraction [7,14]	2.79E+00	2.23E+01
Assembly Purge							
2551-62-4	Sulfur Hexafluoride	Inorganic	3.00E+00	lb./Experiment	Mass Balance[8,14]	3.00E+00	2.40E+01
Surface Cratering and Surface Scouring							
N/A	PM-2.5 (from concrete, gravel and shotcrete)	Criteria Pollutant	1.70E+00	lb./1000 lb. Explosive	COMBIC[9,10,14]	1.70E+00	1.36E+01
N/A	PM-10 (from concrete, gravel and shotcrete)	Criteria Pollutant	2.71E+01	lb./1000 lb. Explosive	COMBIC[9,11,14]	2.71E+01	2.17E+02

[1] Emission factors obtained from AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-2, TNT (USEPA, 2009b)
[2] Emission factors obtained from the OBODM model (SERDP, 1998c) and based on the highest open detonation emissions factor for each organic substance from the following materials: 40 mm HEI Cartridge, Explosive D (ammonium picrate), TNT (2,4,6-Trinitrotoluene), Amatol (50% TNT, 50% Ammn. Nitrate), HBX (48/31/17/4 RDX-TNT-Al-WAX), Tritonal (79% TNT, 21% Aluminum), Composition B (56/38/6 RDX-TNT-WAX), RDX (cyclotrimethylenetrinitramine), Tritonal with 2.5% Calcium Stearate, Detonating train,
[3] Emission factors obtained from AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-1, TNT (USEPA, 2009a)
[4] Emission factors obtained from AP-42 Section 13.3 (Explosives Detonation), RDX (USEPA, 1995a)
[5] Emission factors obtained from AP-42 Section 13.3 (Explosives Detonation), TNT (USEPA, 1995a)
[6] Emission factors based on stoichiometric conversion for the following gases:

Hydrogen Chloride conversion of chlorine in binding agents used in explosive such as PBX 9407
Phosphine complete conversion of phosphorous in binding agents used in explosive such as PBX 9404
Hydrogen Fluoride (HF) complete conversion of fluorine in binding agents used in explosives such as LX-17 and complete conversion of fluorine in one pound (eight pounds annually) of sulfur hexafluoride (SF6) used as an assemble purge gas. LX-04 with a higher HF emission factor than LX-17 may be used in much smaller amounts (e. g., 100 lbs.); however, maximum hourly and annual HF emissions would not exceed the values presented.
LX-17 HF emission factor = 3.79E-02 lb. HF/lb. Explosive
SF6 HF emission factor = 8.22E-01 lb. HF/lb. SF6
LX-04 HF emission factor = 1.00E-01 lb. HF/lb. Explosive
Hydrogen Sulfide: complete conversion of sulfur in 1 lb. of SF6 purge gas in an experiment assembly decomposing to H2S after detonation. H2S emission factor = 2.33E-01 lb. H2S/lb. SF6.

[7] Emission factor based on the maximum amount of metal/inorganic in a large experiment assembly multiplied by the appropriate release fraction for that substance.
[8] Up to 3 lbs. of SF6 may be used as a purge gas in large experiments. Assume all 3 lbs. are emitted to the atmosphere.
[9] Emissions factors obtained from the Combined Obscurant Model for Battlefield Induced Contaminants (COMBIC) for a 1,000 lbs. cased detonation with the following results:

Small particulate (20 µm or less) that remain suspended - 107 lbs.
Large particulate (20 µm - 200 µm) that fall out on-site - 2,366 lbs.
Ballistic concrete/shotcrete and large agglomerates that fall out on-site - 4,027 lbs.

[10] The PM-2.5 emission factor was obtained by multiplying the COMBIC PM-20 result of 107 lbs. by the PM-20 to PM-2.5 cumulative mass percent ratio of 0.54/34 found in AP-42, Section 11.6 (Portland Cement Manufacturing), Table 11.6-6 (USEPA, 1995b).
[11] The PM-10 emission factor was obtained by multiplying the COMBIC PM-20 result of 107 lbs. by the PM-20 to PM-10 cumulative mass percent ratio of 8.6/34 found in AP-42, Section 11.6 (Portland Cement Manufacturing), Table 11.6-6 (USEPA, 1995b).
[12] The maximum hourly and annual formaldehyde emission rates include the contribution from melted plastics in the assembly materials.
[13] The maximum hourly and annual propylene emission rates include the contribution from melted plastics in the assembly materials.
[14] The maximum hourly emission rate is based on the upper bound mass of materials in the largest experiment. The annual emission rate would not exceed eight times the hourly rate.

Table 3. Materials in the OBODM Emission Factor Database that Represent the Types of Explosives Detonated at the Building 851 Firing Table.

