LLNL-TR-812449

Soil Sample Plan in Support of the Site 300 Explosives Waste Treatment Facility Ecological Risk Assessment Pursuant to the Hazardous Waste Facility Permit, Part V, Special Condition #14 a-f

August 2020

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Table of Contents

Executive Summary

The Department of Toxic Substances Control issued the Final Hazardous Waste Facility Permit to Lawrence Livermore National Laboratory, Site 300 in 2017. As part of the continual process to ensure waste treatment emissions are not impacting ecological receptors, LLNL analyzed soil samples in the vicinity of the Explosive Waste Treatment Facility (EWTF) Burn Units (i.e., Burn Cage and Burn Pan) and the Detonation Pad.

Soil samples were analyzed by EPA Solid Waste 846 Methods for furans, explosives, metals, and semi-volatile compounds. In all samples, furans, explosives, and semi-volatile organic compounds were not detected. Metals were detected at concentrations below background levels.

This soil sample plan will sample the same four downwind areas of the Burn Units and the same downwind areas of the Detonation, as well as including four new sample locations. The four new locations will be located to the northeast and southwest of the Burn Units and Detonation (as shown in Figure 3). The constituents to be analyzed are in Tables 2 and 3. Perchlorate was not identified as a constituent of concern in the 2007 Soil Sampling Plan. However, for this plan, all soil samples will be analyzed for perchlorate.

After completion of the sampling event, a soil sample report will be submitted to DTSC in accordance with requirements specified in the Hazardous Waste Facility Permit, Part V, Special Conditions 16 a-f. This proposed soil sampling plan will be fully implemented no later than one year after receiving DTSC approval, in accordance with the Hazardous Waste Facility Permit, Part V, Special Condition 15.

1. History

Lawrence Livermore National Laboratory (LLNL), Site 300 submitted a Resource Conservation and Recovery Act (RCRA) Part A and B permit renewal application in 2005 (LLNL document #PRA05-085) to continue waste management operations at the Building 883 Container Storage Area (B883 CSA), Explosives Waste Storage Facility (EWSF) and the Explosives Waste Treatment Facility (EWTF).

As part of the permit renewal process for EWTF, LLNL Site 300 submitted a Scoping/Phase I Level ecological risk assessment in 2005 (LLNL document #PRA-05-089) that followed guidance in the Department of Toxic Substances Control (DTSC), Human and Ecological Risk Division (HERD) document "Guidance For Ecological Risk Assessment At Hazardous Waste Sites And Permitted Facilities, Part A: Overview and Part B: Scoping Assessment," July 4, 1996. The LLNL ecological risk assessment identified the constituents of concern (COC), biological receptors, and an ecological hazard quotient (EHQ) for each ecological receptor and constituent of concern. EHQs were provided as part of the Phase I, predictive risk assessment.

The ecological risk assessment was revised to address DTSC HERD comments and was approved in 2007 (DTSC correspondence from Hassan Batakji/DTSC to Stephanie Goodwin/LLNL, September 4, 2007). As part of the comment response process, a "Soil Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory" (PRA07-126, Enclosure 2, Appendix 1) was included to evaluate COCs relative to established background levels that were developed by the LLNL/Environmental Restoration Division for site mitigation work pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

The "Soil Sample Report in Support of the Site 300 Explosives Waste Treatment Facility Ecological Risk Assessment and Permit Renewal" was submitted to DTSC in 2012 (ESH-EFA-WP-12-2741, Appendix 2). The report concluded: "Statistical analysis of metals indicate the concentrations in the EWTF area are below site-wide background levels. Therefore, based on the below background metals results and the absence of detections of furans, explosives, and semi-volatiles, it is reasonable to conclude that there are no ecological impacts from EWTF operations."

Based on the report conclusion, DTSC issued a CEQA Addendum dated June 27, 2017 to support the "no impact" conclusion in the March 2016 CEQA Environmental Document Analysis.

The "no impact' conclusion of the 2012 Soil Sample Report and the completion of the CEQA allowed DTSC to open a second public comment period and public hearing in 2016. After responding to all comments, DTSC issued the Hazardous Waste Facility Permit (HWFP, Appendix 3) on June 29, 2017. The HWFP has an effective date of August 7, 2017 and an expiration date of August 7, 2027.

2. Hazardous Waste Facility Permit – EWTF Soil Sampling Requirements

The HWFP, Part V, Special Conditions, pages 27-28 require soil sampling in the vicinity of EWTF. This soil sampling plan addresses Special Conditions #14, a-e. Special Condition #15 specifies the soil sampling implementation timeframe. Special Condition #16 specifies soil sampling report content.

2.1 Hazardous Waste Facility Permit, Special Conditions 14 - 16:

14.

Within three (3) years from the effective date of this Permit, the Permittee shall submit for approval, a Soil Sampling Plan (Soil Sampling Plan) to implement the recommendations of the September 2012 Soil Sample Report (LLNL-TR-588454). The Soil Sampling Plan shall include at a minimum:

a. The laboratory Method Detection Limit and Reporting Limit for each chemical listed in Table 1 of the Soil Sample Report, LLNL-TR-588454;
b. A plan to sample metals, furans, explosives, perchlorate and semi-volatile compounds from one location closest to Units #1 and #2 (Burn Units) and #3 (Open Detonation Unit);
c. A plan to sample metals from each downwind sampling location using the same methodology employed during the 2009 sampling effort, as described in the Soil Sampling Plan, October 2007, LLNL-TR-400074 (2007 Soil Sampling Plan);
d. A plan to sample two additional locations (one to the northeast and the other to the southwest) in addition to pre-existing sampling locations designated as EWTF Downwind #1, #2, #3 and #4 as specified in LLNL-TR-588454 Soil Sample Report. The two additional locations shall be located at the same distance from the Burn Units (Units #1 and #2) as the EWTF Downwind #1 sample location and sampled for metals only.
e. A plan to sample two additional locations (one the northwest and one to the southeast) in addition to pre-existing sample locations designated as Detonation Pad Downwind #1 and #2 as specified in LLNL TR-588454 Soil Sample Report. The two additional locations shall be located at the same distance from the Open Detonation Unit (Unit #3) as the Detonation Pad Downwind #1 sample location and sampled for metals only.
f. A plan to sample for perchlorate at all locations.

15.

The Permittee shall implement the approved Soil Sampling Plan no later than one (1) year after receiving approval from DTSC.

16.

The Permittee shall submit to DTSC, within eight (8) months after receiving the final analytical report, a summary report of the soil sampling effort. At a minimum, the report shall include:

a. Executive summary, including objectives and conclusions;
b. Supporting laboratory report of analytical data;
c. Discussion of any changes in soil chemical concentrations relative to the September 2012 Soil Sample Report (LLNL-TR-588454);
d. Statistical analysis by mean, standard deviation and UCL 95% methods (applied the same as the 2012 Soil Sample Report, LLNL-TR-588454);
e. Identification and analysis of any individual result if the variability is greater than 20% of the mean value for each constituent; and
f. Comparison of results to the CERCLA Site 300 background levels identified in the 2012 Soil Sample Report, LLNL-TR-588454.

3. Summary of the 2007 Soil Sampling Plan and 2012 Soil Sampling Report

3.1 Sample Locations

Sample locations for the Burn Units (i.e., Burn Cage and Burn Pan) and Detonation Pad were based on the prevailing west to east wind direction, topography, and location-specific sampling conditions. Four Burn Unit sample locations were identified along a straight line downwind of the Burn Units in a gently sloping valley that rose up to a ridge. In each sample location, four random samples were obtained for analysis for all constituents of concern. Sample location information is provided in **Table 1**. Two Detonation Pad composite samples were obtained immediately downwind and east of the unit on an uphill slope before cresting a ridge. **Table 1** also includes sample location information for the Detonation Pad and Ambient Areas.

Vegetation, anthropogenic activity, gravel, rocks, and other factors that would affect sample composition and quality did not create sampling problems during the sampling event.

The 2012 Soil Sample Report also included one sample 750 feet upwind of EWTF and three ambient areas approximately 7,000 – 8,000 feet upwind of the EWTF on the west side of the site. Results from the EWTF upwind sample were not significantly different than the down samples; however, the presence of a nearby fire trail used by heavy equipment rendered the sample results somewhat suspect.

The three ambient locations were chosen as background areas unaffected by EWTF operations. However, samples obtained for CERCLA work were used for comparison to EWTF samples instead of the ambient samples for two reasons: 1. The CERCLA background sample dataset consisted of 256 samples, whereas the EWTF Ambient dataset only consisted of 12 samples; and, 2. The CERCLA background values have been used for CERCLA remediation work.

Based on this, the CERCLA background values were used for comparison to the downwind EWTF Burn Units and Detonation Pad values.

Sample Area ID #	Distance from the indicated reference point	GPS Location coordinates
BURN UNITS		
Burn Units Down Wind (DW) #1	78 ft from storm drainpipe (outlet)	N37 degrees 39.597 minutes, W121 degrees, 32.064 minutes
Burn Units DW #2	250 ft from storm drainpipe (outlet)	N37 degrees 39.581 minutes, W121 degrees, 32.018 minutes
Burn Units DW #3	450 ft from storm drainpipe (outlet)	N37 degrees 39.566 minutes, W121 degrees, 31.978 minutes
Burn Units DW #4	500 ft from storm drainpipe (outlet)	N37 degrees 39.559 minutes, W121 degrees, 31.962 minute
BURN UNITS/DETONATION PAD (Det Pad) UPWIND		
Burn Units/Det Pad Up Wind (UW) #1	750 ft from the corner of the burn unit fence	N37 degrees 39.660 minutes, W121 degrees, 32.250 minutes
DETONATION PAD		
Det Pad DW #1	54 ft from edge of concrete pad on Det Pad.	N37 degrees 39.472 minutes, W121 degrees, 32.058 minutes
Det Pad DW #2	120 ft from edge of concrete pad on Det Pad.	N37 degrees 39.460 minutes, W121 degrees, 32.036 minutes
AMBIENT (AM)		
AM #3 (WOBS)	126 ft from curb at west side of WOBS post	N37 degrees 39.955 minutes, W121 degrees, 33.490 minutes
AM #2 (DSW)	55 feet from well "PIT7-13"	N37 degrees 40.351 minutes, W121 degrees, 33.267 minutes
AM #1 (NPS)	SE from NPS, down from fill area	N37 degrees 40.702 minutes, W121 degrees, 32.987 minutes

Table 1. Burn Units, Detonation Pad and Ambient sample locations. From the Soil Sample Report, September 2012.

Figures 1 and 2 show the sample locations of EWTF and ambient areas and EWTF-only, respectively.

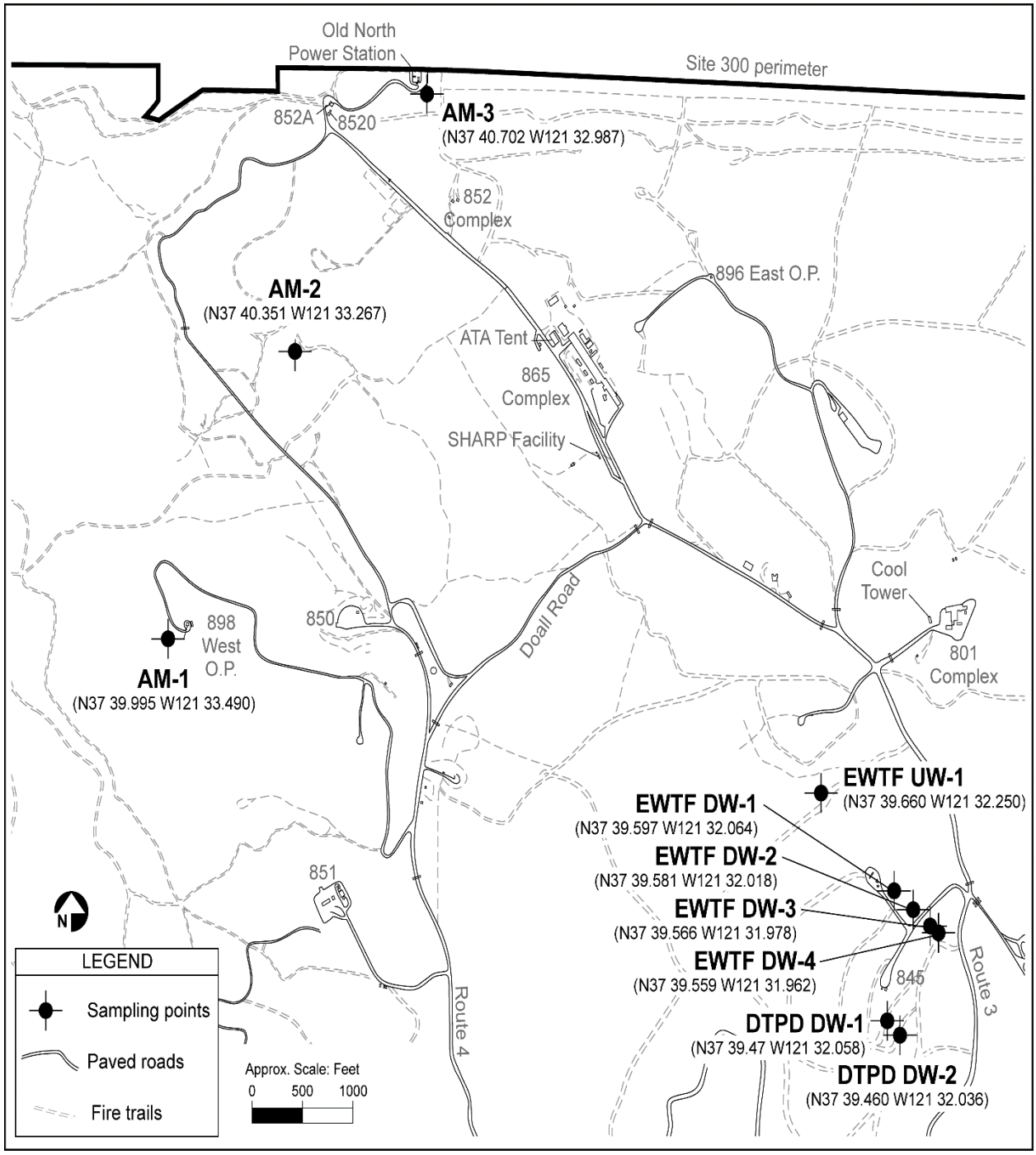

Figure 1. EWTF Burn Units, Detonation Pad and Ambient Sampling Locations. From the Soil Sample Report, September 2012.

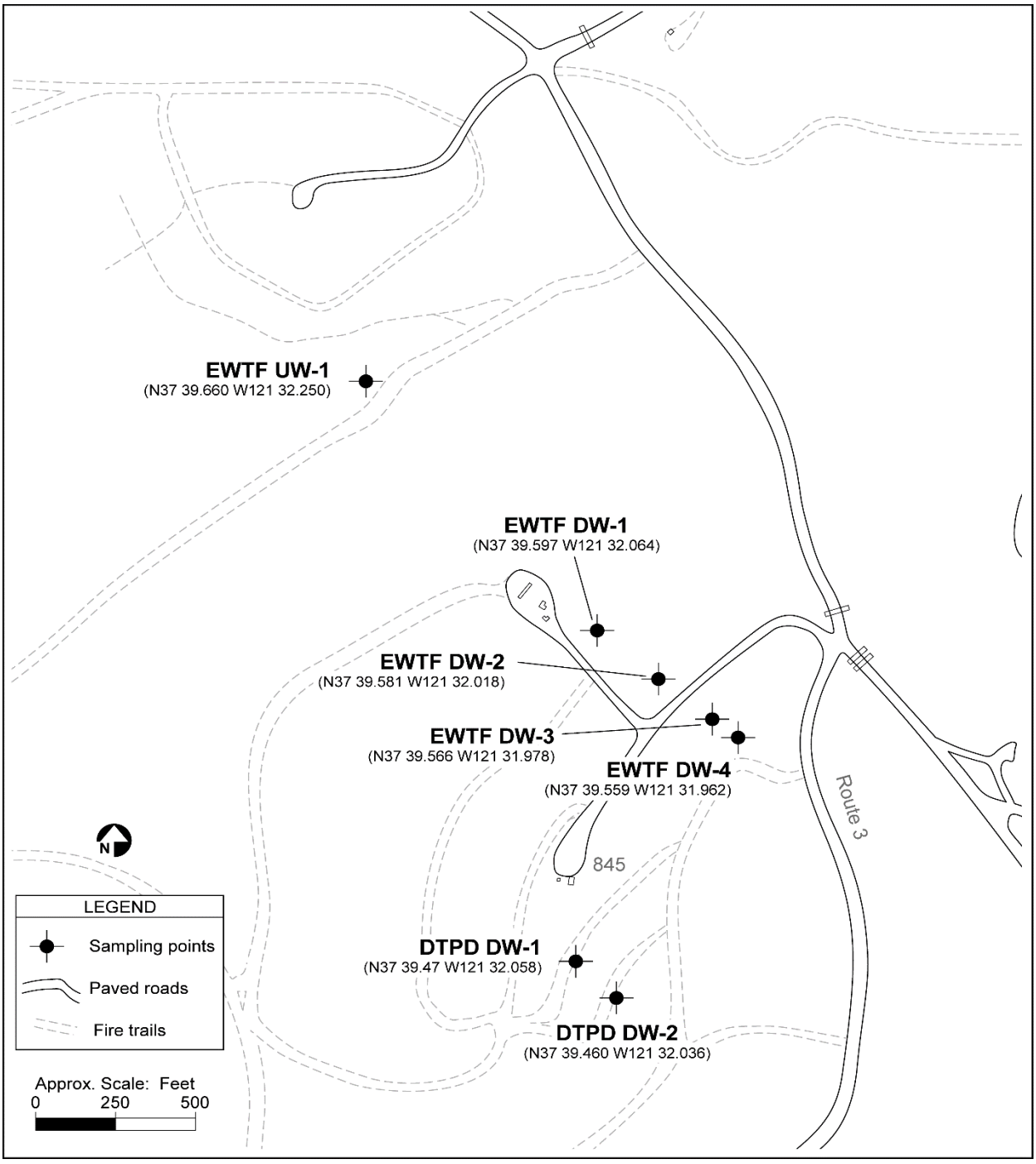

Figure 2. EWTF Burn Units and Detonation Pad Sampling Locations. From the Soil Sample Report, September 2012.

