Lawrence Livermore National Laboratory

March 29, 2013
ESH-EFA-AQ-13-3195 / GG/SH:rtd

Mr. Doug Tolar
Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

Subject: *Prescribed Burning Smoke Management Plan, Lawrence Livermore National Laboratory – Site 300*

Dear Mr. Tolar:

Lawrence Livermore National Laboratory (LLNL) has attached for your review and approval the "Prescribed Burning Smoke Management Plan, Lawrence Livermore National Laboratory – Site 300" for 2013, which is unchanged in scope from the 2012 Plan.

As identified in Figure 2 of the attached 2013 Plan, only 131.6 acres of Plot 16 and 7.5 acres of Plot 11 are located within Alameda County, and thus under the purview of the Bay Area Air Quality Management (BAAQMD). LLNL would like to be allowed to burn the entire 139.1 acres in a single day.

If you have any questions regarding the 2013 Plan or require additional information, please contact David Armstrong at (925) 422-9107.

Sincerely,

Gretchen Gallegos, Group Leader
Water, Air, Monitoring & Analysis
Environmental Functional Area
Environment, Safety & Health

Enclosure: Prescribed Burning Smoke Management Plan, LLNL – Site 300

Copy w/enclosure (PDF):
Larson, Heather (NNSA/LFO)

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Roses, Ricardo (NNSA/LFO)
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Scott, John
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Woollett, Jim
Site 300 Prescribed Burn File

iDocMan: Site 300, Prescribed Burn

LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

UCRL-AR-154173-REV-10

Prescribed Burning Smoke Management Plan

Lawrence Livermore National Laboratory – Site 300

John A. Sharry

March 2013

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

PRESCRIBED BURNING SMOKE MANAGEMENT PLAN
LAWRENCE LIVERMORE NATIONAL LABORATORY – Site 300

GENERAL INFORMATION

PREPARER'S NAME & ADDRESS (street, city, zip) **DATE**
John A. Sharry, Fire Marshal March 1, 2013
P.O. Box 808, L-388
Livermore, CA 94551

PREPARER'S AFFILIATION **PHONE #**
Lawrence Livermore National Laboratory (925) 423-1802

PRIMARY RESPONSIBLE PERSON **PHONE #**
John A. Sharry (925) 423-1802

LAND OWNER(S) & MAILING ADDRESS (street, city, zip) **PHONE #**
Department of Energy (DOE) (925) 422-0758
P.O. Box 808, L-001
Livermore, CA 94551

FIELD CONTACT NAME & 24-HOUR PHONE
Gary Linney (925) 596-1812
(925) 422-7595

PROJECT DESCRIPTION

1. LOCATION

Lawrence Livermore National Laboratory – Site 300
Corral Hollow Road
Tracy, CA 95376

Latitude: 37 39.59
Longitude: 121 33.13

Legal Description
All that land delineated on the following filed maps: Map of Survey, United States Atomic Energy Commission Property, Counties of Alameda and San Joaquin, State of California, filed in Book 4 of Surveys, Page 3, in the Office of the County Recorder, Alameda County, and filed in Book 11 of Surveys, Page 34, in the Office of the County Recorder, San Joaquin County; Map of Survey, United States Atomic Energy Commission Property, County of San Joaquin, State of California, filed in Book of Surveys, Volume 10, Page 118, in the Office of the County Recorder, San Joaquin County; EXCLUDING that parcel of land described in Quitclaim Deed from the United States of America to Robert F. & Carol J. Burns in Book 3887 of Official

Records, page 369, San Joaquin County Records; INCLUDING that parcel of land described in Grant Deed for Connolly Ranch, Inc. to the United States of America, Department of Energy in Instrument Number 91-020198, San Joaquin County Records.

Containing 6,800 acres, more or less.

General Description

Lawrence Livermore National Laboratory's (LLNL's) Site 300 is located in the California Coast Ranges, which is characterized by low rugged mountains and relatively narrow intervening valleys. It is situated 15 miles east of the Livermore Valley near the eastern edge of the Altamont Hills, close to the western boundary of San Joaquin County. Elevations range from 500 feet at the southern boundary to 1,800 feet at the higher peaks in the northwestern areas. Site 300 covers approximately 6,800 acres (about 11 square miles) of land in eastern Alameda County and western San Joaquin County. Site 300 was acquired in 1953; since then all grazing and other agricultural activities have been terminated. The location of Site 300 is identified in **Figure 1**.