Material
TNT (2,4,6-Trinitrotoluene)
RDX (cyclotrimethylenetrinitramine)
Explosive D (ammonium picrate)
Composition B (56/38/6 RDX-TNT-WAX)
Tritonal (79% TNT, 21% Aluminum)
Tritonal with 2.5% Calcium Stearate
Amatol (50% TNT, 50% Ammn. Nitrate)
HBX (48/31/17/4 RDX-TNT-Al-WAX)
Detonating train
40 mm HEI Cartridge

3.2 Air Dispersion Modeling

This section describes the air dispersion modeling that is used to estimate the short-term (one-hour average) and long-term (annual average) ambient concentrations of TACs emissions calculated to result from the Proposed Action at Site 300. LLNL used the United States Environmental Protection Agency's (EPA) AERMOD modeling System to calculate the maximum one-hour average and the annual average TAC concentrations at receptor locations in the modeling domain for input to CARB's Hotspot Analysis and Reporting Program Version 2 (HARP2) risk assessment model. HARP2 was used to calculate potential short-term health impacts (acute hazard index) and potential long-term health impacts (chronic hazard index and cancer risk). The health risk modeling results are presented in Section 3.4.

The AERMOD Modeling System is an EPA-preferred computer program consisting of an air dispersion model (AERMOD) and three preprocessors (AERMAP, AERSURFACE and AERMET). AERMOD is recommended for use in HRAs by OEHHA and the SJVAPCD. AERMAP processes terrain data in relation to the receptors and the sources in the analysis. AERSURFACE processes land use land cover (LULC) data and generates a file of surface characteristic parameters. AERMET processes surface meteorological data, upper air data and surface characteristic data to generate boundary layer data and meteorological data. The three preprocessors are run prior to running AERMOD and their outputs are used as inputs to the air dispersion model.

3.2.1 AERMAP Preprocessor

The AERMAP (Version 11103) preprocessor reads a terrain elevation input data file (available from the United States Geological Survey (USGS)) and produces an output file containing the elevation and hill height scale for each receptor located within the modeling domain. The output file is input to the air dispersion model (AERMOD) where the hill height scale is used to calculate the critical dividing streamline height to determine if a plume will impact a hill, go around a hill or ride over a hill located in the modeling domain.

The terrain elevation input data file used in this analysis was obtained from the USGS's National Elevation Dataset website and is in GeoTIFF format. The dataset is reference to North American Datum 1983 (NAD83) and it has a 1 arc-second (30-meter) horizontal resolution and a one-meter vertical resolution.

The modeling analysis includes the following closest residential and commercial/industrial receptors:

- Residential - SVRA ranger residence (receptor 1), Connolly Ranch residence (receptor 2)
- Commercial/industrial - RISI/Teledyne Facility (receptor 3)
- Planned residential - Tracy Hills (receptor 4)

The modeled receptor locations are shown in Figure 2.

The AERMAP input and output files are listed in Appendix A and are provided on the attached compact disk.

3.2.2 AERSURFACE Preprocessor

The AERSURFACE (Version 13016) preprocessor reads a LULC input data file (available from the USGS) and produces an output file containing values for three surface characteristics (surface roughness length, albedo and Bowen ratio) representative of the location where the meteorological data used in the analysis was collected. The surface characteristic values are used as input to the meteorological data preprocessor program AERMET.

The LULC input data file used in this analysis was obtained from the USGS's National Land Cover Data 1992 (NLCD92) archives. The AERMOD Implementation Guide (USEPA, 2015) recommended upwind distance of one kilometer from the meteorological monitoring station for processing LULC data for determining surface roughness is used in this analysis. The AERMOD Implementation Guide also recommends that if the land cover varies significantly by direction then surface roughness should be based on sectors with widths no less than 30 degrees. Land cover within one kilometer of the Site 300 meteorological tower consists of approximately 29% shrubland and 71% grassland (as shown in Figure 4). Land cover within one kilometer of the Site 300 meteorological tower was reviewed for variation by sector and the following five sectors shown in Figure 4 are used as in this analysis:

- Sector 1: 40 – 145 degrees
- Sector 2: 145 – 250 degrees
- Sector 3: 250 – 290 degrees
- Sector 4: 290 – 330 degrees
- Sector 5: 330 – 40 degrees

Surface moisture conditions at Site 300 during 2012 are determined to be "average" using the approach discussed in the AERSURFACE User's Guide. The rainfall total for Site 300 during 2012 of 11.69 inches is within the 30-70 percentile range ("average") for Site 300 rainfall collected over 30 years from 1981-2010. Therefore, AERSURFACE is run using average surface moisture.

Additionally, the SJVAPCD-recommended monthly distribution of seasons is used as follows:

- Winter with no snow (December, January and February)
- Transitional spring (March and April)
- Mid-summer (May, June, July, August and September)
- Autumn (October and November)

The AERSURFACE input and output files are listed in Appendix A and are contained on the attached compact disk.

3.2.3 AERMET Preprocessor

The AERMET (Version 16216) preprocessor is used to combine site-specific meteorological data, site-specific surface characteristics data, and representative upper air meteorological data to produce a file of boundary layer parameters and a file of meteorological parameters used as input to the AERMOD air dispersion model.