3.2 Constituents of Concern

Constituents of concern were identified in the "Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, October 2007." The 21 COCs are in **Table 2**, below.

Furans PCDFs (5)	**Explosives (3)**	**Metals (8)**	**Semi-volatile Organic Compounds SVOCs (5)**
1-4, 6-8 HpCDF	2,4-Dinitrotoluene	Aluminum	2-Chlorophenol
1-4, 7-9 HpCDF	2,6-Dinitrotoluene	Antimony	Diphenylamine
1-4, 7, 8 HxCDF	RDX	Barium	Fluoranthene
1-3, 6-8 HxCDF		Cadmium	Naphthalene
1-9 OCDF		Chromium	Phenol
		Copper	
		Lead	
		Lead	

Table 2. Constituents of Concern chemical groups (from the "Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, October 2007.")

COCs, Chemical Abstract Services (CAS) Number, limit of sensitivity for the analytical equipment and result are below for all samples.

Constituent of Concern	CAS Number	Limit of Sensitivity (LOS)	Result
1-4, 6-8 Heptachlorodibenzofuran	67562-39-4	10 ng/kg (ppt)	All samples <LOS
1-4, 7-9 Heptachlorodibenzofuran	55673-89-7	10 ppt	All samples <LOS
1-4, 7, 8 Hexachlorodibenzofuran	70648-26-9	10 ppt	All samples <LOS
1-3, 6-8 Hexachlorodibenzofuran	57117-44-9	10 ppt	All samples <LOS
1-4, 6-9 Octachlorodibenzofuran	39001-02-0	20 ppt	All samples <LOS
2,4-Dinitrotoluene	121-14-2	0.5 mg/kg (ppm)	All samples <LOS
2,6-Dinitrotoluene	606-20-2	0.5 ppm	All samples <LOS
RDX	121-82-4	0.5 ppm	All samples <LOS
Aluminum	7429-90-5	12 mg/kg	All samples >LOS
Antimony	7440-36-0	0.5 ppm	4 samples >LOS, 36 samples <LOS
Barium	7440-39-3	5 or 10 ppm depending on dilution	All samples >10 ppm LOS
Cadmium	7440-43-9	0.25 ppm	All samples >LOS
Chromium	7440-47-3	0.75 or 1.5 ppm depending on dilution	All samples >LOS
Copper	7440-50-8	5 or 10 ppm depending on dilution	All samples >LOS
Lead	7439-92-1	0.25 ppm	All samples >LOS
Zinc	7440-66-6	1.3 or 2.6 ppm depending on dilution	All samples >LOS
2-Chlorophenol	95-57-8	0.5 ppm	All samples <LOS
Diphenylamine	122-39-4	0.5 ppm	All samples <LOS
Fluoranthene	206-44-0	0.5 ppm	All samples <LOS
Napthalene	91-20-3	0.5 ppm	All samples <LOS
Phenol	108-95-2	0.5 ppm	All samples <LOS

Table 3. Constituents of concern, Chemical Abstract Services Number, limit of sensitivity of analytical equipment, analytical results summary. Adapted from the Soil Sampling Report, 2012.

Summarizing **Table 3** above, furans, explosives and semi-volatile compounds were not detected above the LOS. Of the eight metals, aluminum was not analyzed by the CERCLA study due to the ubiquitous presence of aluminum in the earth's crust. The average total (opposed to soluble) concentration was 23,075 mg/kg or 23%. Based on a soil pH of 7.5, aluminum would not dissociate from a stable and less toxic solid form into a soluble form. The remaining seven metals were all below the CERCLA background levels.

3.3 2012 Soil Sample Plan Summary

Each sample area of the four downwind sample areas of the Burn Units and two Detonation Pad downwind areas was defined by a 20-foot diameter circle. For each 20-foot diameter circle, four discrete samples were obtained. The four sample locations were chosen by using a random number generator. For implementation in the field, an X-Y axis was drawn and the following points were located according to the following X-Y values in **Tables 4 and 5.** The X-axis points North.

Sample Circle	X Coordinate Value (feet)	Y Coordinate Value (feet)
Burn Units Downwind Sample Area #1	-7	5
	4	-3
	-1	-5
	0	2
Burn Units Downwind Sample Area #2	0	-3
	3	-8
	-1	6
	8	0
Burn Units Downwind Sample Area #3	0	2
	-1	-6
	-4	-2
	3	-9
Burn Units Downwind Sample Area #4	3	-4
	-3	-7
	-2	-9
	0	-3

Table 4. Burn Units X-Y values.

Detonation Pad Downwind Sample Area #1	0	6
	-9	-4
	5	-2
	1	6
Detonation Pad Downwind Sample Area #2	1	0
	9	-3
	-1	1
	-3	2

Table 5. Detonation Pad X-Y values.

Therefore, for the four Burn Unit sample locations, 16 discrete samples were obtained. For the two Detonation Pad sample location, eight discrete samples for obtained. Analytical results for total metals are provided below in **Table 6** below.

Sample Location		**Sb[1]**	**Ba[1]**	**Cd[1]**	**Cr[1]**	**Cu[1]**	**Pb[1]**	**Zn[1]**
Detonation Pad Downwind #01 (DTPD DW01)	Sample #1	1.4	210	1.2	23	45	37	84
	Sample #2	3.2	210	1.4	24	42	37	140
	Sample #3	1.2	230	1.3	25	66	66	150
	Sample #4	2.2	200	1.2	31	89	47	90
Detonation Pad Downwind #02 (DTPD DW02)	Sample #1	0.5	200	1.2	24	24	14	63
	Sample #2	0.5	180	1.2	24	21	12	62
	Sample #3	0.5	180	1.2	23	22	14	59
	Sample #4	0.5	200	1.2	24	22	14	62
Explosives Waste Treatment Facility/Burn Units Downwind #01 (EWTF DW01)	Sample #1	0.5	200	1.1	24	25	11	63
	Sample #2	0.5	220	1.0	23	25	8.6	94
	Sample #3	0.5	160	0.7	20	22	6.3	52
	Sample #4	0.5	190	1.1	26	24	9.8	62
Explosives Waste Treatment Facility/Burn Units Downwind #02 (EWTF DW02)	Sample #1	0.5	200	1.2	26	23	9.9	56
	Sample #2	0.5	180	1.2	26	22	8.2	63
	Sample #3	0.5	180	1.2	31	26	11	62
	Sample #4	0.5	200	1.2	27	23	9.7	58
Explosives Waste Treatment Facility/Burn Units Downwind #03 (EWTF DW03)	Sample #1	0.5	5	0.3	0.8	30	0.3	1.3
	Sample #2	0.5	5	0.3	0.8	29	0.3	1.3
	Sample #3	0.5	5	0.3	0.8	28	0.3	1.3
	Sample #4	0.5	5	0.3	0.8	29	0.3	1.3
Explosives Waste Treatment Facility Downwind #04 (EWTF DW04)	Sample #1	0.5	210	1.7	19	34	14	67
	Sample #2	0.5	170	1.3	16	28	12	54
	Sample #3	0.5	170	1.4	16	28	11	54
	Sample #4	0.5	160	1.2	15	27	11	54
Explosives Waste Treatment Facility Upwind #01 (EWTF UW01)	Sample #1	0.5	190	1.4	35	39	12	79
	Sample #2	0.5	190	1.5	35	37	12	79
	Sample #3	0.5	190	1.5	36	38	12	80
	Sample #4	0.5	190	1.3	36	38	12	79
n		**28**	**28**	**28**	**28**	**28**	**28**	**28**
Mean		**0.7**	**165.4**	**1.1**	**21.9**	**32.4**	**14.7**	**63.3**
Std Dev		**0.6**	**68.6**	**0.4**	**10.4**	**14.7**	**14.7**	**34.6**
UCL 95%[2]		**0.9**	**187.8**	**1.2**	**25.3**	**37.2**	**19.5**	**74.6**
CERCLA Background[3]		**4**	**540**	**1.9**	**122**	**39**	**51**	**110**

[1]Units = mg/kg.

[2]UCL 95 = Mean + (T x StDev)/sqrt (n-1), T=1.701, EPA OSWER 9286.6-10, December 2002.

[3]CERCLA Background from the LLNL Site-Wide Feasibility Study, 1999.

Table 6. Metal results from each discrete sample location. From the Soil Sample Report, 2012.

4. Proposed 2020 Soil Sample Plan

Essential elements of the 2020 Soil Sample Plan are prescribed in the 2017 Hazardous Waste Facility Permit.

This Plan will comply with all HWFP Special Conditions 14 a-f as indicated below.

1. Use the same, or current EPA SW 846 analytical methods and instrument Limit of Sensitivity values that were used for the 2012 report samples. **2020 Soil Sample Plan**, **Table 7, below. HWFP Special Condition 14a.**

2. The downwind sample areas closest to the Burn Units and Detonation Pad will be sampled for the metals, furans, explosives, and semi-volatile organic compounds. Perchlorates will be added to each sample. **2020 Soil Sample Plan, Table 8. HWFP Special Condition 14b**.

3. Use the same sample methodology employed during the 2009 sample event. **2020 Soil Sample Plan, Section 3.3. HWFP Special Condition 14c.**

4. A plan to add two additional sample locations to the northeast and southwest of the Burn Units. The two new additional areas will be sampled for metals and perchlorates. The additional areas will be located approximately 100 feet to the northeast and 100 feet to the southwest of the Burn Units as shown in the **2020 Soil Sample Plan, Figure 3. HWFP Special Condition 14d**.

5. A plan to add two additional sample locations to the northeast and southwest of the Detonation Pad. The two new additional areas will be sampled for metals and perchlorates. The additional areas will be located approximately 100 feet to the northeast and 100 feet to the southwest of the Detonation Pad as shown in the **2020 Soil Sample Plan, Figure 3. HWFP Special Condition 14e.**

6. A plan to sample for perchlorate (CAS No. 14797-73-0) at all locations. All other downwind location will be analyzed for metals and perchlorates only. **2020 Soil Sample Plan, Tables 7 and 8. HWFP Special Condition 14f.**

Constituent of Concern	EPA Method	Limit of Sensitivity
1-4, 6-8 Heptachlorodibenzofuran	8290A	10 ng/kg (ppt)
1-4, 7-9 Heptachlorodibenzofuran	8290A	10 ppt
1-4, 7, 8 Hexachlorodibenzofuran	8290A	10 ppt
1-3, 6-8 Hexachlorodibenzofuran	8290A	10 ppt
1-4, 6-9 Octachlorodibenzofuran	8290A	20 ppt
2,4-Dinitrotoluene	8330	0.5 mg/kg (ppm)
2,6-Dinitrotoluene	8330	0.5 ppm
RDX	8330	0.5 ppm
Aluminum	6010B	12 mg/kg
Antimony	6010B	0.5 ppm
Barium	6010B	5 or 10 ppm depending on dilution
Cadmium	6010B	0.25 ppm
Chromium	6010B	0.75 or 1.5 ppm depending on dilution
Copper	6010B	5 or 10 ppm depending on dilution
Lead	6010B	0.25 ppm
Zinc	6010B	1.3 or 2.6 ppm depending on dilution
2-Chlorophenol	8270	0.5 ppm
Diphenylamine	8270	0.5 ppm
Fluoranthene	8270	0.5 ppm
Napthalene	8270	0.5 ppm
Phenol	8270	0.5 ppm
Perchlorate, CAS No. 14797-73-0	6850	1.0 ppm

Table 7. 2020 Constituents of Concern, analytical methods, and limit of sensitivity.

Sample Location		**Chemical Group**				
Detonation Pad Downwind #1	Sample #1	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
	Sample #2	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
	Sample #3	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
	Sample #4	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
Detonation Pad Downwind #2	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate
Detonation Pad Northeast #3 **NEW LOCATION**	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate
Detonation Pad Southwest #4 **NEW LOCATION**	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate
Explosives Waste Treatment Facility/Burn Units Downwind #1	Sample #1	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
	Sample #2	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
	Sample #3	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
	Sample #4	Furans	Explosives	Metals	Semi-volatiles	Perchlorate
Explosives Waste Treatment Facility/Burn Units Downwind #2	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate
Explosives Waste Treatment Facility/Burn Units Downwind #3	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate
Explosives Waste Treatment Facility/Burn Units Downwind #4	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate
Explosives Waste Treatment Facility/Burn Units Northeast #5 **NEW LOCATION**	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate
Explosives Waste Treatment Facility/Burn Units Southwest #6 **NEW LOCATION**	Sample #1			Metals		Perchlorate
	Sample #2			Metals		Perchlorate
	Sample #3			Metals		Perchlorate
	Sample #4			Metals		Perchlorate

Table 8. 2020 Sample locations and Constituents of Concern.

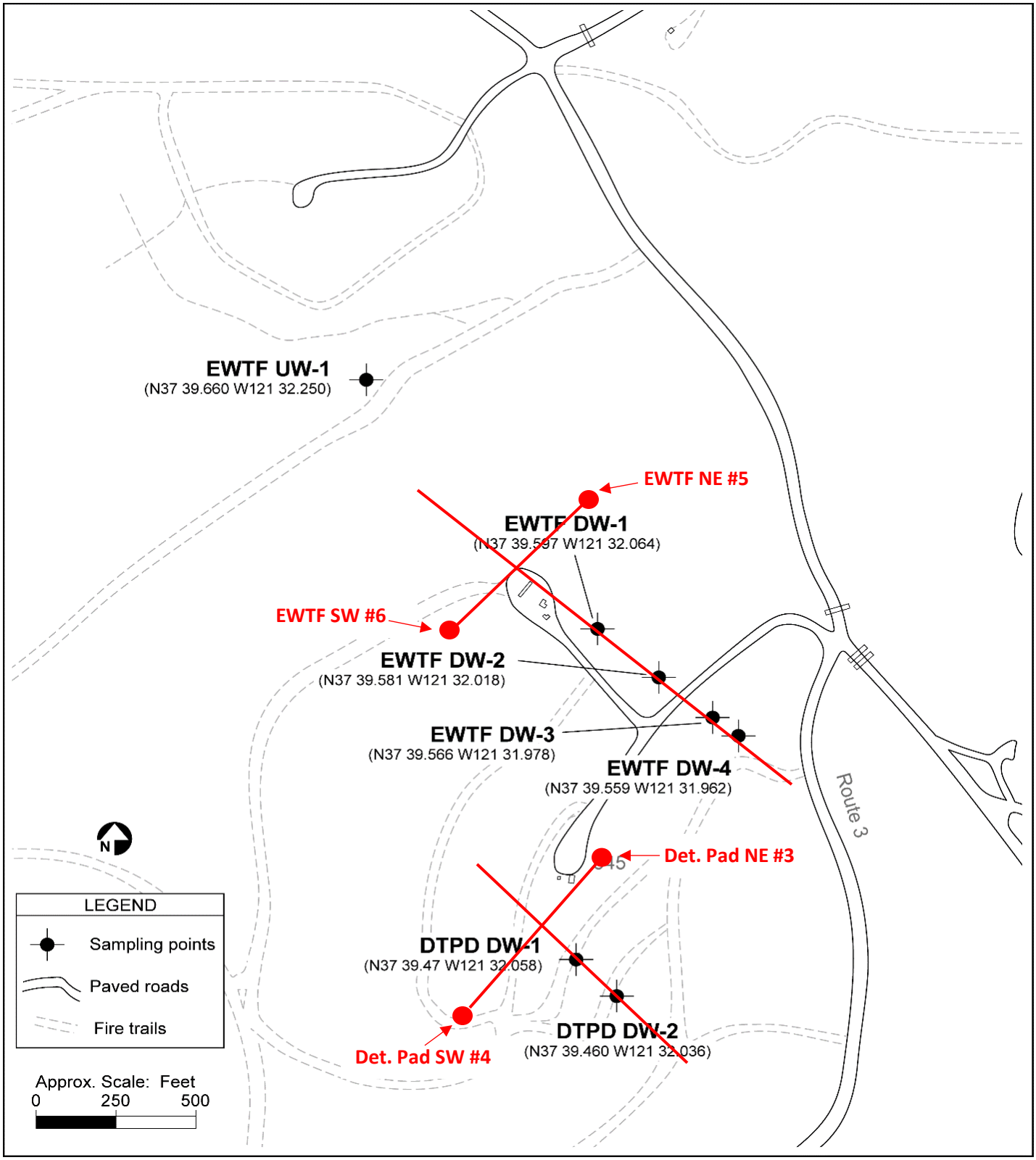

Figure 3. 2020 Sample locations.

Appendix A

LAWRENCE
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LLNL-TR-400074

Soil Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory

Stan Terusaki

October 2007

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

Soil Sampling Plan Revision History

First revision in response to DTSC comments on the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility* March 2006. Comments by Michael J. Anderson, Ph.D.

Second revision in response to DTSC comments on the Ecological Risk Assessment (only). DTSC Cover Letter Date September 4, 2007, DTSC Memorandum Date August 23, 2007.October 2007 in response to DTSC comments. Comments by Michael J. Anderson, Ph.D. and Al Batakji, Hazardous Substance Engineer.