Prescribed fires and suppression activities for all fires are done with recognized wildfire safety parameters to assure minimal impacts on the environment. These include avoidance measures of sensitive and protected species and habitats; pre- and post-fire surveys for impacts to sensitive species; protection of and post-fire evaluation of groundwater monitoring wells and groundwater remediation facilities and equipment; and watershed post-fire assessment and rehabilitation as necessary (e.g., sediment reduction, channel treatments) to stabilize biotic communities, and to prevent degradation of critical known natural resources.

Figure 2 identifies the prescribed burn acreage of each of the 24 plots that are to be burned at LLNL's Site 300. The majority of the acreage falls under the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD). The acreage that specifically falls under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD) is approximately 7.5 acres of Plot 11 and 131.6 acres of Plot 16.

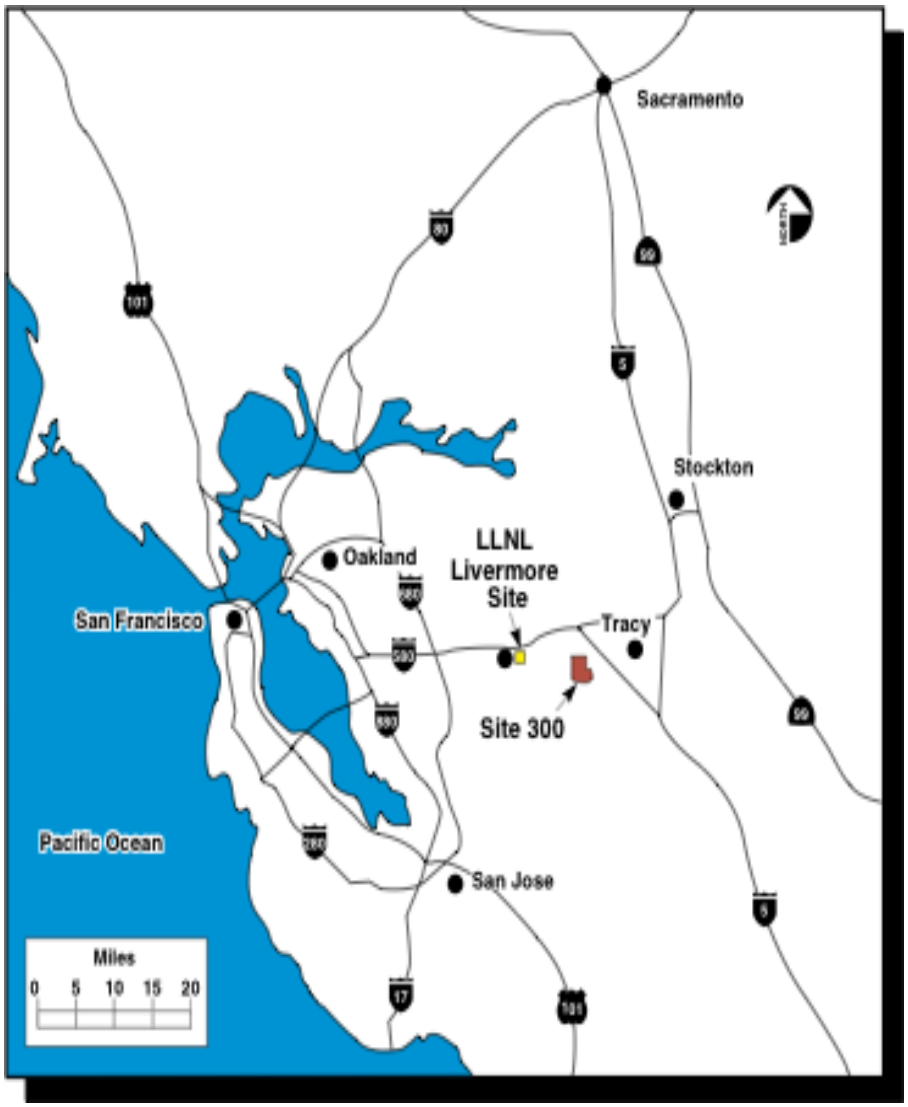

Figure 1. Location of Site 300.