Hourly meteorological data collected at the Site 300 monitoring station during 2012 are used in this analysis. The Site 300 meteorological monitoring station is located in the north central section of Site 300 at an elevation of 387 meters as shown in Figure 4. The hourly meteorological data collected at Site 300 include the following parameters:

- Wind speed (meters/second) at 10-meters, 23-meters and 52-meters above ground level
- Wind direction (degrees from which the wind is blowing) at 10-meters, 23-meters and 52-meters above ground level
- Standard deviation of the horizontal wind direction (degrees) at 10-meters, 23-meters and 52-meters above ground level
- Standard deviation of the vertical wind speed (meters/second) at 10-meters, 23-meters and 52-meters above ground level
- Temperature (degrees Celsius) at 2-meters, 10-meters, 23-meters and 52-meters above ground level
- Temperature difference (degrees Celsius) between 10-meters and 2-meters above ground level
- Dew point temperature (degrees Celsius) at 2-meters and 10-meters above ground level
- Relative humidity (percent) at 2-meters and 10-meters above ground level
- Station pressure and sea level pressure (millibars)
- Precipitation (inches)
- Incoming solar radiation (watts/m^2) and
- Net radiation (watts/m^2)

The Site 300 meteorological data are of high quality. The meteorological sensors meet the accuracy requirements of the USEPA for meteorological monitoring stations and are independently audited by an outside contractor each year. The data are quality assurance (QA) checked daily and a much more rigorous QA check is performed each month. A field technician visits the station each week and performs preventative maintenance.

The site-specific surface characteristics data input to AERMET are developed using the AERSURFACE preprocessor as described in Section 3.2.2. The albedo, Bowen ratio and surface roughness length contained in the AERSURFACE output file are used as input to the AERMET input file.

AERMET requires full upper air soundings to calculate convective mixing heights. Upper air soundings taken at Oakland, CA (the upper air station nearest to Site 300) during 2012 are used in this analysis. The soundings were obtained from the National Oceanic and Atmospheric Administration / Earth System Research Laboratory radiosonde database and are in Forecast Systems Laboratory (FSL) format.

The AERMET preprocessor is run in three passes. The AERMET input and output files are listed in Appendix A and are contained on the attached compact disk.