Third revision in response to DTSC comments received by email regarding additional statistical analysis on the soil sampling results. Comments from Michael J. Anderson, Ph.D., included in an email dated November 1, 2007, from Al Batakji, Hazardous Substance Engineer to Stan Terusaki, LLNL.

Fourth revision in response to DTSC comments to formalize and reference the Soil Sampling Plan in the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory*, UCRL-TR-216940 Vol 1 Rev.4.

Soil Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory

LLNL proposes to obtain soil samples from the following areas:

1. Four areas downwind of the Explosives Waste Treatment Facility (EWTF) Burn Units (i.e., Thermal Treatment Unit and Burn Pan)

2. One area upwind of the Burn Units and Detonation Pad

3. Two areas downwind of the EWTF Detonation Pad

4. Three areas unaffected (representing ambient conditions) by EWTF operations approximately 7000–8000 feet upwind of the facility

The purpose of the sampling in areas 1, 2, and 3 is to detect if operations cause increases in concentrations of materials downwind of the Burn Units or downwind of the Detonation Pad. The purpose of the sampling in area 4 is to determine if previously developed background screening levels can be applied to EWTF operations.

A 20 foot diameter circle will define each sample area. Soil samples will be obtained from four random locations inside each 20 foot circle. The samples will be obtained immediately below the surface, free of any organic matter (e.g., roots) and other surface and subsurface material (e.g., rocks) that is not conducive to analysis. The random identification of four discrete sample locations in each circle will allow the variability between sample locations and areas, if present, to be evaluated statistically. At a minimum, data will be evaluated by the Wilcoxon Rank Sum test.

All future sampling will occur in the same 20 foot diameter circle; however, only one randomly located sample (instead of four) will be obtained. Future samples will be analyzed for the same chemicals of potential ecological concern (CPECs) as the initial sample. Sample areas and locations will be recorded by Global Positioning System coordinates.

Summary of Sample Areas and Locations

Initial sampling: The total number of sample areas will be 10 (listed above). Each sample area will be sampled from four random locations; therefore, soil samples will be obtained from 40 locations.

Future sampling: Samples will be obtained from the same areas downwind of the Burn Units (#1 above), area upwind of EWTF (#2 above), and areas downwind of the Detonation Pad (#3 above). Soil samples will be

obtained at each area from one random location inside the 20 foot circle.

Burn Units Sample Plan

The first three proposed sample areas are in the valley downgradient and east of the Burn Units. The downgradient direction also coincides with the predominantly easterly wind direction during treatment operations. Therefore, CPECs, if present, would most likely be carried downwind and downgradient by wind and erosional processes.

The fourth and last downwind sample area is near a ridge before crossing into another small valley. This would be the last area where CPECs would be deposited before airborne CPECs would be diluted by dispersion effects of the ridge east of the Burn Units.

The upwind sample will be obtained approximately 850 feet west of the Burn Units, near the top of a ridge surrounding EWTF. This sample will also be the upwind sample for the Detonation Pad. **Table A** summarizes the sampling plan for the Burn Units.

Downwind and upwind samples will be compared using the Wilcoxon Rank Sum test (at a significance level of 5%) to determine if a statistically significant difference exists.

Table A. Sample Plan for the Burn Units

Burn Units Sample Area ID #	Distance from Burn Units (feet)	Number of soil sample locations per sample area	Constituents	EPA Method
Burn Units DW[1] #1	Adjacent to facility	4 random	Table B-8 CPECs[2]	Explosives EPA Method 8330, Furans EPA Method 8290, Total Metals EPA Method 6010B, Semi-volatiles EPA Method 8270, + grain size, pH, %organic matter
Burn Units DW #2	250	4 random	Table B-8 CPECs	Explosives EPA Method 8330, Furans EPA 8290, Total Metals EPA Method 6010B, Semi-volatiles EPA Method 8270, + grain size, pH, %organic matter
Burn Units DW #3	500	4 random	Table B-8 CPECs	Explosives EPA Method 8330, Furans EPA Method 8290, Total Metals EPA Method 6010B, Semi-volatiles EPA Method 8270, + grain size, pH, %organic matter
Burn Units DW #4	650	4 random	Table B-8 CPECs	Explosives EPA Method 8330, Furans EPA Method 8290, Total Metals EPA Method 6010B, Semi-volatiles EPA Method 8270, + grain size, pH, %organic matter

continued

Burn Units Sample Area ID #	Distance from Burn Units (feet)	Number of soil sample locations per sample area	Constituents	EPA Method
Burn Units and Detonation Pad UW[3] #1	850	4 random	Table B-8 CPECs	Explosives EPA Method 8330, Furans EPA Method 8290, Total Metals) EPA Method 6010B, Semi-volatiles EPA Method 8270, + grain size, pH, %organic matter

1 DW = Downwind

2 CPECs = Chemicals of Potential Ecological Concern, Attachment 1 (Table B-8, from the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory*, Volume 1: Report of Results, UCRL-TR-216940 Vol 1 Rev.4)

3 UW = Upwind

Detonation Pad Sampling Plan

The proposed sampling strategy for the Detonation Pad will not differ from the burn units sampling plan except for the following:

- The distance from the Detonation Pad to the top of the downwind ridge is approximately 180 feet. Therefore, the shorter distance from the unit to the ridge only allows two sample areas.

Table B summarizes the sampling plan for the Detonation Pad.

Downwind and upwind samples will be compared using the Wilcoxon Rank Sum test (at a significance level of 5%) to determine if a statistically significant difference exists.

Table B. Sample Plan for the Detonation Pad

Detonation Pad Sample Area ID #	Distance from Detonation Pad (feet)	Number of soil sample locations per sample area	Constituents	EPA Method
Detonation Pad DW[1] #1	Adjacent to facility	4 random	Table B-8 CPECs[2]	Furans EPA Method 8290, Total Metals EPA Method 6010B, Semivolatiles EPA Method 8270, Explosives EPA Method 8330, + grain size, pH, %orgnic matter
Detonation Pad DW #2	120	4 random	Table B-8 CPECs	Furans EPA Method 8290, Total Metals EPA Method 6010B, Semivolatiles EPA Method 8270, Explosives EPA Method 8330, + grain size, pH, %orgnic matter

continued

Detonation Pad Sample Area ID #	Distance from Detonation Pad (feet)	Number of soil sample locations per sample area	Constituents	EPA Method
Detonation Pad UW[3] #3	Same sample as the Burn Units upwind sample	4 random	Table B-8 CPECs	Furans EPA Method 8290, Total Metals EPA Method 6010B, Semi-volatiles EPA Method 8270, Explosives EPA Method 8330, + grain size, pH, %orgnic matter

1 DW = Downwind

2 CPECs = Chemicals of Potential Ecological Concern, Attachment 1 (Table B-8, from the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory*, Volume 1: Report of Results, UCRL-TR-216940 Vol 1 Rev.4)

3 UW = Upwind

Ambient Location Sampling Plan

Three sampling locations are proposed to evaluate ambient levels, if present, of the CPECs. The location of the three areas is in the west to northwest corner of Site 300, approximately 7000 - 8000 feet upwind of EWTF. The location of EWTF and the three sample areas (NPS, WOBS, and DSW) are shown in **Figure 1.** Soil samples will be obtained from the "GAF" soil type in order to minimize the effects of potentially different chemical, mechanical weathering processes and source terrain influences on the sample results. **Figure 2** identifies the "GAF" soil type distribution across Site 300.

The same sampling strategy described above for the Burn Units and will be implemented for the ambient sample areas. **Table C** summarizes the sampling plan for the ambient locations.

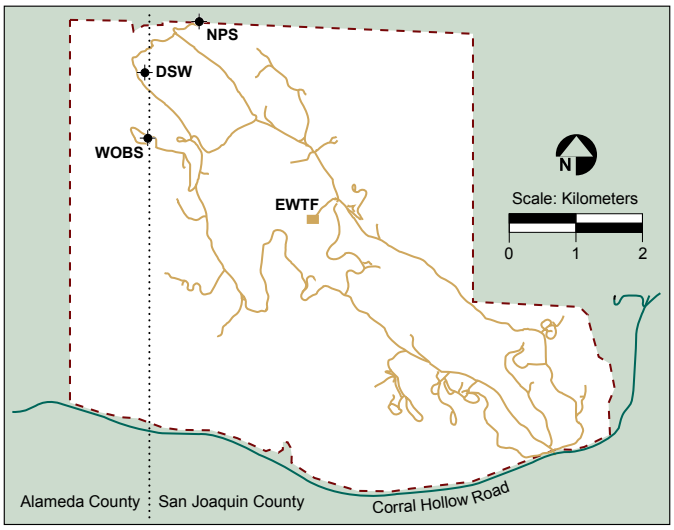
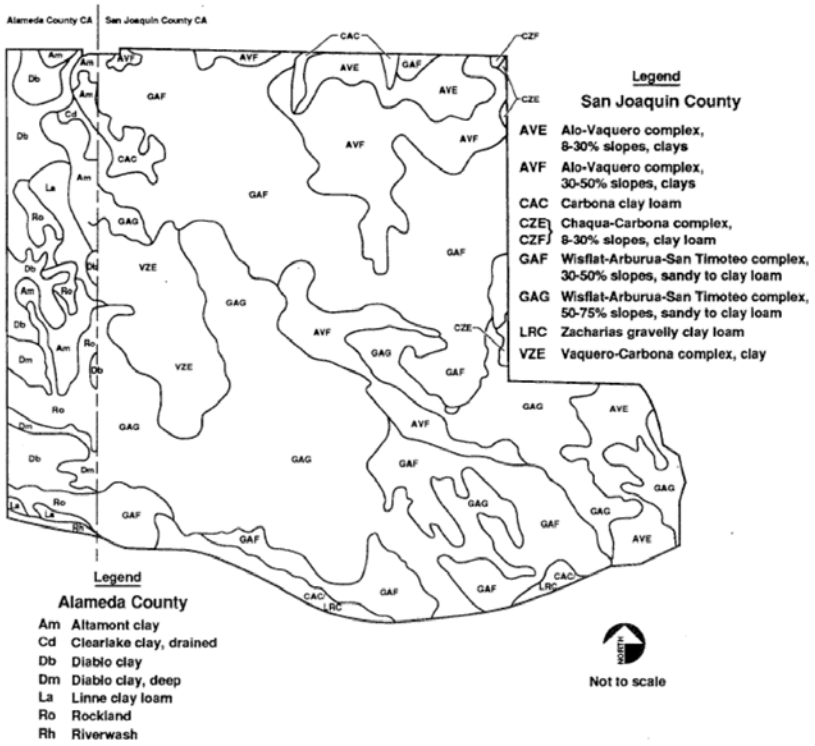


Figure 1. NPS, DSW, WOBS, EWTF locations.



Source: Soil Survey of San Joaquin County, California. Conducted in 1990; Soil Survey of the Alameda County, California, 1966.

Figure 2. Soil map of LLNL Site 300 (soils of the two counties are the same, only nomenclature is different).

Table C. Sample Plan for the Ambient Locations

Sample Area ID #	Approximate Distance from EWTF (feet)	Number of soil sample locations per sample area	Constituents	EPA Method
WOBS	7000	4 random	Table B-8 CPECs[1, 2]	Explosives EPA Method 8330, Furans EPA Method 8290, Semi-volatiles EPA Method 8270, Total Metals EPA Method 6060B, + grain size, pH, %organic matter
DSW	7500	4 random	Table B-8 CPECs[1, 2]	Explosives EPA Method 8330, Furans EPA Method 8290, Semi-volatiles EPA Method 8270, Total Metals EPA Method 6010B, + grain size, pH, %organic matter

continued

Sample Area ID #	Approximate Distance from EWTF (feet)	Number of soil sample locations per sample area	Constituents	EPA Method
NPS	8000	4 random	Table B-8 CPECs[1, 2]	Explosives EPA Method 8330, Furans EPA Method 8290, Semi-volatiles EPA Method 8270, Total Metals EPA Method 6010B, + grain size, pH, %organic matter

1 CPECs = Chemicals of Potential Ecological Concern, Attachment 2 (Table B-8, from the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Volume 1: Report of Results, UCRL-TR-216940 Vol 1 Rev. 4)

2 Samples for total metals analysis by EPA Method 6010B will be obtained if warranted by statistical analysis.

Background Metals Concentrations in Site 300 Soils

Table D provides background screening level concentrations for metals (except aluminum) at Site 300. The concentrations were calculated based on the statistical probability that only 1 in 200 samples from background will exceed that value. All of the soil samples used to create the database were obtained at Site 300 and were not sampled from any known source of anthropogenic contamination.

The Wilcoxon Rank Sum test will be conducted on the ambient and the upwind metals results. If the metals at the ambient locations are not present at elevated concentrations relative to the upwind locations, this will suggest the background screening metals concentrations in **Table D** may be used for future comparisons.

The Wilcoxon Rank Sum (WRS) Test is a non-parametric test which can be used to examine whether measurements from one population tend to be consistently larger (or smaller) than those from another population. LLNL Site 300 will use this test to determine whether inorganic sampling data (background versus site) represent similar or different statistical populations. In addition to visual inspection of the distribution plots and in order to identify potential outliers, LLNL Site 300 will perform a quantile test complementary to the WRS test. The quantile test will be used to detect differences which are not detected by the WRS, and to evaluate and compare the upper tails of two distributions. LLNL Site 300 will use appropriate references including the Navy guidance document found at https://portal.navfac.navy.mil/pls/portal/docs/PAGE/NAVFAC/NAVFAC_WW_PP/NAVFAC_NFESC_PP/ENVIRONMENTAL/ERB/LAB/PROCGUID.PDF for determining inorganic constituent background concentrations in addition to other, appropriate statistical tests. LLNL will submit to DTSC a report including a discussion of the statistical tests (i.e. Wilcoxon Rank Sum test), distribution of data, outliers and complete summary of results.

LLNL proposes to not sample for aluminum based on the fact that aluminum is a ubiquitous and abundant element found in soil in Livermore and Tracy. At Site 300, aluminum is found in clay-bearing source rocks (e.g., graywacke, metagraywacke,

shale, argillite) of the metamorphic Franciscan Assemblage and sedimentary rocks of the Great Valley Sequence. Erosion of the metamorphic and sedimentary rocks has produced a clay-rich soil (Vertisols) high in aluminum concentration that is typical of the Diablo Range, which encompasses Site 300 and the Livermore site.

Soil samples obtained from the Livermore site have an aluminum concentration that ranges from 1 to 2% (10,000 to 20,000 mg/kg). Based on this analytical data for Livermore and the common source terrain (i.e., Diablo Range) for Livermore and Site 300, aluminum soil concentrations at Site 300 should be similar to the Livermore site. Therefore, it may not be possible to discern aluminum from EWTF emissions, which is calculated at 86 mg/kg (Table B, page B-30) relative to 10,000 to 20,00 mg/kg natural background. For this reason, aluminum soil sampling is not proposed as part of this sampling plan.

Soil Sampling Tables

Table E lists each sample area, location, number of samples to be obtained in each location and analytical test. **Table F** provides duplicate sample quality assurance information for the initial effort. **Table G** provides the estimated sample plan five years after the initial effort. Subsequent sampling efforts may only include only one sample location in the Burn Units and Detonation Pad areas; however, additional samples and samples locations may be necessary if the variability exceeds 20% pursuant to DTSC comment 2B [DTSC letter dated September 4, 2007, enclosed HERD Comments].

This sampling plan will be implemented at five year intervals as requested in the DTSC comment letter dated June 8, 2006. The five year sampling plan will be submitted to DTSC for approval based of the statistical analysis of the first year sample results.

Quality Assurance/Quality Control

Table F lists the total number of field duplicates that will be obtained for each sample and duplicate sample locations. The duplicate sample will be collected at the same time from the two locations adjacent to each other, and will be submitted to the analytical laboratory as separate samples (i.e., "blind" duplicates). The duplicates will be used to assess the consistency of the overall sampling effort, including collection, shipping, analysis and consistency and precision of the laboratory's analytical system.

Table D. Background screening levels for metals in soils at Site 300

Metal	Number of Analyses	Number of Detections	Background Screening Level (mg/kg)
Antimony	53	0	1.0
Arsenic	53	50	9.24
Barium	53	53	331
Beryllium	53	24	1.01
Cadmium	53	3	2.6
Chromium	53	53	45.6
Cobalt	53	51	16.2
Copper	53	53	34
Lead	53	16	70.3
Mercury	53	1	0.05
Molybdenum	53	3	12
Nickel	53	50	66
Selenium	53	11	2.87
Silver	53	0	2.5
Thallium	53	0	1.0
Vanadium	53	53	97.5
Zinc	53	53	78

Table E. Soil Sampling Area/Location

Area	Location	# Samples/Analysis	
Burn Units DW #1	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x metals	4 x % organic matter
		4x semi-volatiles	
Burn Unit DW #2	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x metals	4 x % organic matter
		4x semi-volatiles	
Burn Unit DW #3	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x metals	4 x % organic matter
		4x semi-volatiles	
Burn Unit DW #4	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x metals	4 x % organic matter
		4x semi-volatiles	
Burn Unit Detonation Pad UW #1	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x metals	4 x % organic matter
		4x semi-volatiles	
Detonation Pad DW #1	4 random locations	4x semi-volatiles	4x soil grain size
		4x explosives	4 x soil pH
		4x furans	4 x % organic matter
		4x metals	
Detonation Pad DW #2	4 random locations	4x semi-volatiles	4x soil grain size
		4x explosives	4 x soil pH
		4x furans	4 x % organic matter
		4x metals	
WOBS	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x semi-volatiles	4 x % organic matter
DSW	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x semi-volatiles	4 x % organic matter
NPS	4 random locations	4x explosives	4x soil grain size
		4x furans	4 x soil pH
		4x semi-volatiles	4 x % organic matter

Metals may be added to ambient locations (WOBS, DSW, NPS) based on statistical results.