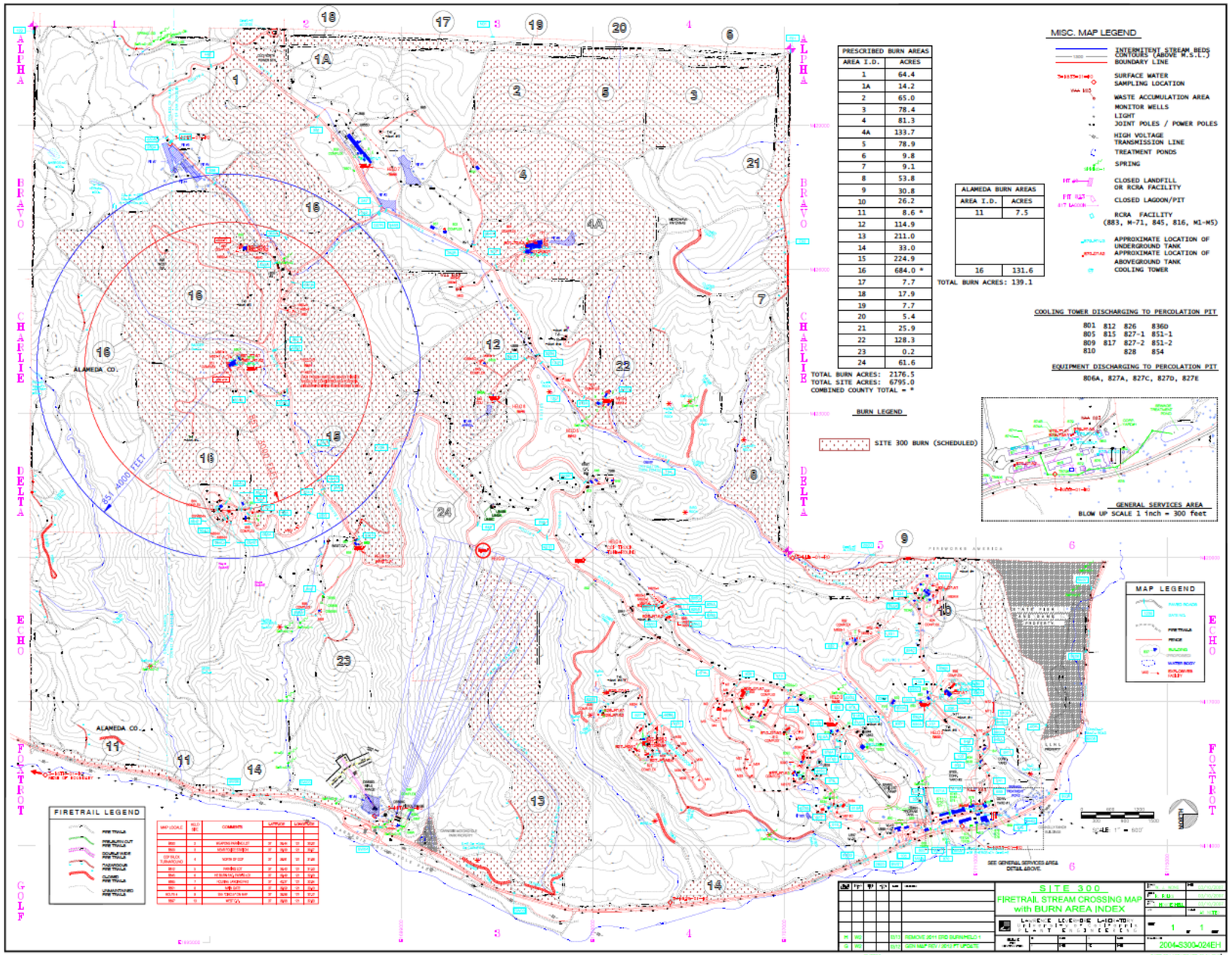

Figure 2. Site 300 Firetrail Access Map with Burn Area Index.

2. OBJECTIVES

Specific Management Objectives

- Develop a smoke management plan consistent with California Air Resources Board's "Smoke Management Guidelines for Agricultural and Prescribed Burning" (CCR, 2001).
- Use prescribed fire and mechanically maintain and/or treat the Site's developed areas to reduce the threat of unwanted fire. Continue to maintain defensible space in accordance with National Fire Protection Association (NFPA) 299, "Standard for the Protection of Life and Property from Wildfire," around all critical facilities at Site 300.
- Meet the Bay Area Air Quality Management District's (BAAQMD's) regulatory rules and policies as they pertain to prescribed burns and smoke management (BAAQMD, 2008).
- Minimize the occurrences of fires that could leave the Site 300 boundaries and impact LLNL's neighbors.
- Manage and enhance plant biodiversity and wildlife habitat at Site 300 through the judicious use of prescribed fires.
- Provide a fire-safe barrier to prevent wildfires from entering Site 300.
- Minimize the occurrence of unnaturally intense fires by reducing the amount of vegetation that can fuel larger, more catastrophic fires.
- Limit the extent of prescribed fires, which would reduce the air quality for LLNL's neighbors.
- Use minimum impact prescribed burns and fire suppression techniques, and rehabilitate disturbed areas to protect natural and cultural resources from adverse impacts attributable to fire suppression activities.
- Conduct all fire management activities commensurate with applicable laws, policies, and regulations (DOE, 2004 and LLNL, 2013).
- Cooperate extensively with adjacent landowners to facilitate safe and prompt suppression of wildfires.
- Suppress all wildfires in accordance with recognized wildfire safety parameters to assure minimal impacts on the environment and cultural resources.
- Engender understanding among fire fighters about the impacts of fire suppression on sensitive resources. Cutting of all firebreaks, fuel reduction, and fire suppression will be done to minimize the impact on the ecosystem from soil erosion.