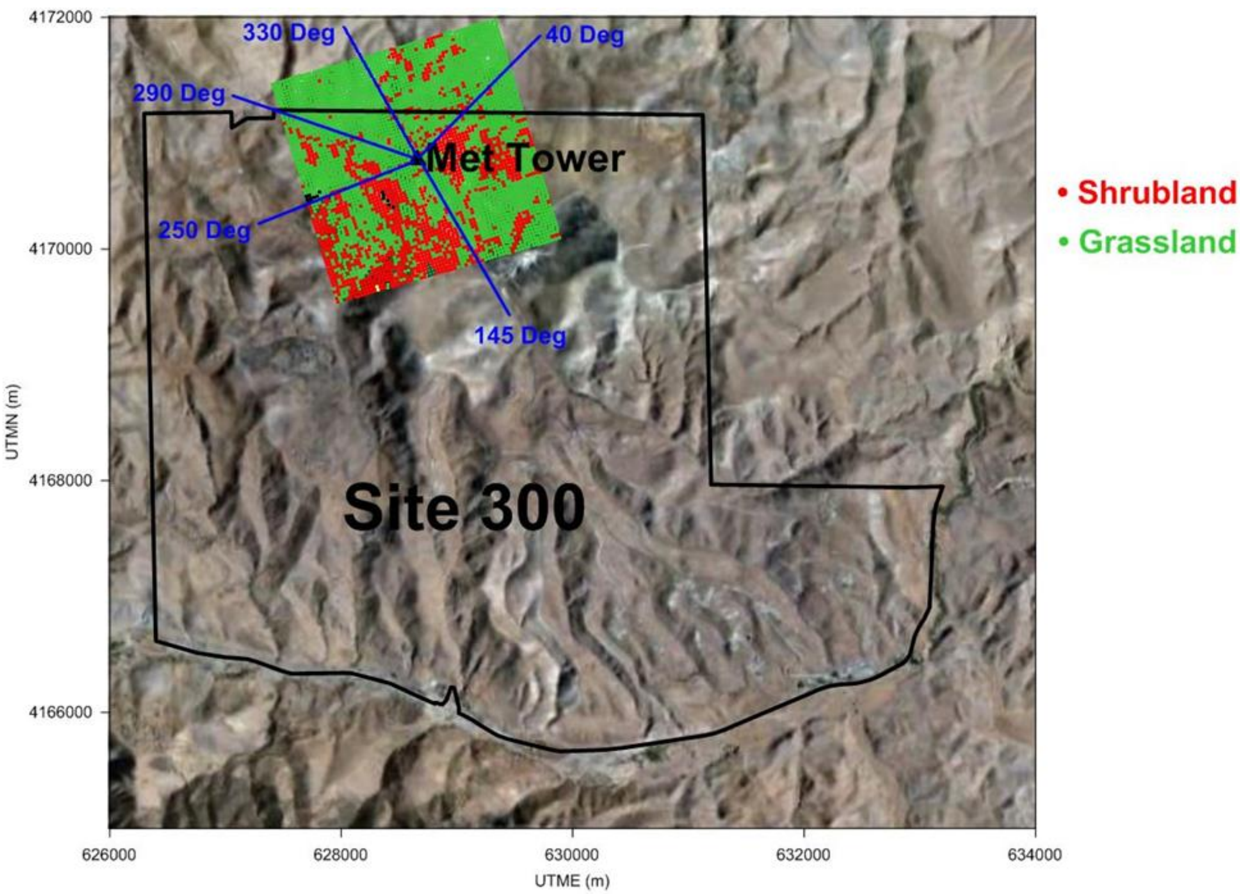

Figure 4. Land Cover Sectors within one Kilometer of the Site 300 Meteorological Monitoring Station.

3.2.4 AERMOD Air Dispersion Model

AERMOD (Version 16216r) was used to model the initial plume associated with a ground-level open detonation, that consists of a vertical stem and top fireball. The stem and fireball are modeled in this analysis using the algorithm developed for LLNL's HotSpot, EpiCode, and National Atmospheric Release Advisory Center (NARAC) models which address open detonation plumes. For this analysis, the stem and fireball plume are modeled as five discrete point sources: one point source at ground-level, and the other four point sources above ground level. Figure 5 is a diagram showing the point source heights and mass distribution of the modeled detonation plume. Note that Figure 5 also describes the initial lateral and vertical dispersion of the plume but because the plume is modeled as point sources (not area or volume sources), the initial dispersion descriptions provided are not included in the modeling analysis. The regulatory default option is used in the analysis.

The final plume rise can be characterized as a function of the weight of explosive being detonated. The plume top height is calculated using the following equation, where w = mass of explosives (lbs.):

$$plume\ top\ height\ (meters) = 76(w)^{0.25}$$

The point source heights are then calculated as a function of plume top height:

$$h(1) = ground\ level$$

$$h(2) = 0.2 * plume\ top\ height$$

$$h(3) = 0.4 * plume\ top\ height$$

$$h(4) = 0.6 * plume\ top\ height$$

$$h(5) = 0.8 * plume\ top\ height$$

The original locations of the five plume point sources are the same as the Building 851 firing table UTM coordinates (referenced to NAD83) of 627604 UTME, 4169059 UTMN, and an elevation of 394 m. The five point source release heights were calculated for each plume and are shown in Table 4. The release temperature, velocity and diameter are nominally set to 0^{o} Kelvin, 0.01 m/s, and 1 m, respectively to eliminate plume rise because the release heights already represent the rise associated with the detonation plume.

Table 4. Point Source Modeling Parameters for 1,000 lbs. of explosives.

Plume Point Source ID (m)	Release Height (m)	Emissions Rate (g/s)	Release Temperature (°K)	Release Velocity (m/s)	Release Diameters (m)
851H1	0	1.0	0.0	0.01	1.0
851H2	85	1.0	0.0	0.01	1.0
851H3	171	1.0	0.0	0.01	1.0
851H4	256	1.0	0.0	0.01	1.0
851H5	342	1.0	0.0	0.01	1.0

A one gram per second emission rate (i.e., 1 g/s unit emission rate) for each of the five point sources is used as input to AERMOD as required by HARP2. HARP2 then scales the AERMOD-calculated 1 g/s-based concentrations by the actual TAC emission rates to arrive at the maximum one-hour average and annual average TAC concentrations at each receptor. The modeled maximum one hour and maximum annual TAC emission rates are listed in Table 5 of Section 3.4.

Open detonations would only occur between 10:00 am and 8:50 pm, however for the purposes of this modeling 9:00 pm was conservatively assumed. Therefore, the hour of day feature (HROFDY secondary keyword) was used to limit dispersion calculations to this period. Although 10:00 am until 9:00 pm is eleven hours, a twelfth hour was added to the HROFDY keyword to account for the fact that the hourly meteorological data are fixed to Pacific Standard Time and local time is advanced one hour in summer to Daylight Savings Time as follows:

$$HROFDY = 9 * 0, 12 * 1, 3 * 0$$

This keyword instructs AERMOD to set the first 9 hours to zero emissions, followed by 12 hours of 1 g/s emissions, followed by 3 hours with zero emissions for each day of meteorological data.

As required by HARP2, each of the five point sources are modeled as its own source group and AERMOD is instructed to generate a plot files containing annual average and maximum one hour average concentrations for each source group. The plot files contain the source-specific unitized concentrations that are used as input to HARP2. The AERMOD input and output files are listed in Appendix A and are contained on the attached compact disk.