Table F. EPA Method/Total Number of Samples/Number of Duplicates

EPA Method	Total Number of Samples	Number of Duplicate Samples	Duplicate Sample Locations
Explosives EPA Method 8330	40	4	Burn Unit DW #1
			Detonation Pad DW #1
			Burn Units/Detonation Pad UW #1
			NPS
Furans EPA Method 8290	40	4	Burn Unit DW #2
			Detonation Pad DW #2
			Burn Units/Detonation Pad DW #1
			DSW
Total Metals EPA Method 6010B	28 (minimum) 40 (maximum)	3 (minimum) 4 (maximum)	Burn Unit DW #3
			Detonation Pad DW #1
			Burn Units/Detonation Pad UW #1
			WOBS
Semi-volatiles EPA Method 8270	40	4	Burn Units DW #1
			Burn Units DW #4
			Detonation Pad DW #1
			NPS
Grain Size	40	4	Burn Unit DW #2
			Detonation Pad DW #2
			Burn Units/Detonation Pad DW #1
			DSW
pH	40	4	Burn Unit DW #2
			Detonation Pad DW #2
			Burn Units/Detonation Pad DW #1
			WOBS
% Organic Matter	40	4	Burn Unit DW #2
			Detonation Pad DW #2
			Burn Units/Detonation Pad DW #1
			NPS
Total	268-280	27-28	

Table G. Estimated Sampling 5 Years After Initial Sampling Effort

Area	Location[1]	# Samples/Analysis[1]
Burn Units DW #1	1-4 random location(s)	1-4x explosives
		1-4x furans
		1-4x metals
		1-4x semi-volatiles
Burn Unit DW #2	1-4 random location(s)	1-4x explosives
		1-4x furans
		1-4x metals
		1-4x semi-volatiles
Burn Unit DW #3	1-4 random location(s)	1-4x explosives
		1-4x furans
		1-4x metals
		1-4x semi-volatiles
Burn Unit DW #4	1-4 random location(s)	1-4x explosives
		1-4x furans
		1-4x metals
		1-4x semi-volatiles
Burn Unit/Detonation Pad UW #1	1-4 random location(s)	1-4x explosives
		1-4x furans
		1-4x metals
		1-4x semi-volatiles
Detonation Pad DW #1	1-4 random location(s)	1-4x explosives
		1-4x furans
		1-4x metals
		1-4x semi-volatiles
Detonation Pad DW #2	1-4 random location(s)	1-4x furans
		1-4x metals

1 Additional sample locations and samples per location may be required based on statistical tests from the first year sampling and DTSC comment 2B. Duplicate samples will be determined after DTSC approval of the total number of sample locations and samples.

Appendix B

Environmental Functional Area
Environmental Support and Programmatic Outreach

Soil Sample Report
In Support of the Site 300
Explosives Waste Treatment Facility
Permit Renewal

September 2012

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Lawrence Livermore National Laboratory
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Table of Contents

Tables

Figures

Appendices

1. Soil Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Terusaki, October 2007.

2. Soil Sample Plan Implementation.

3. Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Gallegos, Daniels, and Wegrecki, October 2007.

4. Site-Wide Feasibility Study for LLNL Site 300, Appendix A, November 1999.

5. Analytical Reports: Total Organic Carbon, Particle Size Analysis, pH, Furans, Explosives, Semi-Volatile Compounds and Metals.

EXECUTIVE SUMMARY

LLNL Site 300 has applied to renew the permits for its Explosives Waste Treatment Facility (EWTF), Explosives Waste Storage Facility (EWSF) and Building 883 Storage Facility. As a part of the permit renewal process, the Department of Toxic Substances Control (DTSC) requested LLNL to obtain soil samples in order to conduct a scoping-level ecological risk assessment pursuant to the *Department of Toxic Substances Control, Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Part A: Overview, July 4, 1996.* As stated in the guidance document, the scoping-level ecological risk assessment provides a framework to determine the potential interaction ecological receptors and chemicals of concern from hazardous waste treatment operations in the area of EWTF.

Project-specific sampling requirements are outlined in *Soil Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Terusaki, October 2007.*

In addition to soil sampling, LLNL completed a predictive ecological risk assessment which is included in the second part of the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Gallegos, Daniels and Wegrecki, October 2007*. The predictive ecological risk assessment and scoping level soil sample report characterize the biology of the hazardous waste facility area, evaluate exposure pathways, identify chemicals of concern and evaluate chemicals of concern concentrations relative to site background concentrations.

Soil samples were obtained and analyzed from four chemical groups: furans, explosives, semi-volatiles and metals. Analytical results for furans, explosives and semi-volatiles indicated the chemicals were not detected; therefore, no further analysis was conducted. Soil samples analyzed for metals were compared to site-wide background levels. Background metal concentrations were developed for site wide cleanup activities pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Total metal concentrations from 28 soil samples obtained in the EWTF area are below background levels. Therefore, following DTSC 1996 guidance, the EWTF hazardous waste treatment units exit the ecological risk evaluation process upon completion of the requirements of a scoping-level assessment report. This soil sample report and the predictive ecological risk assessment provide substantial documentation that exceed the requirements of a scoping-level report.

Soil Sampling - Constituents of Potential Ecological Concern Summary

Soil Samples were obtained following the *Soil Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Terusaki, October 2007*, **Appendix 1**. Soil sampling implementation, quality assurance, quality control, EPA and ASTM analytical methods are provided in **Appendix 2** of this report.

Soil samples were analyzed for the following 21 Constituents of Potential Ecological Concern (CPEC). The CPECs were identified in the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Gallegos, Daniels and Wegrecki, October 2007*, **Appendix 3.**

Table 1. Constituents of Potential Ecological Concern

PCDFs (5)	Explosives (3)	Metals (8)	SVOCs (5)
1-4, 6-8 HpCDF	2,4-Dinitrotoluene	Aluminum	2-Chlorophenol
1-4, 7-9 HpCDF	2,6-Dinitrotoluene	Antimony	Diphenylamine
1-4, 7, 8 HxCDF	RDX	Barium	Fluoranthene
1-3, 6-8 HxCDF		Cadmium	Naphthalene
1-9 OCDF		Chromium	Phenol
		Copper	
		Lead	
		Zinc	

EPA Methods and detection limits were chosen for the appropriate soil matrix and to achieve the lowest, reproducible analytical result. The following table provides CPEC name, corresponding Chemical Abstract Services (CAS) number, and a qualitative comparison of Limit of Sensitivity to result.

Table 2. CPEC, CAS Number, Limit of Sensitivity and Result

Matrix: Soil
Analytical Group: Furans

CPEC	CAS Number	Limit of Sensitivity (LOS)	Result
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	10 ng/kg (ppt)	All samples <LOS
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	10 ppt	All samples <LOS

1,2,3,4,7,8- Hexachlorodibenzofuran	70648-26-9	10 ppt	All samples <LOS
1,2,3,6,7,8- Hexachlorodibenzofuran	57117-44-9	10 ppt	All samples <LOS
1,2,3,4,6,7,8,9- Octachlorodibenzofuran	39001-02-0	20 ppt	All samples <LOS

Matrix: Soil
Analytical Group: Explosives

CPEC	CAS Number	Limit of Sensitivity (LOS)	Result
2,4-Dinitrotoluene	121-14-2	0.5 mg/kg (ppm)	All samples <LOS
2,6-Dinitrotoluene	606-20-2	0.5 ppm	All samples <LOS
RDX	121-82-4	0.5 ppm	All samples <LOS

Matrix: Soil
Analytical Group: Heavy Metals

CPEC	CAS Number	Limit of Sensitivity (LOS)	Result
Aluminum	7429-90-5	12 mg/kg (ppm)	All samples >LOS
Antimony	7440-36-0	0.5 ppm	4 samples >LOS, 36 samples <LOS

Barium	7440-39-3	5 or 10 ppm depending on dilution	All samples >10 ppm LOS
Cadmium	7440-43-9	0.25 ppm	All samples >LOS
Chromium	7440-47-3	0.75 or 1.5 ppm depending on dilution	All samples >LOS
Copper	7440-50-8	5 or 10 ppm depending on dilution	All samples >LOS
Lead	7439-92-1	0.25 ppm	All samples >LOS
Zinc	7440-66-6	1.3 or 2.6 ppm depending on dilution	All samples >LOS

Matrix: Soil
Analytical Group: Semi-Volatiles

CPEC	CAS Number	Limit of Sensitivity	Result
2-Chlorophenol	95-57-8	0.5 ppm	All samples <LOS
Diphenylamine	122-39-4	0.5 ppm	All samples <LOS
Fluoranthene	206-44-0	0.5 ppm	All samples <LOS
Naphthalene	91-20-3	0.5 ppm	All samples <LOS
Phenol	108-95-2	0.5 ppm	All samples <LOS

The furans, explosives and semi-volatiles results were all below the limit of sensitivity of the laboratory analytical equipment. Therefore, additional statistical analysis was not performed on the 13 CPECs belonging to the furans, explosives and semi-volatile compound chemical groups.

Aluminum analysis was conducted on all 36 samples. The average concentration was 23,075 mg/kg, or 23%. Aluminum is the most commonly occurring metal in the Earth's crust, with concentration ranging from 1% to 30%. Although the concentration of aluminum is high relative to other metals, aluminum bearing minerals do not start to dissociate until soil pH lowers to 5.5. As the concentration of soluble aluminum increases, the toxicity also increases. However, in neutral soil pH environments, aluminum bearing minerals are stable and therefore do not pose a toxicity hazard. The average pH of 36 samples obtained in the EWTF and Ambient (background) areas is 7.5. Therefore, in this pH neutral to slightly basic environment, aluminum would not be found in the soluble, toxic state.

In order to evaluate the CPECs, background samples were collected as part of the EWTF soil sampling project. Samples were obtained by using the same methodology as EWTF area samples. The sample plan is described in the *Soil Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Terusaki, October 2007.* Soil sampling implementation information is provided in the **Appendix 2** of this report.

The three background sample areas were designated "Ambient" in the sampling. The three areas were upwind of EWTF by 7,000 to 8,000 feet; therefore, it is unlikely that emissions from EWTF affected the background areas. Locations of the background sample areas, as well as the EWTF area samples, are shown in **Appendix 2, Figures 6-1 and 6-2.**

In addition, a much larger background dataset consisting of samples obtained across the entire site was considered, and ultimately accepted as the dataset for comparison to the EWTF area metal levels. This larger dataset was developed for Comprehensive, Emergency Response and Compensation Liability Act (CERCLA) site-wide clean-up activities. The CERCLA soil samples were obtained from locations across the entire site, as shown in the **Figure 1**. EWTF sample locations are also shown in the same figure. The following table shows the number of samples obtained for each CPEC metal.

Table 3. Number of Samples Obtained for Each CPEC Metal

	Antimony	**Barium**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Zinc**
Number of Samples	9	422	79	403	340	194	324

A comprehensive description of the CERCLA background study is provided in **Appendix 4**, *Site-Wide Feasibility Study for LLNL Site 300, Appendix A, November 1999.* This 1999 background data is still used to evaluate analytical data from construction projects, CERCLA background determinations, and is a key reference document in the EPA, DTSC, and RWQCB-approved *Site-Wide Record of Decision, Lawrence Livermore National Laboratory, Site 300, July 2008*.

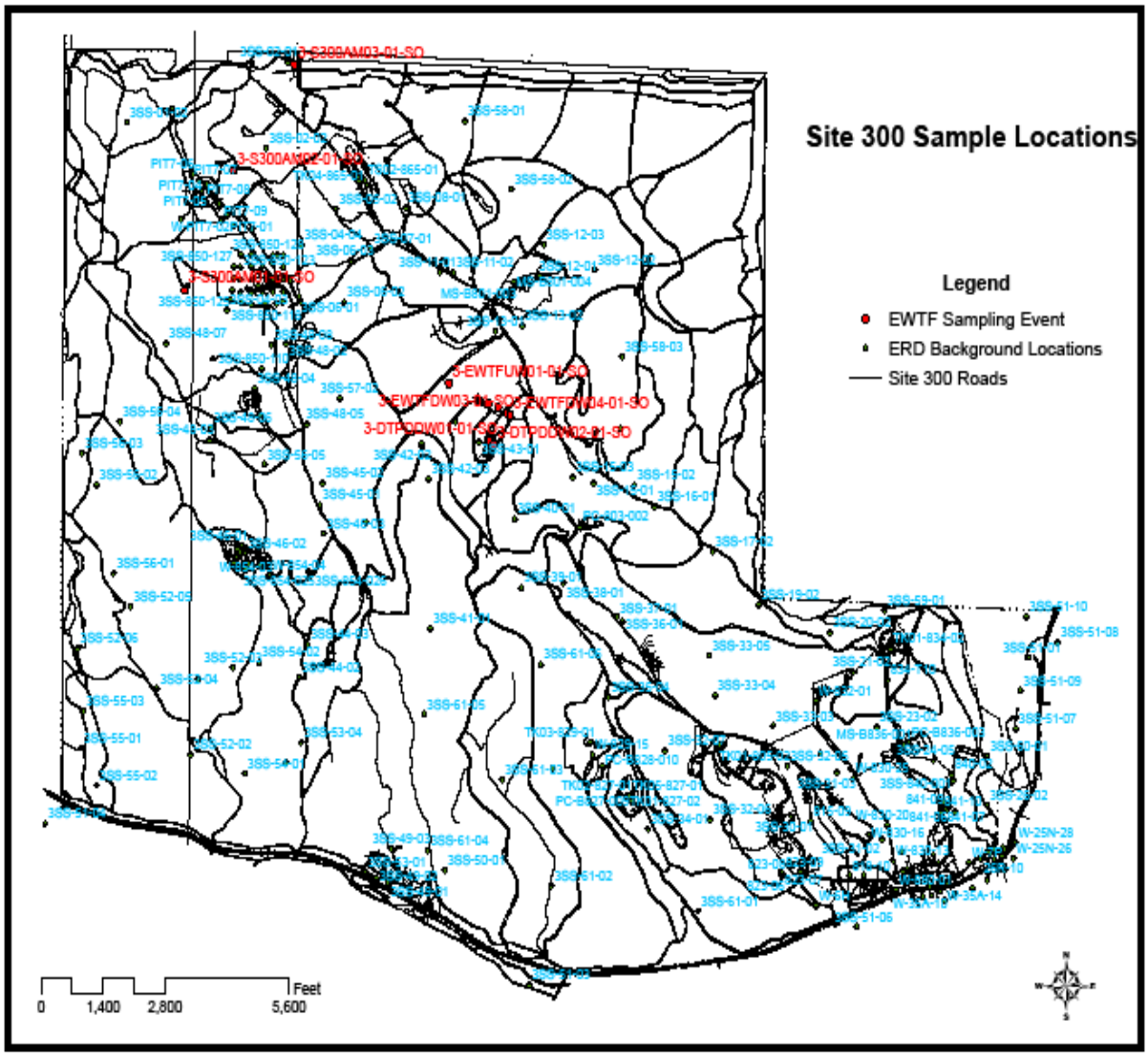

Figure 1. EWTF and CERCLA (ERD) Sample Locations

Soil Sampling - Non-CPEC Summary

Soil particle analysis by ASTM Method D422 was conducted on all soil samples in order to classify the soil texture by standard United States Department of Agriculture (USDA) terminology. The purpose of this test was to ensure consistency of soil sample texture relative to particle size. Soil texture is a qualitative classification tool used in to classify soils based on their physical texture.

Samples obtained in the EWTF area grouped in the middle to bottom middle of the USDA soil texture triangle, **Figure 2**. Samples obtained in the EWTF Ambient (background) areas were more widely distributed. **Table 4** shows the distribution of soil types, location and number of samples in each soil type.

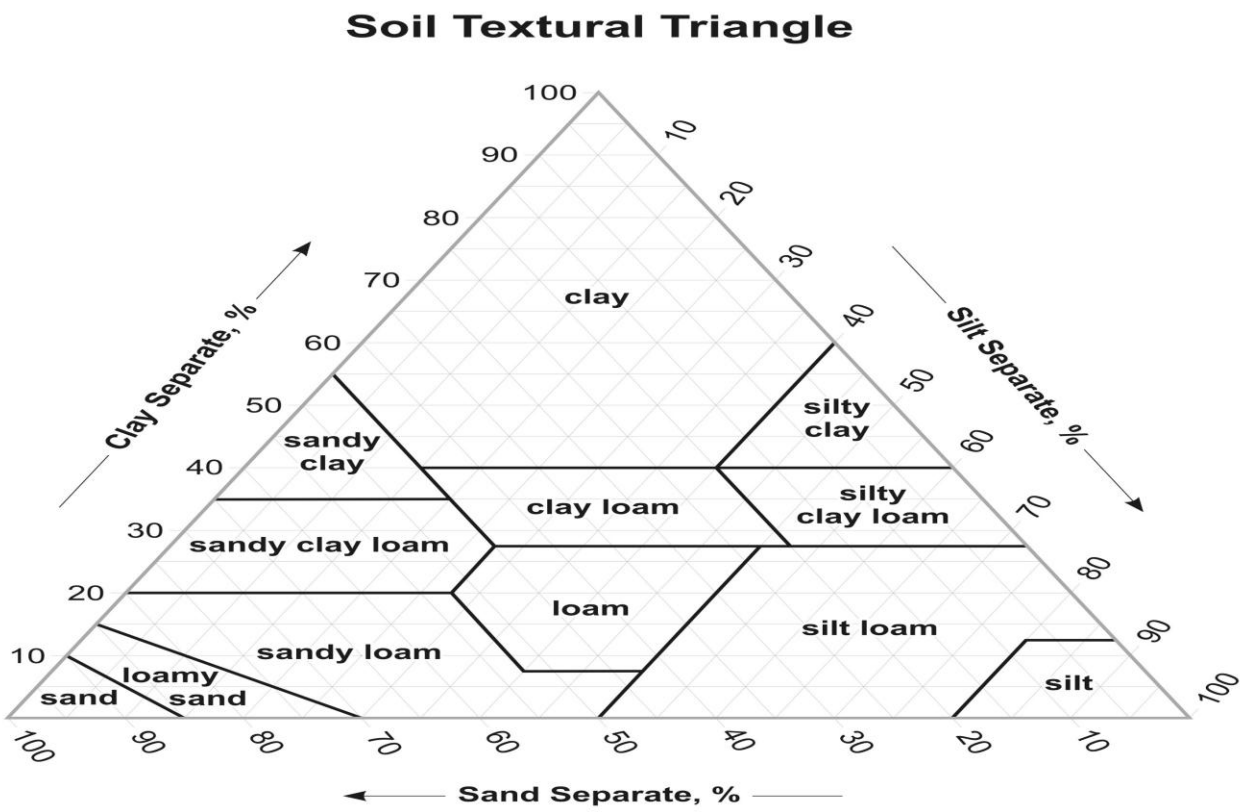

Figure 2. USDA Soil Texture Triangle.