Other Management Objectives

- Provide for the safety of employees, visitors, and neighbors during all phases of the wildland fire management process.
- Preserve and extend the capability to safely test explosives while protecting the environment.
- Provide opportunities for public understanding of fire ecology principles, smoke management, and prescribed fire program objectives.

3. PROJECTED ACREAGE

Figure 2 identifies the prescribed burn acreage of each of the 24 plots that are to be burned at LLNL's Site 300. The majority of the acreage falls under the jurisdiction of the SJVAPCD. The acreage that specifically falls under the jurisdiction of the BAAQMD is as follows:

Plot 11: 7.5 acres
Plot 16: 131.6 acres

Plots 11 and 16 are characterized as ungrazed annual grassland.

4. PROJECTED TONNAGE

The fuel loading for the project is ungrazed annual grassland, estimated to be up to 1 ton per acre (depending on the grass height, distribution, and density), and is based on the Albini (1976) and National Fire Danger Rating System (NFDRS) fuel models for annual grass.

Plot 11: 7.5 tons (based on 7.5 acres at 1 ton per acre)
Plot 16: 131.6 tons (based on 131.6 acres at 1 ton per acre)

5. TYPE(S) AND ARRANGEMENT OF VEGETATION TO BE BURNED

Vegetation Type	% of Unit	Fuel Model Albini (1976)	Fuel Model NFDRAS
Annual Grass	100%	1	A

Plots 11 and 16 are characterized as ungrazed annual grassland. The grass is approximately 4 to 24 inches (averaging less than 12 inches) in height with a uniform horizontal continuity and thin to moderate density.

6. FUEL CONDITION

Plots 11 and 16 are characterized as ungrazed annual grassland, which is natural standing.

7. COMBUSTION

The annual grass is considered a light, flashy fuel, and is expected to burn at approximately 100%.

8. PROJECTED BURN SCHEDULE

Proposed Ignition Dates: May 1 – August 1, 2013

9. EXPECTED DURATION OF PROJECT

Of the two plots, 7.5 acres of Plot 11 and 131.6 acres of Plot 16 fall under the jurisdiction of the BAAQMD. Given the size of Plots 11 and 16, it is estimated that the duration of the prescribed burn for both plots, under favorable conditions, can be completed in one (1) or two (2) days. However, due to weather conditions, burn day approval, acreage allocations, spare the air days, resource availability, staffing, and requirements for U.S. Department of Energy (DOE) approval, the prescribed burns may take longer and may be completed by burning over a series of days that may or may not be consecutive.

(a) IGNITION
Plot 11: 15 minutes to 120 minutes for each day of burn
Plot 16: 15 minutes to 60 minutes for each day of burn

(b) COMBUSTION
Plot 11: 10 minutes to 30 minutes for each day of burn
Plot 16: 10 minutes to 30 minutes for each day of burn

(c) BURN DOWN
Plot 11: 20 minutes to 60 minutes for each day of burn
Plot 16: 20 minutes to 60 minutes for each day of burn

SMOKE MANAGEMENT COMPONENTS

10. DIRECTIONS AND DISTANCES TO NEARBY SENSITIVE RECEPTOR AREAS

The National Atmospheric Release Advisory Center (NARAC) at LLNL conducted smoke dispersion simulation modeling to better understand the atmospheric dispersion of smoke from prescribed burns at Site 300, and to examine how smoke behavior might differ for different burns and burn-plot terrain. The report on the simulations is entitled "Smoke Dispersion Simulations for Prescribed Burns at Site 300, Lawrence Livermore National Laboratory." The report provides persuasive evidence that there were no air quality problems caused by the prescribed burns for which smoke dispersion was simulated. Furthermore, it is expected from the report that future prescribed burns will not adversely impact sensitive receptors in the areas surrounding LLNL's Site 300.