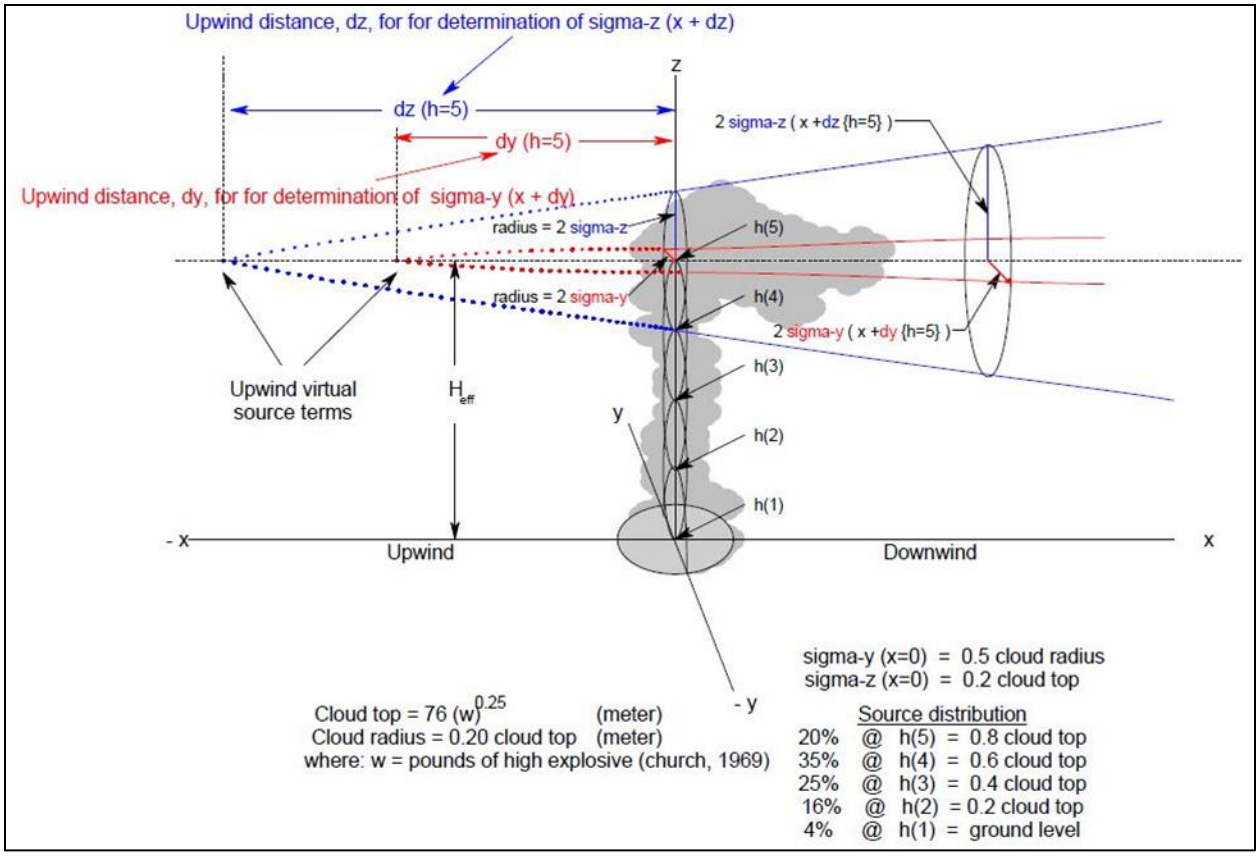

Figure 5. Modeled Plume Point Sources.

3.3 Process Weight

As part of the ATC/PTO application, SJVACPD requires details on the type and the total weight of each material consumed or processed by each emission unit based on pounds per hour or some other mass per unit time which most accurately provides a mechanism to quantify maximum emissions. Section 3.1 and the associated tables in this document provide this information.

3.4 Health Risk Assessment Modeling

The CARB's HARP2 Air Dispersion Modeling and Risk Tool (ADMRT version 17052) health risk assessment model is used to calculate the cancer risk, chronic hazard index and acute hazard index associated with TAC emissions from the proposed open detonation project. HARP2 is recommended for use in health risk assessment by California's OEHHA and by the SJVAPCD. It incorporates the exposure algorithms, dose-response data and risk calculation methodologies contained in OEHHA (2015). For this analysis, the inhalation, dermal, soil ingestion, home grown produce and mother's milk pathways are evaluated. Default values for input parameters are used if site-specific data are not available. As recommended by the SJVAPCD, the 70-year exposure duration OEHHA Derived Method is used for the risk calculations.