Table 4. EWTF Area and Ambient (Background) Soil Types.

	Loam	Sandy Loam	Silty Clay Loam	Silt Loam	Clay Loam	Silty Clay	Clay	Total Number Samples
EWTF Area	10	1	8	3	6			28
EWTF Ambient (Background)	3	4			1	1	3	12

Total Organic Carbon (TOC) analysis was determined by EPA Method 9060. This test was requested by DTSC in order to identify differences in TOC between the samples. The following table shows the average, maximum, minimum and standard deviation % values for the 28 EWTF area samples and the 12 Ambient (background) area samples. Significant differences are not apparent as shown in **Table 5** below. The TOC analytical data, as well as soil particle size reports and analytical reports for the 21 CPECs is provided in **Appendix 5**.

Table 5. EWTF Area and Ambient (Background) Total Organic Carbon Average, Maximum, Minimum, and Standard Deviation.

	Average %	Maximum %	Minimum %	Standard Deviation %	Total Number Samples
EWTF Area	12.9	17	5.2	2.7	28
EWTF Ambient (Background)	11.3	17	7.6	2.7	12

Statistical Evaluation of Constituents of Potential Ecological Concern

The 95% Upper Confidence Level (95% UCL) was calculated for the seven EWTF area sample locations and the three Ambient (background) locations.

The 95% UCL statistical method was selected as statistical methodology according guidance provided in the *Environmental Protection Agency, Office or Solid Waste and Emergency Response document Calculating Upper Confidence Limits For Exposure Point Concentrations At Hazardous Waste Sites, OSWER 9286.6-10, December 2002*.

The 95% UCL value was calculated for each metal from the seven EWTF areas. Based on the sample strategy, the four EWTF downwind locations, two downwind Detonation Pad locations and the one EWTF upwind location were used for the 95% UCL value. A total of 28 (seven areas with four discrete soil samples per area) sample concentrations were included in the 95% UCL calculation. **Table 6** provides the result for each metal. CERCLA background levels are also included in order to allow direct comparison. All EWTF area levels are below CERCLA background levels.

Table 6. 95% UCL Detonation Pad and Explosives Waste Treatment Facility Levels Compared to CERCLA Background Levels

Sample Location		Sb[1]	Ba[1]	Cd[1]	Cr[1]	Cu[1]	Pb[1]	Zn[1]
Detonation Pad Downwind #01 (DTPD DW01)	Sample #1	1.4	210	1.2	23	45	37	84
	Sample #2	3.2	210	1.4	24	42	37	140
	Sample #3	1.2	230	1.3	25	66	66	150
	Sample #4	2.2	200	1.2	31	89	47	90
Detonation Pad Downwind #02 (DTPD DW02)	Sample #1	0.5	200	1.2	24	24	14	63
	Sample #2	0.5	180	1.2	24	21	12	62
	Sample #3	0.5	180	1.2	23	22	14	59
	Sample #4	0.5	200	1.2	24	22	14	62
Explosives Waste Treatment Facility Downwind #01 (EWTF DW01)	Sample #1	0.5	200	1.1	24	25	11	63
	Sample #2	0.5	220	1.0	23	25	8.6	94
	Sample #3	0.5	160	0.7	20	22	6.3	52
	Sample #4	0.5	190	1.1	26	24	9.8	62
Explosives Waste Treatment Facility Downwind #02 (EWTF DW02)	Sample #1	0.5	200	1.2	26	23	9.9	56
	Sample #2	0.5	180	1.2	26	22	8.2	63
	Sample #3	0.5	180	1.2	31	26	11	62
	Sample #4	0.5	200	1.2	27	23	9.7	58
Explosives Waste Treatment Facility Downwind #03 (EWTF DW03)	Sample #1	0.5	5	0.3	0.8	30	0.3	1.3
	Sample #2	0.5	5	0.3	0.8	29	0.3	1.3
	Sample #3	0.5	5	0.3	0.8	28	0.3	1.3
	Sample #4	0.5	5	0.3	0.8	29	0.3	1.3
Explosives Waste Treatment Facility Downwind #04 (EWTF DW04)	Sample #1	0.5	210	1.7	19	34	14	67
	Sample #2	0.5	170	1.3	16	28	12	54
	Sample #3	0.5	170	1.4	16	28	11	54
	Sample #4	0.5	160	1.2	15	27	11	54
Explosives Waste Treatment Facility Upwind #01 (EWTF UW01)	Sample #1	0.5	190	1.4	35	39	12	79
	Sample #2	0.5	190	1.5	35	37	12	79
	Sample #3	0.5	190	1.5	36	38	12	80
	Sample #4	0.5	190	1.3	36	38	12	79
n		**28**	**28**	**28**	**28**	**28**	**28**	**28**
Mean		**0.7**	**165.4**	**1.1**	**21.9**	**32.4**	**14.7**	**63.3**
Std Dev		**0.6**	**68.6**	**0.4**	**10.4**	**14.7**	**14.7**	**34.6**
UCL 95%[2]		**0.9**	**187.8**	**1.2**	**25.3**	**37.2**	**19.5**	**74.6**
CERCLA Background[3]		**4**	**540**	**1.9**	**122**	**39**	**51**	**110**

[1]Units = mg/kg.

[2]UCL 95 = Mean + (T x StDev)/sqrt (n-1), T=1.701, EPA OSWER 9286.6-10, December 2002.

[3]CERCLA Background from the LLNL Site-Wide Feasibility Study, 1999.

The 95% UCL values were also calculated for the Ambient (background) samples. **Table 7** shows the Ambient (background) levels relative to the CERCLA background levels.

Table 7. 95% UCL Ambient (Background) Levels compared to CERCLA Background Levels

Sample Location		Sb[1]	Ba[1]	Cd[1]	Cr[1]	Cu[1]	Pb[1]	Zn[1]
North Power Station Ambient #01 (AM01)	Sample #1	0.5	180	0.37	30	29	9.6	64
	Sample #2	0.5	160	0.31	27	26	9.4	67
	Sample #3	0.5	160	0.29	27	26	8.7	67
	Sample #4	0.5	150	0.32	26	25	9.3	63
Disposal Site West, Pit 1/7 Area, Ambient #02 (AM02)	Sample #1	0.5	220	1	20	33	9.5	67
	Sample #2	0.5	190	0.63	18	31	9.3	59
	Sample #3	0.5	190	1.1	21	32	9.2	66
	Sample #4	0.5	200	1.1	21	33	9	66
West Observation Post, Ambient #03 (AM03)	Sample #1	0.5	160	1.3	18	21	10	67
	Sample #2	0.5	140	1.3	18	21	9.3	67
	Sample #3	0.5	160	1.3	19	22	9.3	66
	Sample #4	0.5	160	1.3	20	22	9.5	67
n		**12**	**12**	**12**	**12**	**12**	**12**	**12**
Mean		**0.5**	**172.5**	**0.9**	**22.1**	**26.8**	**9.3**	**65.5**
Std Dev		**0.0**	**23.4**	**0.4**	**4.2**	**4.7**	**0.3**	**2.4**
Ambient UCL 95%[2]		**0.5**	**184.5**	**1.1**	**24.3**	**29.2**	**9.5**	**66.7**
CERCLA Background[3]		**4**	**540**	**1.9**	**122**	**39**	**51**	**110**

[1]Units = mg/kg.
[2]Ambient UCL 95 = Mean + (T x StDev)/sqrt (n-1), T=1.701, EPA OSWER 9286.6-10, December 2002.
[3]CERCLA Background from the LLNL Site-Wide Feasibility Study, 1999.

All Ambient (background) 95% UCL levels are below the CERCLA background levels. However, this comparison of Ambient (background) to CERCLA background is of limited value, based on the large difference in dataset size, 256 vs. 12, and the large difference in sample locations. Many more samples would be required over a large area in order to determine if the 95% UCL levels of the Ambient dataset would converge to the CERCLA levels.

According to DTSC guidance provided in the Department of Toxic Substances Control, Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Part A: Overview, July 4, 1996, page 13: "If no organic chemicals of ecological concern are present or concentrations of inorganic elements are at or below 'background' concentrations the site or facility exits the risk assessment process upon preparation and acceptance of a minimal scoping assessment report detailing these findings and conclusions."

Based on the non-detect result of the furans, explosives and semi-volatile analyses, the insoluble chemical form of aluminum due to the neutral pH soil environment, and the below background levels of the remaining metals, the EWTF area meets the requirements to exit the ecological risk assessment process as stated in the 1999 DTSC guidance document.

Information provided in this report must be combined with the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Gallegos, Daniels and Wegrecki, October 2007; Soil*

Sampling Plan in Support of the Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Terusaki, October 2007; and all referenced documents in order to assess the conclusions in this report.

From this soil report and the *Human Health and Ecological Risk Assessment for the Operation of the Explosives Waste Treatment Facility at Site 300 of the Lawrence Livermore National Laboratory, Gallegos, Daniels and Wegrecki, October 2007*, it is reasonable to conclude that there are no ecological impacts from EWTF operations.

Appendix C

California Environmental Protection Agency
Department of Toxic Substances Control

FINAL HAZARDOUS WASTE FACILITY PERMIT

Facility Name: Lawrence Livermore National Laboratory – Site 300 Corral Hollow Road Tracy, California	EPA ID Number: CA2 890 090 002 Effective Date: August 7, 2017 Expiration Date: August 7, 2027
Owner Name: United States Department of Energy National Nuclear Security Administration Livermore Site Office P.O. Box 808, L-293 Livermore, California 94551-0808	
Operator Name: Lawrence Livermore National Security, LLC. P.O. Box 808, L-001 Livermore, California 94550	

Pursuant to California Health and Safety Code section 25200, this Resource Conservation and Recovery Act (RCRA)-equivalent Hazardous Waste Facility Permit is hereby issued to: Lawrence Livermore National Security, LLC/Lawrence Livermore National Laboratory and the United States Department of Energy.

The Issuance of this Permit is subject to the terms and conditions set forth in Attachment A and the Part "B" Application (Operation Plan) dated January 2015. Attachment A consists of 39 pages.

Lori Koch

Lori Koch, P.E.
Supervising Hazardous Substances Engineer I
Office of Permitting

Date: 6/27/2017

Lawrence Livermore National Laboratory - Site 300
Corral Hollow Road
Tracy, California

FINAL HAZARDOUS WASTE FACILITY PERMIT

ATTACHMENT "A"

TABLE OF CONTENTS

PART I. DEFINITIONS

All terms used in this Permit shall have the same meaning as those terms have in the California Health and Safety Code, division 20, chapter 6.5 and California Code of Regulations, title 22, division 4.5, unless expressly provided otherwise by this Permit.

1. **"DTSC"** as used in this Permit means the California Department of Toxic Substances Control.

2. **"Explosives waste"** as used in this permit means reactive hazardous waste as defined in California Code of Regulations, title 22, section 66261.23(a) (6) and (7), including explosives-containing process waste sludge, explosives-contaminated packaging, and explosives-contaminated laboratory waste.

3. **"Facility"** as used in this Permit means all contiguous land and structures, other appurtenances, and improvements on the land used for the treatment, transfer, storage resource recovery, disposal, or recycling of hazardous waste. A hazardous waste facility may consist of one or more treatment, transfer, storage, resource recovery, disposal or recycling operational units or combinations of these units.

   For the purpose of implementing corrective action under California Code of Regulations, title 22, division 4.5, a hazardous waste facility includes all contiguous property under the control of the owner or operator required to implement corrective action.

4. **"Permittee"** as used in this Permit means the Owner and Operator.

5. **"RCRA"** as used in this Permit means the Resource Conservation and Recovery Act (42 U.S.C. §6901 et seq.).

PART II. DESCRIPTION OF THE FACILITY AND OWNERSHIP

1. Owner of Facility:

United States Department of Energy,
National Nuclear Security Administration
Livermore Site Office
P.O. Box 808, L-293
Livermore, California 94551-0808.

2. Owner of Real Property:

United States Department of Energy,
National Nuclear Security Administration
Livermore Site Office
P.O. Box 808, L-293
Livermore, California 94551-0808.

3. Operator of Facility:

Lawrence Livermore National Security, LLC,
Lawrence Livermore National Laboratory (LLNL) and the
United States Department of Energy,
National Nuclear Security Administration
Livermore Site Office
P.O. Box 808, L-293
Livermore, California 94551-0808.

4. Location:

The Facility (Site 300) is located 15 miles southeast of the Lawrence Livermore National Laboratory (LLNL) Main Site in Livermore and two miles northeast of the City of Tracy, California (Figure 1) at Latitude: 37° 39' 30", Longitude 121° 32' 30". The Facility comprises approximately 6,800 acres. About one-sixth of the Facility lies in Alameda County; the remainder, including all units covered by this Permit is located in San Joaquin County. The nearest urban area is the City of Tracy, California. The Facility is located outside the Tracy city limits.

The legal description can be found in page II-4 of the operations plan.

5. Description of Facility Operations:

The Facility is primarily an explosives test facility that supports the LLNL weapons program in research, development, and testing associated with non-nuclear weapons components. The Facility's operations include chemical formulation of explosives, machining explosive charges, and assembling machined charges before they are sent to the on-site test firing facilities.

Hazardous waste generated from these activities is sent to the on-site waste management facilities for treatment, packaging, or storage, and eventual shipment to an off-site disposal facility. In addition to accepting on-site generated hazardous waste, the Facility also accepts explosives waste from the LLNL Main Site (EPA Identification Number CA2890012584) for storage and treatment.

6. Facility History:

The Facility was established by the Department of Energy and the University of California in 1955 as an experimental test site for explosives testing. Prior to 1992, the Facility operated the B829 High Explosives Burn Pits (B829) and B883 Container Storage Area (B883) under Interim Status granted by the United States Environmental Protection Agency (US EPA). In 1993, DTSC issued an order requiring the closure of B829 and the submittal of a Part B Permit Application for the Explosives Waste Treatment Facility (EWTF). DTSC issued a Hazardous Waste Facility Permit (Permit) for the operation of the Explosives Waste Storage Facility (EWSF) and B883 in 1996 (1996 EWSF Permit). In 1997, DTSC issued a second Permit for the operation of the EWTF (1997 EWTF Permit). In 2005, the Facility submitted a consolidated permit renewal application for B883, EWSF and EWTF.

7. Facility Size and Type for Fee Purposes:

The Facility is categorized as a small treatment facility and a small storage facility pursuant to Health and Safety Code section 25205.1 and for purposes of Health and Safety Code sections 25205.2 and 25205.19.

8. Closure Cost Estimate:

LLNL – Site 300 is owned by the United States Department of Energy and is exempt from the requirements to provide a closure cost estimate and financial assurance mechanisms for closure in accordance with California Code of Regulations, title 22, section 66264.140(c).

PART III. GENERAL CONDITIONS

1. PERMIT APPLICATION DOCUMENTS

The Part "A" Application dated January 2015 and the Part "B" Application dated January 2015 (Operation Plan), including, but not limited to all attachments and exhibits therein, are hereby made a part of this Permit by reference.

2. EFFECT OF PERMIT

(a) The Permittee shall comply with the terms and conditions of this Permit and the provisions of the Health and Safety Code and California Code of Regulations (Cal. Code Regs.), title 22, division 4.5. The issuance of this Permit by DTSC does not release the Permittee from any liability or duty imposed by federal or state statutes or regulations or local ordinances, except the obligation to obtain this Permit. The Permittee shall obtain the permits required by other governmental agencies, including but not limited to, those required by the applicable land use planning, zoning, hazardous waste, air quality, water quality, and solid waste management laws for the construction and/or operation of the Facility.

(b) The Permittee is permitted to treat and store hazardous wastes in accordance with the terms and conditions of this Permit. Any management of hazardous wastes not specifically authorized in this Permit is strictly prohibited.

(c) Compliance with the terms and conditions of this Permit does not constitute a defense to any action brought under any other law governing protection of public health or the environment, including, but not limited to, one brought for any imminent and substantial endangerment to human health or the environment.

(d) DTSC's issuance of this Permit does not prevent DTSC from adopting or amending regulations that impose additional or more stringent requirements than those in existence at the time this Permit is issued and does not prevent the enforcement of these requirements against the Permittee.