A summary of the report, "Smoke Dispersion Model Report Summary," was submitted to the BAAQMD in May 2002, and again in the "2003 Prescribed Burning Smoke Management Plan, Lawrence Livermore National Laboratory – Site 300." As noted in the Report Summary, the simulated near-surface smoke plume extends in generally a southeasterly to a south-southeasterly direction from the Site 300 burn sites.

Figure 3, Sensitive Receptors within a 20-mile Radius of Site 300, identifies the sensitive receptors within a 20-mile radius of LLNL's Site 300. The map was updated in March 2012 and includes urban areas (i.e., cities), major roads, hospitals, nursing homes, schools, daycare centers, and airports.

Sensitive receptors within a 20-mile radius of Site 300

Key to Features

S300

Site 300 20-mile Radius

Schools

Childcare

Residential Care

Hospitals

County Boundaries

Sources:

Basemap:
U.S. Census Bureau TIGER files
(www.census.gov/geo/www/tiger)

Schools:
California Department of Education
(www.cde.ca.gov)

Residential Care and Childcare:
California Department of Social Services Community Care Licensing Division
(www.ccld.ca.gov)

Hospitals:
Census Bureau TIGER "point landmark" files, and
http://www.lat-long.com

Map produced March, 2012

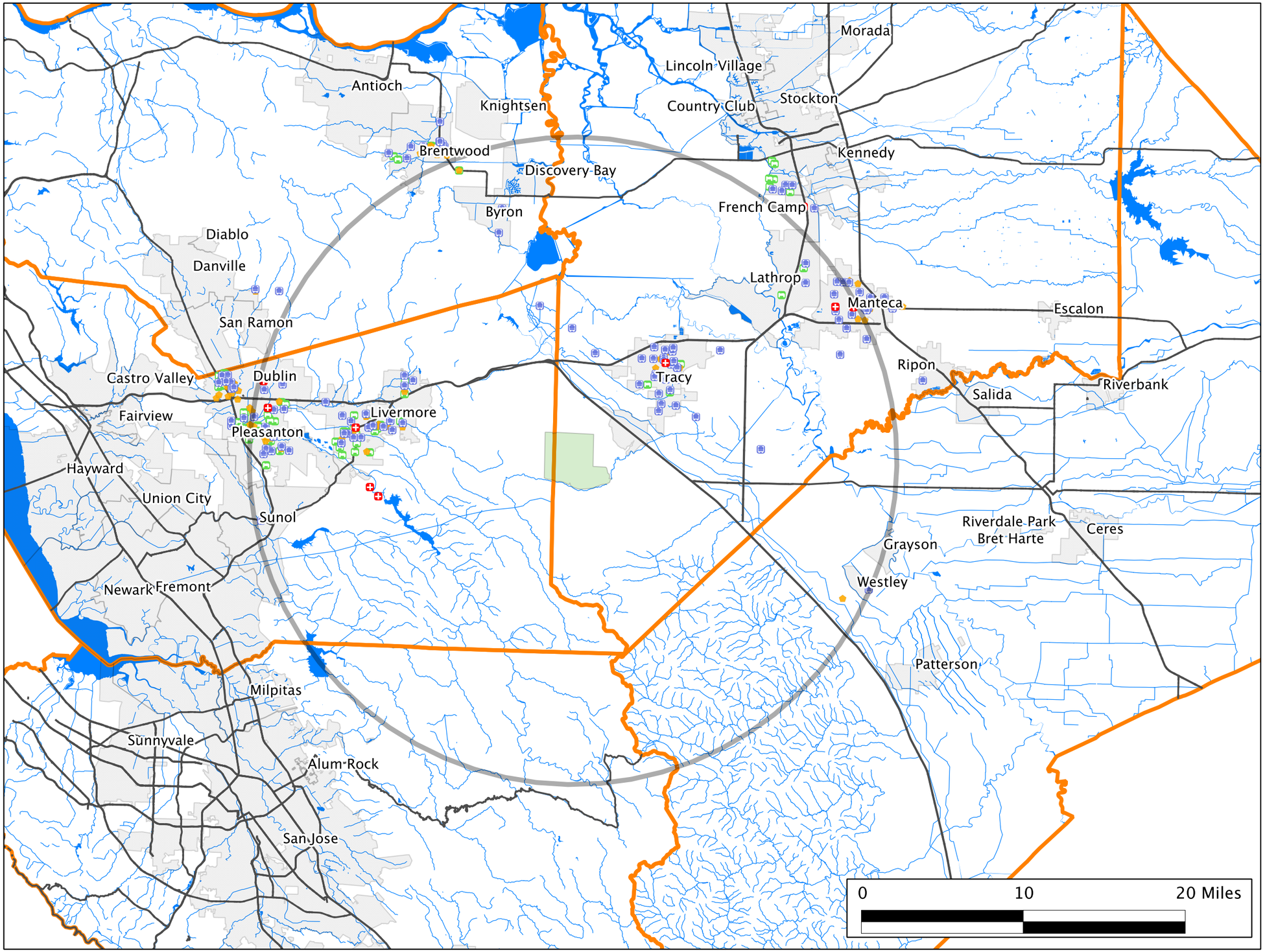

Figure 3. Sensitive receptors within a 20-mile radius of Site 300

For clarity of presentation, only receptor locations within 25 miles of Site 300 are shown.