HARP2 ADMRT reads the AERMOD unitized concentration plot files described in section 3.2.4 and maximum hourly and maximum annual TAC emission rates to calculate TAC concentrations at each receptor to obtain risk results. The modeled maximum hourly and maximum annual TAC emission rates are presented in Table 5. As shown in Figure 5, the detonation plume is modeled as five discrete point sources, with the total plume emissions distributed as follows:

$$851H1 = 4\% \text{ of plume total}$$

$$851H2 = 16\% \text{ of plume total}$$

$$851H3 = 25\% \text{ of plume total}$$

$$851H4 = 35\% \text{ of plume total}$$

$$851H5 = 20\% \text{ of plume total}$$

Table 5. Modeled maximum one hour and maximum annual TAC emission rates

CAS_No.	SUBSTANCE	Maximum Emission Rate lb./hr.	Maximum Emission Rate lb./year
67562394	1-4,6-8HpCDF	1.80E-09	1.35E-08
35822469	1-4,6-8HpCDD	1.50E-08	1.13E-07
55673897	1-4,7-9HpCDF	5.50E-10	4.13E-09
57117449	1-3,6-8HxCDF	4.40E-10	3.30E-09
60851345	2-4,6-8HxCDF	5.40E-10	4.05E-09
39001020	1-8OctaCDF	3.40E-09	2.55E-08
3268879	1-8OctaCDD	2.20E-07	1.65E-06
57117314	2-4,7,8PeCDF	7.00E-10	5.25E-09
51207319	2,3,7,8-TCDF	8.60E-10	6.45E-09
106990	1,3-Butadiene	9.00E-03	6.75E-02
121142	2,4-DiNitToluen	1.50E-03	1.13E-02
75070	Acetaldehyde	1.22E-04	9.77E-04
107028	Acrolein	1.93E-06	1.54E-05
79107	Acrylic acid	5.51E-07	4.41E-06
107131	Acrylonitrile	3.10E-04	2.33E-03
71432	Benzene	1.10E-01	8.25E-01
117817	Di2-EthHxPhthal	9.90E-03	7.43E-02
56235	CCl4	4.50E-03	3.38E-02
67663	Chloroform	3.80E-04	2.85E-03
75003	Ethyl Chloride	6.90E-04	5.18E-03
100414	Ethyl Benzene	2.50E-03	1.88E-02
50000	Formaldehyde	5.82E-02	4.37E-01
71556	1,1,1-TCA	3.80E-04	2.85E-03
75092	Methylene Chlor.	8.70E-01	6.53E+00
78933	MEK	1.45E-04	1.16E-03
91203	Naphthalene	2.60E-04	1.95E-03
110543	Hexane	1.90E-02	1.43E-01
115071	Propylene	7.30E-02	5.48E-01
100425	Styrene	4.20E-02	3.15E-01
127184	Perc	1.80E-02	1.35E-01
108883	Toluene	2.60E-02	1.95E-01
75014	Vinyl Chloride	1.30E-03	9.75E-03
7440417	Beryllium	3.78E-03	3.02E-02
7440508	Copper	2.44E+01	1.95E+02
7439921	Lead	2.27E-01	1.82E+00
7439965	Manganese	9.57E-01	7.66E+00
7440020	Nickel	5.57E-02	4.46E-01
7440622	Vanadium	6.03E+00	4.82E+01
7664417	NH3	2.20E+01	1.65E+02
630080	Carbon Monoxide	4.80E+00	3.60E+01
7647010	HCl	2.60E+01	1.95E+02
74908	HCN	1.35E+01	1.01E+02
7697372	Nitric Acid	4.50E-01	3.38E+00
7803512	Phosphine	3.57E+00	2.68E+01
7664393	HF	3.87E+01	2.91E+02
7783064	H2S	2.33E-01	1.87E+00
10102440	Nitrogen Dioxide	1.30E+01	9.75E+01
7446095	Sulfur Dioxide	4.00E-02	3.00E-01

Also, as discussed in Section 3.2.4, detonations are modeled to occur only 12 hours per day. Therefore, the annual TAC emission rates were multiplied by the factor 24/12 to ensure that the total mass of TACs emitted per year is accounted for in the modeled 12-hour day.

An Excel spreadsheet was developed which distributes the total plume TAC emission rates to the five point sources in the percentages specified above. It also adjusts the annual TAC emission rates by a factor of 24/12. The distributed and adjusted emission rates are then output to a comma separated variable (csv) file and imported to HARP2 ADMRT.

The HARP2 ADMRT input and output files are listed in Appendix A and contained on the attached compact disk.

For cancer risk the resident 70-year adult scenario is used. For chronic hazard index the resident scenario is used. The HARP2 input and output files for each modeled scenario are listed in Appendix A and contained on the attached compact disk.

3.5 Health Risk Assessment Results of the Proposed Action

This Section summarizes the HARP2-calculated cancer risk, chronic hazard index and acute hazard index for receptors of interest.

3.5.1 Cancer Risk Results

Table 6 shows the cancer risk at each receptor of interest. The maximum cancer risk is 1.5 X 10^{-9} at the SVRA ranger residence receptor.

3.5.2 Chronic Hazard Index Results

Table 6 shows the chronic hazard index results at each receptor of interest. The maximum chronic hazard index result is 0.00018 at the SVRA ranger residence receptor.