(e) Failure to comply with any term or condition set forth in the Permit in the time or manner specified herein will subject the Permittee to possible enforcement action including but not limited to penalties pursuant to Health and Safety Code section 25187.

(f) Failure to submit any information required in connection with the Permit, or falsification and/or misrepresentation of any submitted information, is grounds for revocation of this Permit (Cal. Code Regs., tit. 22, §66270.43).

(g) In case of conflicts between the Operation Plan and the Permit, the Permit conditions take precedence.

(h) This Permit includes and incorporates by reference any conditions of waste discharge requirements issued to the Facility by the State Water Resources Control Board or any of the California Regional Water Quality Control Boards and any conditions imposed pursuant to section 13227 of the Water Code.

3. COMPLIANCE WITH CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

In accordance with the requirements of Public Resources Code section 21000 et seq. and the CEQA Guidelines sections 15162, 15163, and 15164, DTSC determined that Negative Declarations that it prepared as lead agency for issuance of the 1996 EWSF Permit and the 1997 EWTF Permit provided an accurate description of proposed project activities, and that the conditions requiring preparation of a subsequent environmental impact report are not present. To document its determination, DTSC prepared an Addendum to the previous Negative Declarations.

4. ENVIRONMENTAL MONITORING

The Permittee shall comply with the applicable environmental monitoring and response program requirements of California Code of Regulations, title 22, division 4.5, chapter 14, articles 6 and 17.

5. ANNUAL HAZARDOUS WASTE REDUCTION AND MINIMIZATION CERTIFICATION

The Permittee shall certify annually that it has a hazardous waste reduction and minimization program and method in place and shall keep the annual certification as part of its Operating Record in accordance with California Code of Regulations, title 22, section 66264.73(b)(9).

6. ACCESS

(a) DTSC, its contractors, employees, agents, and/or any United States Environmental Protection Agency representatives are authorized to enter and freely move about the Facility for the purposes of interviewing Facility personnel and contractors; inspecting records, operating logs, and contracts relating to the Facility; reviewing progress of the Permittee in carrying out the terms of Part VI of the Permit; conducting such testing, sampling, or monitoring as DTSC deems necessary; using a camera, sound recording, or other documentary-type equipment; verifying the reports and data submitted to DTSC by the Permittee; or confirming any

other aspect of compliance with this Permit, Health and Safety Code, division 20, chapter 6.5, and California Code of Regulations, title 22, division 4.5. The Permittee shall provide DTSC and its representatives access at all reasonable times to the Facility and any other property to which access is required for implementation of any provision of this Permit, Health and Safety Code, division 20, chapter 6.5, and California Code of Regulations, title 22, division 4.5, and shall allow such persons to inspect and copy all records, files, photographs, documents, including all sampling and monitoring data, that pertain to work undertaken pursuant the entire Permit or undertake any other activity necessary to determine compliance with applicable requirements.

(b) Nothing in this Permit shall limit or otherwise affect DTSC's right to access and entry pursuant to any applicable State or federal laws and regulations.

PART IV. PERMITTED UNITS AND ACTIVITIES

This Permit authorizes operation only of the facility units and activities listed below. The Permittee shall not treat, store or otherwise manage hazardous waste in any unit other than those specified in this Part IV. Any modifications to a unit or activity authorized by this Permit require the written approval of DTSC in accordance with the permit modification procedures set forth in California Code of Regulations, title 22, division 4.5.

UNIT #1

UNIT NAME:

Open Burn Cage

LOCATION:

The Open Burn Cage is located within the Explosives Waste Treatment Facility in the southern portion of the Facility (Figures 2 and 3).

ACTIVITY TYPE:

Open burning of explosives waste in Miscellaneous Unit (X01)

ACTIVITY DESCRIPTION:

Explosives-contaminated debris (e.g., explosives-containing process waste sludge, explosives-contaminated packaging, and explosives-contaminated laboratory waste including personal protective equipment) are placed inside the Open Burn Cage. When ready for treatment, the unit operator closes the access door in order to secure the waste inside the cage, and then starts the burning process by igniting the propane burners from a remote location (Building 845A). Upon completion of the treatment and after 24 hours of cooling time, the treatment residue (ash) is collected and removed for storage prior to disposal at an authorized off-site Treatment Storage and Disposal Facility (TSDF). If any explosives residual is left, a re-burn will be done before any collection of treatment residue.

PHYSICAL DESCRIPTION:

This unit consists of a ventilated metal enclosure that is eight feet in diameter and eight feet high, with a refractory liner. This unit is installed on an elevated metal base on a concrete pad. Propane fuel from a protected supply tank is piped to the unit and is used to aid in the combustion process.

MAXIMUM CAPACITY:

The maximum permitted treatment capacity for this unit is 260 pounds (118 kilogram (kg)) of total waste or 50 pounds (23 kg) of net explosive waste per day/event.

WASTE SOURCES:

Explosives waste from waste generator areas at the Facility and from the LLNL Main Site.

WASTE TYPES:

Explosives Waste identified as Form 3 and Form 4 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, F002, F003, F005, K044, K045, K046, K047

CALIFORNIA HAZARDOUS WASTE CODES:

352, 491

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store hazardous waste in this Unit.

2. The Permittee shall not conduct more than 100 open burn events in this Unit per calendar year.

3. Open burning in this Unit shall be conducted in accordance with all the requirements of the San Joaquin Valley Air Pollution Control District.

4. Open burning in this Unit shall not commence before sunrise or after sunset.

5. The Permittee shall wait at least 24-hours following a burn event to remove the treatment residue from this Unit.

UNIT #2

UNIT NAME:

Open Burn Pan

LOCATION:

The Open Burn Pan is located within the Explosives Waste Treatment Facility adjacent to the Open Burn Cage in the southern portion of the Facility (Figures 2 and 3).

ACTIVITY TYPE:

Open burning of explosives waste in Miscellaneous Unit (X01)

ACTIVITY DESCRIPTION:

Pieces, powders, pastes, absorbed liquids, and small assemblies of explosives waste derived from pure materials or formulated products (generally containing 80 to 100% explosive material) that will not detonate during the open burning in the Open Burn Cage are placed on the pan on a layer of straw or paper to facilitate burning of the waste. Combustible material (e.g., Kerosene) may be used to facilitate the ignition and burning of the explosives waste. When ready for treatment, the unit operator starts the burning process by remotely igniting the waste from Building 845A. The pan cover is then placed over the burn pan after the treatment has been completed. Upon completion of the treatment and after 24 hours of cooling time, the treatment residue is collected and removed for storage prior to disposal at an authorized off-site TSDF. If any explosives residue is left, a re-burn will be completed before any residue is collected. In addition to treatment of explosives waste, an area between the Open Burn Pan and Open Burn Cage has been set up for decontaminating process equipment that may contain some explosives residue. The area is equipped with a steel plate foundation upon which process equipment is placed. The decontamination is accomplished by flashing the equipment with a torch.

PHYSICAL DESCRIPTION:

This unit consists of a rectangular welded steel, water tight metal burn pan measuring four feet by eight feet and six inches deep, mounted on steel legs. The pan is equipped with a remotely controlled steel cover.

MAXIMUM CAPACITY:

The maximum permitted treatment capacity for this unit is 100 pounds (45 kg) of explosives waste per day/event.

WASTE SOURCES:

Explosives waste from waste generator areas at the Facility and from the LLNL Main Site.

WASTE TYPES:

Explosives Waste identified as Form 2 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, P081, P112, U117, U234

CALIFORNIA HAZARDOUS WASTE CODES:

331, 352, 551

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store hazardous waste in this Unit.

2. The Permittee shall not conduct more than 100 open burn events in this Unit per calendar year.

3. Open burning in this Unit shall be conducted in accordance with all the requirements of the San Joaquin Valley Air Pollution Control District.

4. Open burning in this Unit shall not commence before sunrise or after sunset.

5. The Permittee shall wait at least 24 hours following a burn event to remove the treatment residue from this Unit.

UNIT #3

UNIT NAME:

Open Detonation Unit

LOCATION:

The Open Detonation Unit is located within the Explosives Waste Treatment Facility in the southern portion of the Facility (Figures 2 and 3).

ACTIVITY TYPE:

Open detonation of explosives waste in Miscellaneous Unit (X01)

ACTIVITY DESCRIPTION:

This unit is used for treatment of explosives waste that generally contains 90 to 100% explosive material which cannot be safely treated by open burning. Small amounts of explosives waste are staged on the Open Detonation Unit, and then remotely detonated from Building 845A bunker, using detonators or other initiating devices.

PHYSICAL DESCRIPTION:

This unit consists of a level gravel pad, measuring 30 feet by 30 feet by eight feet deep.

MAXIMUM CAPACITY:

The maximum permitted treatment capacity is 100 pounds of explosives waste per day/event and 1000 pounds of explosives waste per year.

WASTE SOURCES:

Explosives waste from waste generator areas at the Facility and the LLNL Main Site.

WASTE TYPES:

Explosives Waste identified as Form 1 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, P081, P112, U117

CALIFORNIA HAZARDOUS WASTE CODES:

331, 352

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store hazardous waste in this Unit.

2. The Permittee shall not detonate more than 100 pounds of explosives waste per day/event and 1000 pounds of explosives waste per year.

3. Open detonation in this Unit shall be conducted in accordance with all the requirements of the San Joaquin Valley Air Pollution Control District.

4. Open detonation in this Unit shall not commence before sunrise or after sunset.

5. The Permittee shall wait at least 24-hours following a detonation event to remove the treatment residue from this Unit.

UNIT #4

UNIT NAME:

Explosives Waste Treatment Residue Storage Unit 1 – near Open Burn.

LOCATION:

This unit is located adjacent to the Open Burn Cage and Open Burn Pan in the southern portion of the Facility (Figures 2 and 3).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

This Unit is used for storage of treatment residue from the Open Burn Cage and Open Burn Pan.

PHYSICAL DESCRIPTION:

This Unit is a prefabricated metal chemical storage cabinet with integrated secondary

containment.

MAXIMUM CAPACITY:

The maximum permitted storage capacity is 275 gallons.

WASTE SOURCES:

Treatment residue from the Open Burn Cage and Open Burn Pan.

WASTE TYPES:

Residue ash from treated explosives waste identified as Form 2, Form 3 and Form 4 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, P081, P112, U117, U234

CALIFORNIA HAZARDOUS WASTE CODES:

571

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. This Unit shall be kept closed and locked except when in use.

2. The Permittee shall maintain a hazardous waste sign on the front of this Unit. The sign shall have the emergency contact name and phone number on it and shall be visible from a distance of at least 10 feet.

3. The Permittee shall not store any containers larger than 55 gallons in this Unit.

4. This Unit shall only store treatment residue generated from the Open Burn Cage (Unit #1) and Open Burn Pan (Unit #2).

UNIT #5

UNIT NAME:

Explosives Waste Treatment Residue Storage Unit 2 – near Open Detonation.

LOCATION:

This Unit is located adjacent to the Open Detonation Unit in the southern portion of the Facility (Figures 2 and 3).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

This Unit is used for storage treatment residue from the Open Detonation Unit.

PHYSICAL DESCRIPTION:

This Unit is a prefabricated plastic cabinet with integrated secondary containment.

MAXIMUM CAPACITY:

The maximum permitted storage capacity is 110 gallons.

WASTE SOURCES:

Treatment residue from the Open Detonation Unit.

WASTE TYPES:

Residue ash from treated explosives waste identified as Form 1 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, P081, P112, U117, U234

CALIFORNIA HAZARDOUS WASTE CODES:

571

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. This Unit shall be kept closed and locked except when in use.

2. The Permittee shall maintain a hazardous waste sign on the front of this Unit. The sign shall have the emergency contact name and phone number on it and shall be visible from a distance of at least 10 feet.

3. The Permittee shall not store any containers larger than 55 gallons in this Unit.

4. This Unit shall only store treatment residue generated from the Open Detonation Unit (Unit #3).

UNIT #6

UNIT NAME:

Magazine 2 (M2)

LOCATION:

This Unit is located within the Explosives Waste Storage Facility (EWSF) in the southern portion of the Facility (Figures 2 and 4).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

Storage of explosives waste such as damp fines from machining and processing operations, wet filters, cased explosives, fabricated parts, pastes, powders, explosive liquids and explosive liquids absorbed onto sawdust. The explosives waste is contained in plastic bags and stored in rigid plastic containers, tubs, or United States Department of Transportation (US DOT)-compliant packaging.

PHYSICAL DESCRIPTION:

Magazine 2 is a semi-cylindrical, corrugated metal structure overlain with two feet and six inches of earth. The floor is one foot and 10 inch thick reinforced concrete and is covered with a non-conducting, non-sparking membrane. The inside floor measures 21 feet and 10 inches by 15 feet and five inches. The ceilings at the highest point measures nine feet and two inches. The storage area has a vault door constructed of two ¼ inch steel plates with four inches of fiberglass insulation between them. Inside, the magazine has two rows of steel frame plywood shelving. This magazine also has a row of freestanding plywood shelves in the center of the room. Wastes are stored on the shelves or elevated on pallets or skids. There are no floor drains.

MAXIMUM CAPACITY:

The maximum permitted storage capacity is 3209 pounds.

WASTE SOURCES:

Explosives waste from waste generator areas at the Facility and from the LLNL Main Site.

WASTE TYPES:

Explosives waste identified as Form 1, Form 2 and Form 3 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, K044, K045, K046, K047, P081, P112, U117, U234

CALIFORNIA HAZARDOUS WASTE CODES:

331, 352, 491, 551

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store any containers larger than 55 gallons in this Unit.

2. At all times, the Permittee shall display the total weight currently stored within the Unit on the outer side of the Unit's door.

UNIT #7

UNIT NAME:

Magazine 3 (M3)

LOCATION:

This Unit is located within the Explosives Waste Storage Facility in the southern portion of the Facility (Figures 2 and 4).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

Storage of explosives waste such as damp fines from machining and processing operations, wet filters, cased explosives, fabricated parts, pastes, powders, explosive liquids and explosive liquids absorbed onto sawdust. The explosives waste is contained in plastic bags and stored in rigid plastic containers, tubs, or US DOT-compliant packaging.

PHYSICAL DESCRIPTION:

Magazine 3 is a rectangular steel reinforced concrete building. The floor is 10 inch thick reinforced concrete covered with a non-conducting, non-sparking membrane. The inside floors measure 12 feet and 4 inches by 11 feet and 2 inches. The inside ceiling measures nine feet and nine inches above the floor. The front wall is constructed of one foot thick reinforced concrete. The remaining reinforced concrete walls and roof are 10 inch thick and are covered with three feet of earth. The door is constructed of two ¼ inch steel plates with four inches of fiberglass insulation between them. Two screened metal louvers in front and a 12-inch pipe at the rear provide ventilation for the magazine. Inside, the magazine has two rows of steel frame plywood shelving. Wastes are stored on the shelves or elevated on pallets or skids. This unit has no floor drain.

MAXIMUM CAPACITY:

The maximum permitted storage capacity is 5592 pounds.

WASTE SOURCES:

Explosives waste from waste generator areas at the Facility and from the LLNL Main Site.

WASTE TYPES:

Explosive Waste identified as Form 1, Form 2 and Form 3 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, K044, K045, K046, K047, P081, P112, U117, U234

CALIFORNIA HAZARDOUS WASTE CODES:

331, 352, 491, 551

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store any containers larger than 55 gallons in this Unit.

2. At all times, the Permittee shall display the total weight currently stored within the Unit on the outer side of the Unit's door

Unit #8

UNIT NAME:

Magazine 4 (M4)

LOCATION:

This Unit is located within the Explosives Waste Storage Facility in the southern portion of the Facility (Figures 2 and 4).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

Storage of explosives waste such as damp fines from machining and processing operations, wet filters, cased explosives, fabricated parts, pastes, powders, explosive liquids and explosive liquids absorbed onto sawdust. The explosives waste is contained in plastic bags and stored in rigid plastic containers and tubs or in US DOT-compliant packaging.

PHYSICAL DESCRIPTION:

Magazine 4 is a rectangular steel reinforced concrete building. The floor is 10" thick reinforced concrete covered with a non-conducting, non-sparking membrane. The inside floor measures 12 feet and 4 inches by 11 feet and 2 inches. The inside ceiling measures nine feet and nine inches above the floor. The front wall is constructed of one foot thick reinforced concrete. The remaining reinforced concrete walls and roof are 10 inch thick and are covered with three feet of earth. The door is constructed of two ¼ inch steel plates with four inches of fiberglass insulation between them. Two screened metal louvers in front and a 12-inch pipe at the rear provide ventilation for the magazine. Inside, the magazines have two rows of steel frame plywood shelving. Wastes are stored on the shelves or elevated on pallets or skids. This unit has no floor drain.

MAXIMUM CAPACITY:

The maximum permitted storage capacity for this unit is 4291 pounds.

WASTE SOURCES:

Explosives waste from waste generator areas at the Facility and from the LLNL Main Site.

WASTE TYPES:

Explosives Waste identified in Form 1, Form 2 and Form 3 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, K044, K045, K046, K047, P081, P112, U117, U234

CALIFORNIA HAZARDOUS WASTE CODES:

331, 352, 491, 551

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store any containers larger than 55 gallons in this Unit.

2. At all times, the Permittee shall display the total weight currently stored within the Unit on the outer side of the Unit's door.

Unit #9

UNIT NAME:

Magazine 5 (M5)

LOCATION:

This unit is located within the Explosives Waste Storage Facility in the southern portion of the Facility (Figures 2 and 4).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

Storage of explosives waste such as damp fines from machining and processing operations, wet filters, cased explosives, fabricated parts, pastes, powders, explosive liquids and explosive liquids absorbed onto sawdust. The explosives waste is contained in plastic bags and stored in rigid plastic containers and tubs or in US DOT-compliant packaging.