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11. METEOROLOGICAL PRESCRIPTION

	Range	Optimum	Observed
Temperature (F)	55-100	80	
Relative Humidity %	20-75	35	
Wind Speed (mph)	5-20	15	
Wind Direction	All	NW	
Fuel Moisture 1 hour (%)	3-16	7	
Minimum Forecasted Mixing Height (ft)	500	NA	

12. SPECIFICATIONS FOR MONITORING AND VERIFICATION OF METEOROLOGICAL CONDITIONS AND SMOKE BEHAVIOR BEFORE AND DURING THE BURN

Personnel and Equipment
All burns will be conducted with personnel and equipment as set forth in the Alameda County Policy: Site 300 Prescribed Burn.

A minimum of ten (10) chief officers, captains, and firefighters will be present at all burns.

Staffing

1	Incident Commander	Chief Officer
1	Safety Officer	Chief Officer or Captain
2	Division Officers	Captains or Acting Captains
2	Torch Company Officers	Captains or Acting Captains
2	Torch Persons	Firefighters
2	Observation Personnel	Firefighters

Equipment

1	Command Vehicle
4	Patrols/Engines

Ignition Operations
At the beginning of each burn day, a small test ignition at the burn site will be conducted with a drip torch to observe ignition combustion rates and smoke behavior. Fire behavior and smoke conditions will be visually monitored to achieve compliance with the conditions set in the burn plan. All conditions, including the burn prescription, will be satisfied before the Incident Commander makes a decision to continue burning.

Ignition operations will be conducted using those set forth in the Alameda County Fire Department Procedure: Site 300 Prescribed Burn. Strip firing, head firing, and backing fire ignition patterns will be used to ignite the plot. Firing patterns and directions could change depending on safety, wind direction, other weather parameters, or smoke management concerns.

Duration of project ignition will last approximately 15 minutes to 120 minutes for each plot. Combustion and burn-down times are minimal due to the light flashy fuels.

Smoke Management

Smoke volume from the project should not have a significant impact upon the surrounding communities. Due to the proximity of Corral Hollow Road, the southernmost perimeter trail along Corral Hollow Road is expected to be burned during non-commute hours (that is, between 0900 hours and 1400 hours). Winds from the north occasionally create decreased visibility hazards along Corral Hollow Road; these hazards can be minimized by partial closures and postings on the road.

Smoke emission and behavior will be visually monitored on a continual basis. Any significant change in smoke emissions and/or column behavior will be reported to the Incident Commander. The Incident Commander will manage the project in a manner that will minimize impact to sensitive areas and the public. The project size, firing tactics, and burn duration will be adjusted to meet these goals.

Monitoring and Evaluation Procedures

At 0645 hours on the day of the burn, the Fire Captain at the Alameda County (ALCO) Fire Station 21 will log onto the LLNL web page at www-metdat.llnl.gov and select the "Site 300" link under the "Current Conditions" heading to obtain the current weather at Site 300. From there, the Fire Captain can click the "Expanded" link next to "Instruments" in the upper right corner to review the following (click on the plot icon to review plot charts):

- Air Temperature,
- Dew Point,
- Peak Wind Gust,
- Relative Humidity,
- Wind Direction, and
- Wind Speed.

Additional weather readings will be obtained at the site of the burn with portable instrumentation (Kestrel 4000). During the burn, on-site monitoring will be conducted and the Incident Commander will observe weather, smoke, and fire behavior.

On the day of the burn, the Fire Captain at ALCO Fire Station 21 will enter the following information into the incident report for the controlled burn:

- Staffing and positions,
- Duration of burn,
- Plots burned,
- Weather as captured at the start of the burn, and
- Total acreage burned for the day.