3.5.3 Acute Hazard Index Results

Table 6 shows the acute hazard index results at each receptor of interest. The maximum acute hazard index result is 0.70 at the SVRA ranger residence receptor.

3.5.4 Cumulative Risk Results

Table 7 shows the maximum cumulative cancer risk, chronic hazard index and acute hazard index results for this ATC/PTO application. The maximum cumulative cancer risk is 15.4 in one million which is below the project approval criteria of 20 in one million. The maximum cumulative chronic hazard index is 0.0053 which is below the project approval criteria of 1.0. The maximum cumulative acute hazard index result is 0.70 which is below the project approval criteria of 1.0.

3.5.5 Conclusion

The proposed project’s cumulative risks are below the criteria that are used to determine if a project may be approved. Therefore, based on the calculated cumulative health risks, the proposed project is approvable.

Table 6 Proposed Action Risk Results.

Receptor	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Carnegie	1.52E-09	0.00018	0.70
Connolly Ranch	2.64E-10	0.000032	0.21
RISI/Teledyne	3.22E-10	0.000039	0.11
Tracy Hills	3.29E-10	0.000039	0.048

Table 7 Cumulative Risk Results.

Risk	Proposed Action Maximum	Previously Approved Projects	Cumulative	SJVAPCD Significance Thresholds
Cancer	1.52E-09	1.54E-05	1.54E-05	2.00E-05
Chronic Hazard Index	0.0002	0.0051	0.0053	1
Acute Hazard Index	0.70	0.0025	0.70	1

4.0 Best Available Control Technology (BACT) Discussion

The District defines BACT, in Regulation II, Rule 2201.3.9, as the most stringent emission limitation or control technique of the following:

- 3.9.1 Achieved in practice for such category and class of source;
- 3.9.2 Contained in any State Implementation Plan approved by the Environmental Protection Agency for such category and class of source. A specific limitation or control technique shall not apply if the owner of the proposed emissions unit demonstrates to the satisfaction of the APCO that such a limitation or control technique is not presently achievable; or
- 3.9.3 Contained in an applicable federal New Source Performance Standard; or
- 3.9.4 Any other emission limitation or control technique, including process and equipment changes of basic or control equipment, found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source.

LLNL searched the database of BACT information (http://www.valleyair.org/busind/pto/bact/bactchidx.htm) on September 14, 2017. This search resulted in no source category similar to the proposed open detonation in our application. AP 42 Chapter 15 contains some relatively new sections on "Ordnance Detonation," including sections on "Emissions and Controls." These sections contain the same conclusion with controls, i.e., "As this ordnance is typically used in the field, there are no controls associated with its use." Examples are Section 15.4.1.2 (Projectiles, Canisters and Charges), Section 15.5.4.2 (Grenades), and Section 15.6.5.2 (Rocket).

The following is a discussion of other control measures that were considered in preparing the permit application. The discussion of these potential control measures is not an Alternatives Analysis under NEPA/CEQA, although aspects of these measures are captured in the alternatives analysis (See the Draft EA). These techniques do not constitute BACT as their effectiveness has not been studied or quantified and the techniques therefore do not meet the criteria for entry into any BACT database.

4.1 Permanent Containment Facility

LLNL currently has a Contained Firing Facility Building 801. The existing CFF at Site 300 has a 132 lbs. structural limit and operates under a SJVAPCD air permit (SJVAPCD permit N-472-62-0). The existing CFF would not be capable of the necessary 1,000 lbs./day detonations. Explosive weights and types of experiments permitted are restricted to protect the structural integrity of the firing chamber. Constructing a larger contained firing facility at Site 300 was one alternative considered but eliminated from further analysis in the Draft EA.

Although building a contained firing facility large enough to allow explosive detonations up to 1,000 lbs. may be structurally feasible, it would not meet DOE/NNSA mission needs. Experiments with relatively long data gathering timeframes cannot reasonably be conducted inside a CFF. A permanent or temporary containment of a reasonably achievable size would obscure the experimental data. Construction of a new CFF would require congressional approval in the form of a line-item appropriation. However, the justification for such a line-item appropriation does not exist based on the inability for the project to meet experimental data collection needs.

Despite this, LLNL considered the cost effectiveness of this control method assuming a scale up in size and volume of the existing CFF. If LLNL conservatively assumed a direct scale up of costs with the size of the facility, costs to design and construct the project could approach $700 million in 2012 dollars. Operating costs for the facility could be in excess of $2 million per year over a 30-year life span.

4.2 Temporary Containment Tent

For a temporary containment tent to be effective at reducing or eliminating air emissions, it would have to withstand explosives overpressure, debris, and thermal effects well enough not to become punctured, melted or collapsed. This is not technologically feasible. A tent would be destroyed by overpressures or perforated by blast fragments. This control method was therefore not evaluated for cost effectiveness.