PHYSICAL DESCRIPTION:

Magazine 5 is a semi-cylindrical, corrugated metal structure overlain with two feet and six inches of earth. The floor is one foot and 10 inch thick reinforced concrete and is covered with a non-conducting, non-sparking membrane. The floor measures 15 feet by 10 feet. The

ceiling measures seven feet and eight inches at the highest point. The storage area has vault doors constructed of two ¼ inch steel plates with four inches of fiberglass insulation between them. Inside, the magazine has two rows of steel frame plywood shelving. Wastes are stored on the shelves or elevated on pallets or skids. There are no floor drains.

MAXIMUM CAPACITY:

The maximum permitted storage capacity for this unit is 2744 pounds.

WASTE SOURCES:

Explosives waste from waste generator areas at the Facility and from the LLNL Main Site.

WASTE TYPES:

Explosives waste identified as Form 1, Form 2 and Form 3 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, K044, K045, K046, K047, P081, P112, U117, U234

CALIFORNIA HAZARDOUS WASTE CODES:

331, 352, 491, 551

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store any containers larger than 55 gallons in this Unit.

2. At all times, the Permittee shall display the total weight currently stored within the Unit on the outer side of the Unit's door.

UNIT #10

UNIT NAME:

Magazine 816 (M816)

LOCATION:

This Unit is located with the Explosives Waste Storage Facility in the southern portion of the Facility (Figures 2 and 4).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

Storage of explosives-contaminated paper, wipes, filters, plastic, rubber, wood, cotton, tubing, personal protective equipment, wet wipes and laboratory trash. The explosives waste is contained in plastic bags and stored in 55-gallon drums.

PHYSICAL DESCRIPTION:

Magazine 816 is a prefabricated metal building measuring 27 feet by 38 feet. The floor is six inches of reinforced concrete with spread type footings around the perimeter. The ceiling ranges from seven feet to 12 feet. Two roof vents provide ventilation. Containers are elevated on pallets or skids to prevent contact with potential surface liquids. This unit has no floor drain.

MAXIMUM CAPACITY:

The maximum permitted storage capacity for this unit is 9240 gallons.

WASTE SOURCES:

Explosives waste from waste generator areas at this Facility and the LLNL Main Site.

WASTE TYPES:

Explosives waste identified as Form 4 in Table 1 of this Permit.

RCRA HAZARDOUS WASTE CODES:

D003, F002, F003, F005

CALIFORNIA HAZARDOUS WASTE CODES:

352

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store any containers larger than 55 gallons in this Unit.

2. The Permittee shall not store liquid wastes in this Unit.

UNIT #11

UNIT NAME:

Building 883 (B883) Container Storage Area (CSA).

LOCATION:

The Unit is located on the southeast corner of the Facility (Figures 2 and 5).

ACTIVITY TYPE:

Storage in containers

ACTIVITY DESCRIPTION:

This Unit is used for storage of hazardous waste. Ignitable waste is stored in the designated chemical storage locker.

PHYSICAL DESCRIPTION:

This Unit consists of a concrete pad surrounded by a slat fence and covered by a galvanized tin roof. The floor measures 48 feet 11 inches by 33 feet 11 inches. The floor consists of two 6-inch thick slabs. The base slab is continuously poured. The top slab is poured in sections with a polyvinyl water stop between the sections. The concrete pad is covered with an impermeable coating. A curb with a minimum height of 5.75 inches surrounds the pad to form secondary containment. The floor is sloped towards a sump that measures 25.75 inches by 36 inches by 10 inches deep, and is located in the southwest corner of the storage area.

MAXIMUM CAPACITY:

The maximum permitted storage capacity for this Unit is 5500 gallons, inclusive of the maximum capacity for the chemical storage locker. The maximum capacity of the chemical storage locker is 330 gallons.

WASTE SOURCES:

Hazardous waste from waste generator areas at this Facility

WASTE TYPES:

See Table 4

RCRA HAZARDOUS WASTE CODES:

See Table 5

CALIFORNIA HAZARDOUS WASTE CODES:

See Table 6

AIR EMISSION STANDARDS

This Unit is subject to the applicable requirements of California Code of Regulations, title 22, division 4.5, chapter 14, article 28.5.

UNIT-SPECIFIC SPECIAL CONDITIONS:

1. The Permittee shall not store any containers larger than 1110 gallons in this Unit.

2. The Permittee shall not stack 55-gallon or larger containers more than two containers high.

3. The Permittee shall segregate and store incompatible hazardous wastes in separate secondary containment systems.

4. The Permittee shall not store any explosives waste in this Unit.

PART V. SPECIAL CONDITIONS

1. The Permittee shall not store, treat or manage radioactive wastes or hazardous wastes containing radioactive waste or constituents (mixed waste).

2. The Permittee shall not receive any hazardous waste from off-site facilities or locations, with the exception noted in Special Condition 3 below.

3. The Permittee may receive only explosives waste from LLNL Main Site (EPA ID No. CA2890012584) for the purpose of storage and treatment as authorized by this Permit and only in an amount not to exceed 22 pounds (10 kg) per shipment by ground transportation.

4. The Permittee is prohibited from conducting any hazardous waste transfer, storage, treatment or other management activity unless it is specifically described in this Permit or otherwise authorized by DTSC.

5. The Permittee shall label all hazardous waste containers in accordance with California Code of Regulations, title 22, section 66262.34(f). The label shall clearly indicate the name and address of the waste generator, including the LLNL Main Site as applicable.

6. The Permittee shall clearly mark containers of explosives waste with the compatibility group designation letter as specified in Table 2 of this Permit and shall keep the containers segregated and stored in accordance with Table 3 of this Permit.

7. The Permittee shall keep Group L waste comprising of ammunition waste as described in Table 2 of this Permit segregated and stored separately from other explosives wastes.

8. The Permittee shall maintain a minimum of 30 inches of aisle space between rows of containers at all times.

9. The Permittee shall not stack any containers holding explosives waste on top of any other container.

10. In the event any cracks, gaps or tears are detected in any hazardous waste management unit, the Permittee shall initiate repair as soon as possible and complete repair within one week of discovery of the problem. The Permittee shall notify DTSC within 24 hours whenever a containment crack, gap or tear is found. Within seven days of discovery of the problem, the Permittee shall notify DTSC in writing of corrective measures that have been taken.

11. Containers holding hazardous wastes shall be stored only in the authorized areas designated in Part IV of this Permit. Any non-hazardous waste that is stored in a designated hazardous waste storage area as provided by this Permit shall be subject to the conditions of this Permit, including volume calculations, compatibility and inspections.

12. For the purpose of calculating the permitted maximum capacity limitations for storage and for secondary containment, all containers in the authorized units are assumed to be full, and all hazardous waste that is stored or located in an authorized unit shall be included in the calculation for that unit.

13. Only employees of the Permittee who are fully trained in the Facility's operations and procedures are allowed to handle the treatment, transfer, and storage operations at the Facility.

14. Within three (3) years from the effective date of this Permit, the Permittee shall submit for approval, a Soil Sampling Plan (Soil Sampling Plan) to implement the recommendations of the September 2012 Soil Sample Report (LLNL-TR-588454). The Soil Sampling Plan shall include at a minimum:

    a. The laboratory Method Detection Limit and Reporting Limit for each chemical listed in Table 1 of the Soil Sample Report, LLNL-TR-588454;

    b. A plan to sample metals, furans, explosives, perchlorate and semi-volatile compounds from one location closest to Units #1 and #2 (Burn Units) and #3 (Open Detonation Unit);

    c. A plan to sample metals from each downwind sampling location using the same methodology employed during the 2009 sampling effort, as described in the Soil Sampling Plan, October 2007, LLNL-TR-400074 (2007 Soil Sampling Plan);

    d. A plan to sample two additional locations (one to the northeast and the other to the southwest) in addition to pre-existing sampling locations designated as EWTF Downwind #1, #2, #3 and #4 as specified in LLNL-TR-588454 Soil Sample Report. The two additional locations shall be located at the same distance from the Burn Units (Units #1 and #2) as the EWTF Downwind #1 sample location and sampled for metals only.

    e. A plan to sample two additional locations (one to the northwest and one to the southeast) in addition to pre-existing sample locations designated as Detonation Pad Downwind #1 and #2 as specified in LLNL-TR-588454 Soil Sample Report. The two additional locations shall be located at the same distance from the Open Detonation Unit (Unit #3) as the Detonation Pad Downwind #1 sample location and sampled for metals only.

    f. A plan to sample for perchlorate at all locations.

15. The Permittee shall fully implement the approved Soil Sampling Plan no later than one (1) year after receiving approval from DTSC.

16. The Permittee shall submit to DTSC, no later than eight (8) months after full implementation of the approved Soil Sampling Plan, a summary report of the soil sampling effort. At a minimum, the report shall include:

    a. Executive summary, including objectives and conclusions;

b. Supporting laboratory report of analytical data;

c. Discussion of any changes in soil chemical concentrations relative to the September 2012 Soil Sample Report (LLNL-TR-588454);

d. Statistical analysis by mean, standard deviation and UCL 95% methods (applied the same as the 2012 Soil Sample Report, LLNL-TR-588454);

e. Identification and analysis of any individual result whose variability is greater than 20% of the mean value for each constituent; and

f. Comparison of results to the CERCLA Site 300 background levels identified in the 2012 Soil Sample Report, LLNL-TR-588454.

PART VI - CORRECTIVE ACTION

On June 29, 1992, the United States Department of Energy (DOE), Lawrence Livermore National Laboratory signed a Federal Facility Agreement under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 120 with the United States Environmental Protection Agency, the California Department of Toxic Substances Control, and the California Regional Water Quality Control Board. Section VII of this agreement, "Statutory Compliance/RCRA-CERCLA Integration," states that the parties intend to integrate DOE's CERCLA response obligations and RCRA corrective action obligations which relate to the releases of hazardous substances, hazardous wastes, pollutants, or contaminants. The parties intend that remedial action selected, implemented, and completed under this Agreement shall be deemed by the parties to be protective of human health and the environment such that remediation of releases covered by this Agreement shall obviate the need for further corrective action under RCRA with respect to those releases. The parties agree that with respect to releases of hazardous waste covered by this Agreement, RCRA shall be considered an applicable or relevant and appropriate requirement pursuant to CERCLA. Therefore, based on the terms of the Federal Facility Agreement, corrective action at Site 300 is currently being addressed by DTSC's Northern California Site Mitigation Branch.

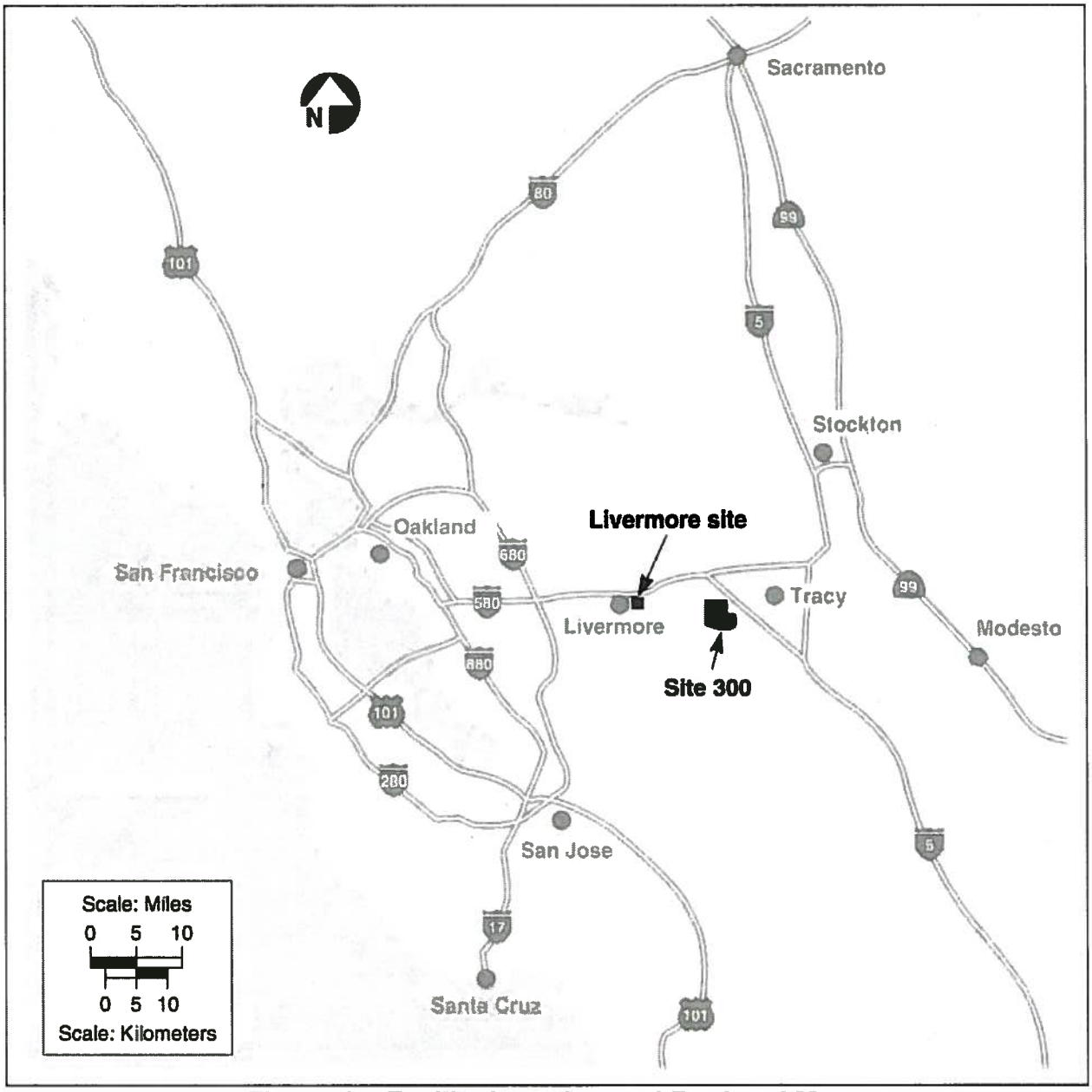

Figure 1 – Facility Location and Regional Map

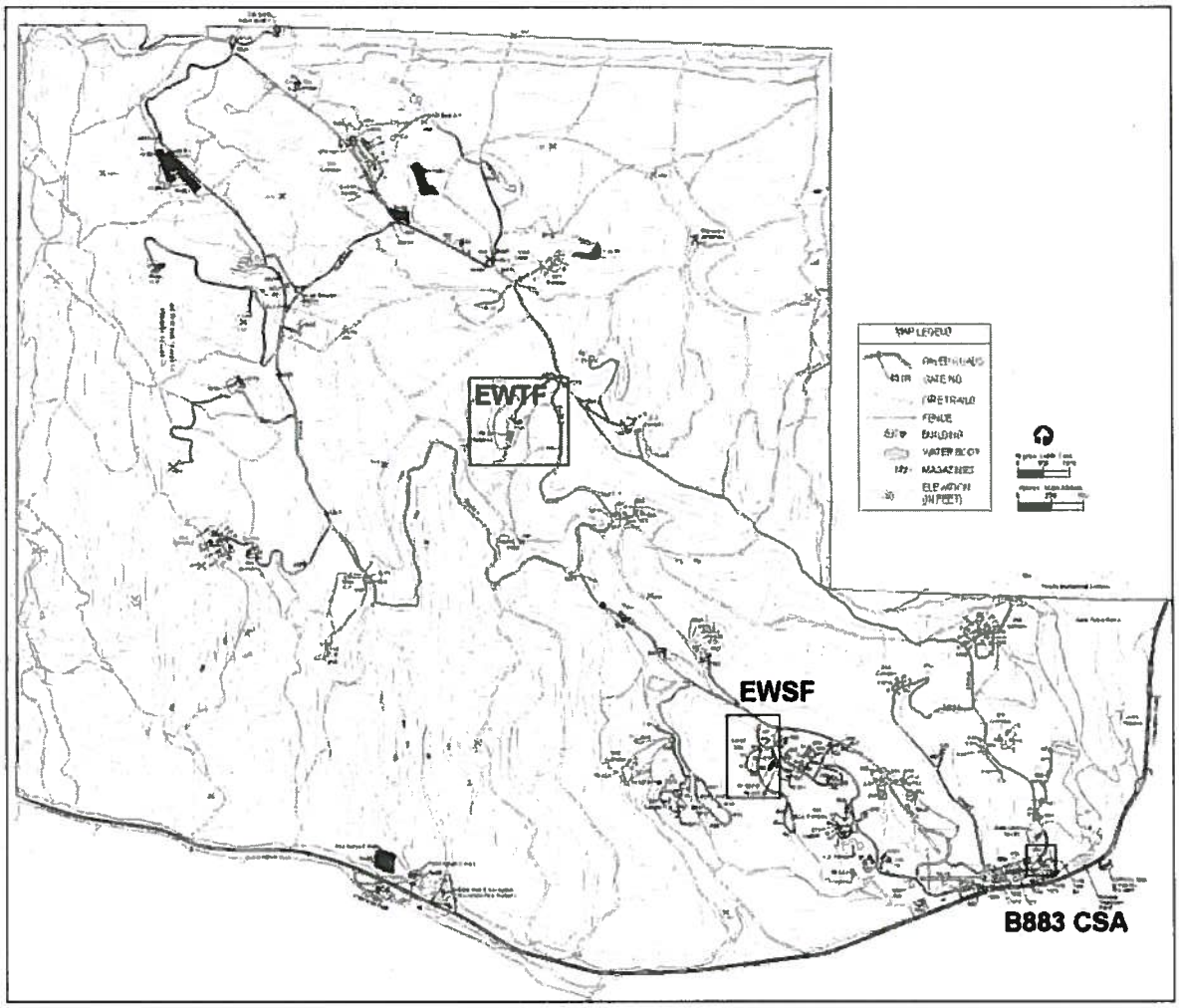

Figure 2 – Location of Hazardous Waste Management Units

B883 CSA – Building 883 Container Storage Area
EWSF – Explosives Waste Storage Facility
EWTF – Explosives Waste Treatment Facility