13. SPECIFICATIONS FOR DISSEMINATING PROJECT INFORMATION TO PUBLIC

Media Coordination and Public Notification

In advance of burn activities, the Public Affairs Office (PAO) at LLNL notifies neighbors and nearby residents of Site 300 of the intent to perform the annual burn project. This notification is conducted by mail and web using current contact information. LLNL points of contact are provided along with the PAO's Environmental Community Relations (ECR) representative so individual questions/concerns can be addressed, e.g., specific timing for individual burn areas. In addition, a public notice is prepared and distributed to local media (e.g., Tracy Press, Stockton Record, and Tri-Valley Times) prior to the burn. The contact information telephone numbers allow for receiving and addressing complaints after the burn. However, few smoke-related complaints have been received as a result of LLNL's recent burns.

The Alameda County Regional Emergency Communications Center will notify the following agencies/personnel on the morning of the burn:

- National Nuclear Security Administration, Livermore Field Office – (925) 422-0758
- SJVAPCD – (209) 557-6442 (only on days of burns in San Joaquin County)
- BAAQMD – (415) 749-4979
- California Department of Forestry, Emergency Communications Center – (408) 779-2121
- Alameda County Fire Department fire stations in eastern Alameda County – (925) 447-6611
- Site 300 /LLNL CAS operators – (925) 423-5222 and (925) 422-7222
- SRI – (925) 243-8710
- Fireworks America – (925) 449-1023
- San Joaquin County Fire Dispatch – (209) 464-4648
- Tracy Fire Department – (209) 831-4700
- Site 300 Deputy Manager – (925) 422-2367
- Site 300 Environmental Oversight and Special Projects Manager – (925) 423-9136
- LLNL PAO – (925) 423-3125
- Carnegie State Vehicular Recreation Area – (925) 447-0426

14. WHAT CONTINGENCY ACTIONS WILL BE TAKEN DURING THE BURN TO REDUCE EXPOSURE IF SMOKE INTRUSIONS IMPACT ANY SENSITIVE RECEPTOR AREA

This project will be conducted in a manner that will avoid smoke intrusion into any smoke sensitive area. In the event a smoke intrusion does occur in a smoke sensitive receptor, the following actions will be taken to reduce smoke production, if appropriate:

- Halt ignitions, except as needed to maintain control of fire.
- Reduce the size of the burn plot by developing new control lines.
- Suppress active fire.
- Initiate mop-up operations once fire is controlled.
- Focus suppression and mop-up operations on areas of greater smoke production.

- Resume burn, if favorable conditions return.
- Contact the LLNL Public Information Officer.
- Notify the affected populations.

In the unlikely event that a prescribed fire leaves Site 300 and enters a neighbors grazing land, it is expected that it would be extinguished with the resources described herein. Lands that border Site 300 on the west, east, and north are used for cattle grazing. These grasses are very similar to those found at Site 300 with the exception of the grass height. Grasses that have been grazed are usually less than three inches tall and will not support a credible fire spread. In order for a wildfire to reach a populated area, a fire would have to burn unchecked for a distance of approximately nine miles, through the grazed grass, jump Interstate 580, jump two aqueducts, and burn through fields of irrigated crops before reaching the City of Tracy.

LLNL contracts with the Alameda County Fire Department to provide emergency response services for fire, emergency medical, technical rescue, and hazardous materials incidents on LLNL property. The Alameda County Fire Department staffs both LLNL fire stations with security cleared, trained, firefighters and firefighter/paramedics. The primary fire suppression responsibility for the area described in this document lies within the jurisdiction of Alameda County Fire Station 21 (formerly LLNL Fire Station 2). Response is also provided from Alameda County Fire Station 20 (formerly LLNL Fire Station 1). The response is supported by a strong secondary response from the City of Tracy, all the Alameda County fire departments and the California Department of Forestry and Fire Protection (CAL Fire). Mutual aid agreements between the various agencies have been in place since 1960. A Mutual Threat Zone Agreement is also in place with CAL Fire. This agreement provides aircraft, helicopters, and air command aircraft in addition to their basic response of eight engines, two bulldozers, and a battalion chief.

15. ATTACH A COPY OF THE ENVIRONMENTAL IMPACT ANALYSIS PREPARED FOR THE BURN PLAN THAT INCLUDES AN EVALUATION OF ALTERNATIVES TO BURNING, IF SUCH AN ANALYSIS IS REQUIRED BY STATE OR FEDERAL LAW OR STATUTE

The DOE's principal vehicle for compliance with the National Environmental Policy Act (NEPA) at LLNL and Site 300 is the "2005 Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement," (DOE, 2005) California Environmental Quality Act (CEQA) compliance is addressed by the 1992 Final Environmental Impact Statement and Environmental Impact Report (EIS/EIR) (DOE, 1992) and the 1997 Environmental Impact Report Addendum (see http://www.envirinfo.llnl.gov). These NEPA compliance (EIS) and CEQA compliance (EIR) documents were prepared to analyze the impacts of the proposed action of continued operation of LLNL and Site 300.