4.3 Use of Water and Chelating Agents

Under this control method, a small temporary tent would be placed around the experimental assembly and filled with water and chelating agents. Particulates generated during detonation would mix with the solution upon experiment detonation. In contained environments, there is a measurable decrease in the amount of airborne particulate that results when this method is employed. However, for an open detonation, there would be less time for mixing because the tent would be destroyed in a matter of milliseconds. Some attachment of particulate to the chelation agent in the water solution would still be expected and thus minimally reduce emissions.

This technique would result in the undesired generation and discharge of waste-water containing metals. Additionally, the water solution would interfere with the experiment objectives. Similar to the permanent containment facility method, this method would also not be feasible for experiments with a relatively long data gathering timeframe. The potential for this technique to reduce airborne emissions would be very low.

4.4 Application of Solid Capture Materials

Use of solid capture materials, such as foam or gypsum board was considered. The technique of applying foam directly to the experiment was attempted and determined not to be feasible by the Los Alamos National Laboratory. Like the water and chelating agents technique, this technique would not be feasible for experiments with a relatively long data gathering timeframe since the foam would interfere with the experiment objectives. The direct application of foam would make assembling instrumentation directly into the experiment impossible, thus limiting the useful diagnostic technique to radiography. Further, it would be impossible to perform a diagnostic alignment after the foam is applied to the experiment.

However, creating a foam-lined enclosure or gypsum-board enclosure over the experiment could result in the capture of some larger particulate upon detonation. This enclosure could remove the constraint of not being able to correct alignment and allow additional digital and fiber-optic based diagnostic equipment to be used. However, the enclosure would likely do nothing to prevent volatilization of the foam or emissions of very small particles. Previous experimental use of gypsum board as "witness plates" to determine information about fragments and penetrations suggests that gypsum board could be used to capture larger particles from the detonations. The potential for these techniques to reduce airborne emissions would be very low.

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Appendix A – List of Modeling Files on the Attached CD

Model	Folder Name	Filename and Content
AERMAP	**AERMAP**	**AERMAP.bat** – AERMAP batch run file
		AERMAP.inp - AERMAP input file
		AERMAP.out - AERMAP output file
		LLLNL_Site300_Domain_NED.tif - terrain elevation input data file; USGS's National Elevation Dataset in GeoTIFF format; NAD83, 30-meter horizontal resolution; 1-meter vertical resolution
		RECEPTORS.prn – receptor utm coordinates (NAD83)
		RECEPTORS.REC – AERMAP receptor output used as input to AERMOD
AERSURFACE	**AERSURFACE**	**Site300_NLCD_1992.bat** - AERSURFACE batch run file
		Site300_NLCD_1992_Ave.dat – AERSURFACE input file
		Site300_NLCD_1992_Ave.out – AERSURFACE output file with albedo, Bowen Ratio and surface roughness input to AERMOD
		ca_north_NLCD_042800_erd.tif - USGS National Land Cover Data 1992; tif file format
AERMET	**AERMET\Stage 1**	AERMET input and output files for **Stage 1** processing
		UpperAir_OAK_FSL_2012.DAT - Upper air datafile Oakland, CA 2012
		301AERMET2012.csv - Onsite meteorological datafile Site 300 for 2012
	AERMET\Stage 2	AERMET input and output files for **Stage 2** processing
	AERMET\Stage 3	AERMET input and output files for **Stage 3** processing
		301AERMET2012.SFC - Surface parameter file used as input to AERMOD
		301AERMET2012.PFL - Profile parameter file used as input to AERMOD
AERMOD	**AERMOD**	AERMOD input and output files

Model	Folder Name	Filename and Content
		OD_1000_851H1_1_RMR.PLT – maximum hourly plot file for Source 851H1
		OD_1000_851H2_1_RMR.PLT – maximum hourly plot file for Source 851H2
		OD_1000_851H3_1_RMR.PLT – maximum hourly plot file for Source 851H3
		OD_1000_851H4_1_RMR.PLT – maximum hourly plot file for Source 851H4
		OD_1000_851H5_1_RMR.PLT – maximum hourly plot file for Source 851H5
		OD_1000_851H1_ ANN _RMR.PLT – maximum annual plot file for Source 851H1
		OD_1000_851H2_ ANN _RMR.PLT – maximum annual plot file for Source 851H2
		OD_1000_851H3_ ANN _RMR.PLT – maximum annual plot file for Source 851H3
		OD_1000_851H4_ ANN _RMR.PLT – maximum annual plot file for Source 851H4
		OD_1000_851H5_ ANN _RMR.PLT – maximum annual plot file for Source 851H5
HARP2 (ADMRT)	**HARP2RUN**	ADMRT input and output files
	\Modeled Emissions	**Modeled Emissions.xlsx** – Excel file containing TAC emissions input to ADMRT
	\B851	**B851_INPUT.adm** – ADMRT input file
	\B851\data	Source, emissions, pathways and plot files
	\B851\glc	Ground-level concentration files by pollutant
	\B851\hra	Health risk assessment output files

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