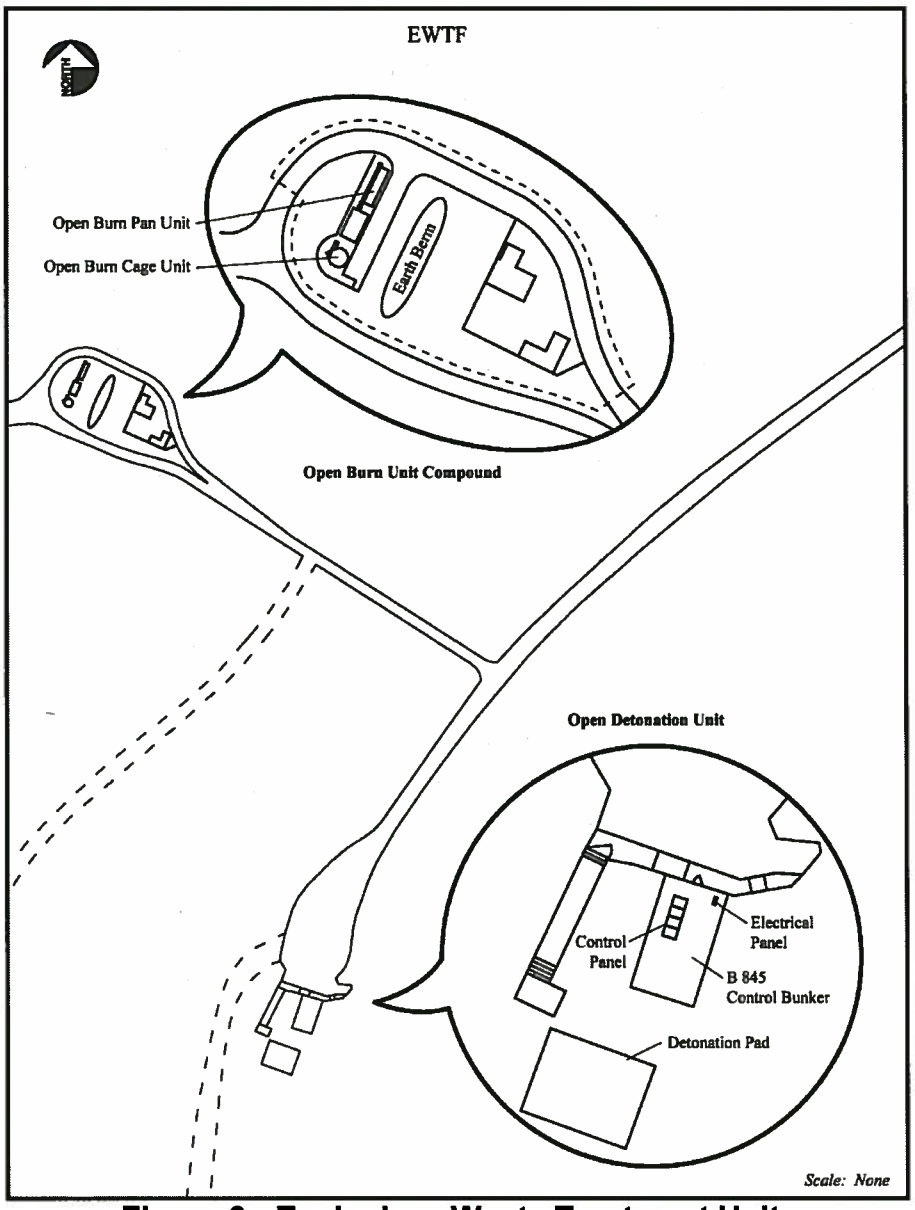

Figure 3 - Explosives Waste Treatment Units
Open-Burn Pan
Open-Burn Cage
Open-Detonation Pad

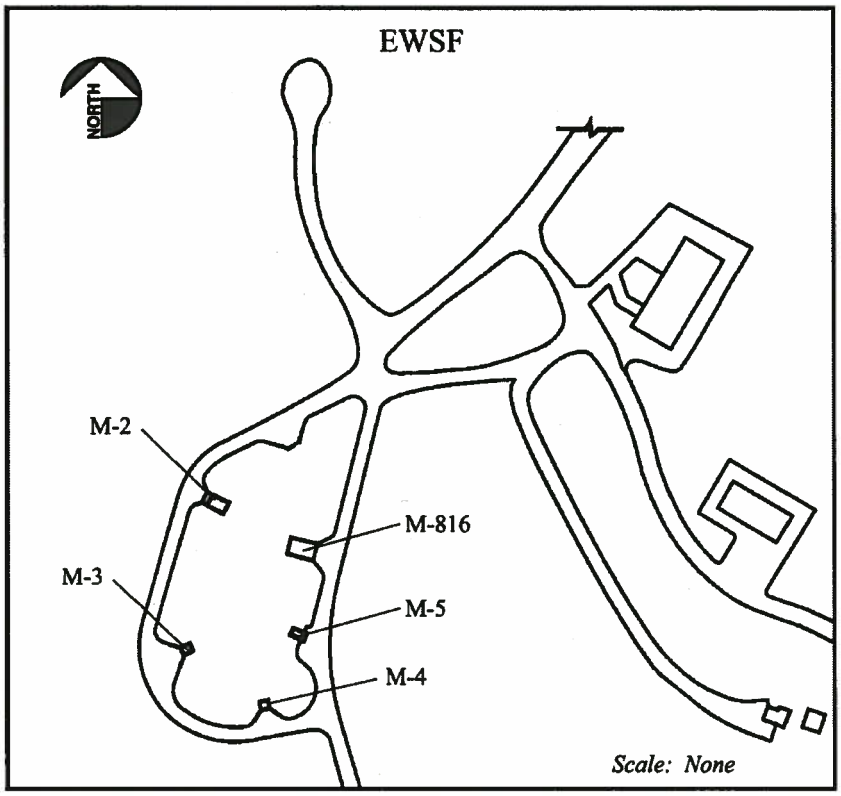

Figure 4 – Explosives Waste Storage Units M-2, M-3, M-4, M-5, M-816

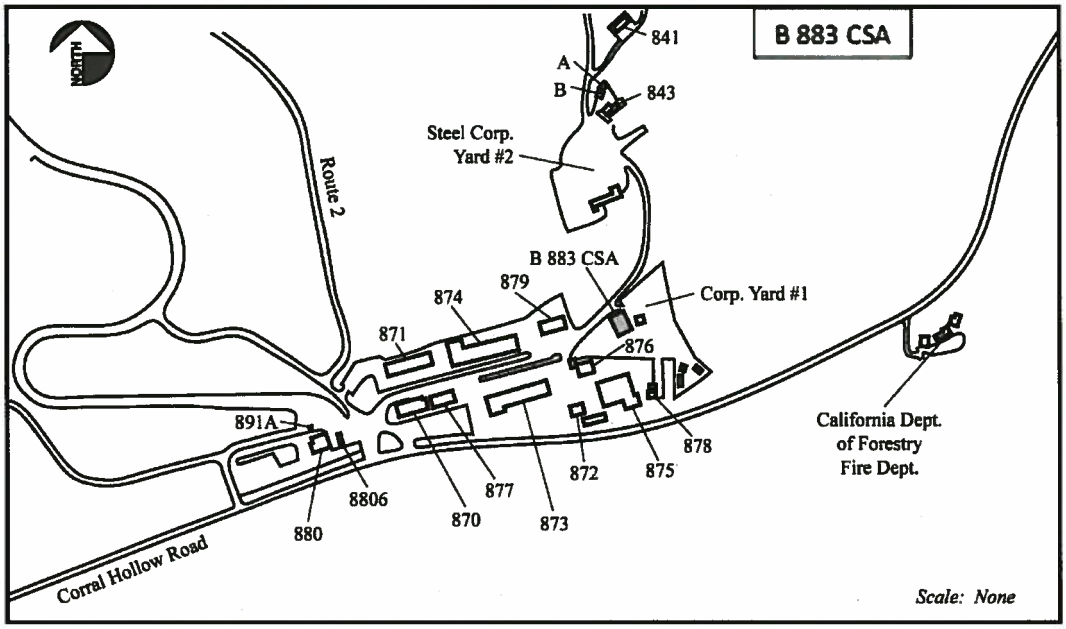

Figure 5 - Building B883 Container Storage Area

TABLE 1

WASTE STREAMS PERMITTED FOR TREATMENT AT THE EXPLOSIVES WASTE TREATMENT FACILITY

Explosives Waste Stream Number	Waste Stream Description and Examples	U.S. EPA Waste Codes	CA Waste Codes	Treatment Method/Unit
Form 1	Waste explosives that, because of configuration or composition, are best treated by open detonation. Examples are explosive assemblies or devices that may detonate during open burning	D003, P081, P112, U117	331, 352	Open Detonaton/ Open Detonation Unit
Form 2	Waste explosives that, because of configuration or composition, are best treated by open burning in the open burning pan. Examples are explosive parts and pieces that are generated during explosives formulation, processing, or testing, or that are being removed from inventory.	D003, P081, P112, U117, U234	331, 352, 551	Open Burning/ Burn Pan
Form 3	Waste explosives that, because of their configuration or composition, are best treated by open burning in the thermal treatment unit (burn cage). Examples are wet machine fines generated during explosives processing; wet, explosives-contaminated sludge from weirs and settling	D003, K044, K045, K046, K047	352, 491	Open Burning/ Burn Cage

	basins; and wet expendable filters from the recycle system.			
Form 4	Waste material with energetic materials that are best treated by open burning in the thermal treatment unit (burn cage). Examples are paper; rags; plastic tubing; dry, expendable filters from vacuum systems; and PPE used in explosives operations. The waste is judged to retain explosives hazards and is, therefore, considered to be reactive waste.	D003, F002, F003, F005	352	Open Burning/ Burn Cage

From Part III, Table 3, Part B Permit Application for Hazardous Waste Treatment and Storage Facilities Site 300, October 2007.

TABLE 2

WASTE STREAMS PERMITTED FOR STORAGE AT THE EXPLOSIVES WASTE STORAGE FACILITY

UNO STORAGE[2] COMPATIBILITY GROUP	DESCRIPTION
Group A	Initiating explosives
Group B	Detonators and similar initiating devices not containing two or more independent safety features
Group C	Bulk propellants, propellants propelling charges, and devices containing propellant with or without their means of ignition.
Group D	Black powder, high explosives (HE), ammunition/devices containing HE without its own means of initiation and without propelling charge, or a device containing an initiating explosive and containing two or more independent safety features.
Group E	Ammunition/explosives devices containing HE without its own means of initiation and with propelling charge (other than one containing a flammable or hypergolic liquid)
Group F	Ammunition containing HE with its own means of initiation and with propelling charge (other than one containing a flammable or hypergolic liquid or without propelling charge)
Group G	Fireworks, illuminating, incendiary and smoke, including hexachlorethane or tear producing munitions other than those munitions that are water activated or which contain white phosphorus (WP) or flammable liquid or gel.
Group H	Ammunition containing both explosives and WP or other pyrophoric material.
Group J	Ammunition containing both explosives and flammable liquids or gels.
Group K	Ammunition containing both explosives and toxic chemical agents.
Group L	Ammunition not included in other compatibility groups. Ammunition having characteristics that do not permit storage with other types of ammunition, or kinds of explosives, or dissimilar ammunition of this group.
Group N	Ammunition containing only extremely insensitive detonating substance.
Group S	Ammunition presenting no significant hazard.

[2] From Part III, Table 9, Part B Permit Application for Hazardous Waste Treatment and Storage Facilities Site 300, October 2007.

TABLE 3

STORAGE COMPATIBILITY MATRIX FOR THE EXPLOSIVES WASTE STORAGE FACILITY

Groups[4]	A	B	C	D	E	F	G	H	J	K	L	N	S
A	X	Z											
B	Z	X	Z	Z	Z	Z	Z						X
C		Z	X	X	X	Z	Z						X
D		Z	X	X	X	Z	Z						X
E		Z	X	X	X	Z	Z						X
F		Z	Z	Z	Z	X	Z						X
G		Z	Z	Z	Z	Z	X						X
H								X					X
J									X				X
K										Z			
L											(d)		
N			Z	Z	Z							X	X
S		X	X	X	X	X	X	X	X			X	X

[4] Corresponds to Table 2 of this permit.

Matrix Restrictions:

a. An ""X" in the above matrix indicates that these groups may be stored in the same magazines. Otherwise, storage of these groups is prohibited or restricted according to Restriction b, below.

b. A "Z" in the above matrix indicates that when warranted by operational considerations or magazine unavailability, and when safety is not sacrificed, limited quantities (not to exceed 1,000 pounds) of these groups may be stored in the same magazine.

c. No mark in a block indicates that storage of these groups in the same magazine is prohibited.

d. Group L is "ammunition not included in other groups, requiring separate storage requirements, and therefore are not compatible with other groups. Group L can be damaged or suspect ammunition of any group and will be stored separately. Types presenting similar hazards may be stored together but not mixed with other groups.

TABLE 4

WASTE STREAMS PERMITTED FOR STORAGE AT THE BUILDING 883 (B883) CONTAINER STORAGE AREA

Waste[1] Stream Number/ Form Code	Waste Name	Waste[1] Stream Number/ Form Code	Waste Name
W001	Lab packs from any source not containing acute hazardous waste	W206	Waste oil
W002	Contaminated debris (lab packed or bulk debris)	W209	Paint, ink, lacquer, or varnish
W004	Lab packs containing acute hazardous wastes	W210	Reactive or polymerizable organic liquids and adhesives
W101	Very dilute aqueous waste with low concentration (<1%) of solvents	W211	Paint thinner or petroleum distillates
W103	Spent concentrated acid (≥ 5%) with metals	W219	Other organic liquid
W105	Acidic aqueous waste < 5% acid	W301	Contaminated soil (usually from spill cleanup, demolition, or remediation); see also W512
W107	Caustic solution with metals and cyanide	W303	Ash (from any type of burning of hazardous waste)
W110	Caustic aqueous waste without cyanides	W304	Slags, drosses, and other solid thermal residues
W113	Other aqueous waste or wastewaters (fluid but not sludge)	W307	Metal scale, filings and scrap
W117	Waste liquid mercury	W312	Cyanide or metal cyanide bearing solids, salts or chemicals
W119	Other inorganic liquids	W316	Metal salts or chemicals not containing cyanides
W200	Still bottoms in liquid form	W319	Other waste inorganic solids
W202	Concentrated Halogenated solvent	W401	Pesticide solids
W203	Concentrated non-halogenated solvent	W403	Solid resins, plastics, or polymerized organics
W204	Concentrated halogenated/non-halogenated solvent mixture	W405	Explosives or reactive organic solids
W205	Oil-water emulsion or mixture	W406	Dried paint

[1] From Part III, Table 1, Part B Permit Application for Hazardous Waste Treatment and Storage Facilities Site 300, January 2015.

TABLE 4 (Continued)

WASTE STREAMS PERMITTED FOR STORAGE AT THE BUILDING 883 (B883) CONTAINER STORAGE AREA

Waste[1] Stream Number/ Form Code	Waste Name
W409	Other organic solids
W501	Lime and/or metal hydroxide sludges and soils with no cyanides (not contaminated muds-W512)
W503	Gypsum sludges from wastewater treatment or air pollution control
W504	Other sludges from wastewater treatment or air pollution control
W505	Metal bearing sludges (including plating sludge) not containing cyanides
W506	Cyanide-bearing sludges (not contaminated soils –W512)
W512	Sediment or lagoon dragout, drilling or other muds ; see also W301
W519	Other inorganic sludges (not contaminated muds – W512)
W603	Oily sludge (not contaminated muds – W512)
W604	Paint or ink sludges, still bottoms in sludge form (not contaminated muds – W512)
W606	Resins, tars, polymer or tarry sludge (not contaminated muds – W512)
W609	Other organic sludge
W801	Compressed gases of any type

1 From Part III, Table 1, Part B Permit Application for Hazardous Waste Treatment and Storage Facilities Site 300, January 2015.

TABLE 5

RCRA HAZARDOUS WASTE CODES PERMITTED FOR STORAGE AT THE BUILDING 883 (B883) CONTAINER STORAGE AREA

D001	D015	D039	F010	P105
D002	D016	D040	F025	P106
D003	D018	F001	F028	P112
D004	D019	F002	F039	U007
D005	D022	F003	K044	U025
D006	D028	F004	K045	U117
D007	D029	F005	K046	U144
D008	D030	F006	K047	U196
D009	D031	F007	P002	U234
D010	D035	F008	P015	
D011	D038	F009	P081	

TABLE 6

CALIFORNIA HAZARDOUS WASTE CODES PERMITTED FOR STORAGE AT THE BUILDING 883 (B883) CONTAINER STORAGE AREA

121	141	213	251	321	411	491	561	723	751
122	151	214	252	322	421	511	571	724	791
123	162	221	261	331	431	512	581	725	792
131	171	222	271	341	441	513	591	726	801
132	172	223	272	342	451	521	611	727	
133	181	231	281	343	461	531	711	728	
134	211	232	291	351	471	541	721	731	
135	212	241	311	352	481	551	722	741	