Prescribed burning is discussed in these documents appropriate to the context, including safety, environmental impacts and wildfire prevention, Site 300 testing requirements, natural resource impact, and potential impact to neighbors and planned adjacent communities. NEPA reviews occur through annual pre-burn meetings attended by LLNL's Environmental Stewardship,

Planning and Monitoring Program (responsible for NEPA compliance) and preparation of formal evaluations as to the adequacy of the EIS/EIR documents if a given burn varies from impacts previously evaluated.

LLNL environmental policy requires that all Laboratory operations be conducted in compliance with applicable governmental regulations and DOE Orders (DOE, 2004 and LLNL, 2009).

LLNL previously submitted to the BAAQMD a copy of a Final Summary Document for Controlled Burning at Site 300. The document describes the measures LLNL has taken to ensure the effectiveness and safety of its controlled burn operations at Site 300, and includes additional measures taken in light of the Cerro Grande Fire in New Mexico. The document summarizes reviews and analyses of the LLNL prescribed burn program from LLNL procedures and NEPA documents.

A full range of alternatives to burning has been considered, all of which modify approved land use, destroy wildlife habitat, create erosion, or are unsafe. Those alternatives include:

- Grazing,
- Sterilization,
- Planting fire resistive, non-native vegetation,
- Disking, and
- Mowing.

16. PROJECT FUEL LOADING ESTIMATE (TONS VEGETATION/ACRE) BY VEGETATION TYPE(S) AND A DESCRIPTION OF THE CALCULATION METHOD

The fuel loading for the project is ungrazed annual grassland estimated to be up to 1 ton per acre (depending on the grass height, distribution, and density), and is based on the Albini (1976) and National Fire Danger Rating System (NFDRS) fuel models for annual grass.

Plot 11: 7.5 tons (based on 7.5 acres at 1 ton per acre)
Plot 16: 131.6 tons (based on 131.6 acres at 1 ton per acre)

Vegetation Type	% of Unit	Fuel Model Albini (1976)	Fuel Model NFDRAS
Annual Grass	100%	1	A

17. PARTICULATE MATTER EMISSIONS ESTIMATE INCLUDING REFERENCED EMISSION FACTOR(S) AND A DESCRIPTION OF THE CALCULATION METHOD USED

EPA's Compilation of Air Pollutant Emission Factors (AP-42)
PM 10 = 10 g/kg
Fuel Load = 1 ton/acre
PM 10 g/acre = 1 ton/acre × 2000 lbs/ton × 1 kg/2.2 lbs × 10g/kg
= 9090.91 g/acre
= 9.091 kg/acre
PM 10 tons/acre = 9.091 kg/acre × 2.2 lbs/1 kg × 1 ton/2000 lbs
= 0.010 ton/acre
Plot 11: 7.5 acres × 0.010 ton/acre = 0.075 ton (PM 10)
Plot 16: 131.6 acres × 0.010 ton/acre = 1.316 tons (PM 10)

CERTIFICATION

18. I HEREBY CERTIFY, AS A QUALIFIED PROFESSIONAL RESOURCE ECOLOGIST, BIOLOGIST, OR FORESTER, THAT THE PROPOSED BURNING DESCRIBED ABOVE IS NECESSARY TO ACHIEVE THE SPECIFIC MANAGEMENT OBJECTIVE(S) OF THE SMOKE MANAGEMENT PLAN PREPARED FOR THIS BURN PROJECT

Signature _____

Date March 19, 2013

Name (print) Jim Woollett

Title (print) Wildlife Biologist

References

Albini, Frank A. 1976. Estimating wildfire behavior and effects. Gen. Tech. Rep. INT-30. Ogden, UT: U.S. Department of Agriculture, Forest Service, lntermountain Forest and Range Experiment Station.

Bay Area Air Quality Management District Regulation 5 2008. "Open Burning."

Department of Energy 2004. G 450-1.4 "Wildland Fire Management Program."

Department of Energy and University of California. 2005 Final Site-wide Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory and Supplemental Stockpile Stewardship and Management Programmatic Environmental Impact Statement, Livermore, CA.

Department of Energy and University of California. 1992. Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, CA.

Lawrence Livermore National Laboratory 2013. "Wildland Fire Management Plan," Rev 3.0.

Title 17 California Code of Regulations, Subchapter 2 2001. "Smoke Management Guidelines for Agricultural and Prescribed Burning", Sections 80100-80330.