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September 1, 2006

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APPROVAL OF SOIL MANAGEMENT PLAN AND GROUNDWATER MONITORING AND MANAGEMENT PLAN, LAWRENCE BERKELEY NATIONAL LABORATORY, ENVIRONMENTAL RESTORATION PROGRAM, EPA ID No: CA4890008986

Dear Dr. Javandel:

We have received draft Soil Management (SM) and Groundwater Monitoring & Management (GWMM) plans for Lawrence Berkeley National Laboratory, dated March 2006. We have reviewed these plans and considered them to be technically complete. DTSC hereby approves both SM and GWMM plans. Please proceed with the schedule as proposed.

If you have any questions, please call Waqar Ahmad at (510) 540-3932.

Sincerely,

Salvatore Ciriello, PE
Supervising Hazardous Substances Engineer
Standardized Permitting and Corrective Action Branch

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E.O. Lawrence Berkeley National Laboratory
University of California
Environmental Restoration Program

United States Department of Energy

Soil Management Plan

for the Lawrence Berkeley National Laboratory

ENVIRONMENTAL RESTORATION PROGRAM

September 2006

Soil Management Plan

for the

Lawrence Berkeley National Laboratory

ENVIRONMENTAL RESTORATION PROGRAM

A Joint Effort of
Environment, Health and Safety Division and
Earth Sciences Division
Lawrence Berkeley National Laboratory
University of California
Berkeley, CA 94720

September 2006

This work was done at the Lawrence Berkeley National Laboratory, which is operated by the University of California for the U. S. Department of Energy under contract DE-AC02-05CH11231.

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Permit To Penetrate Ground or Existing Surfaces of LBNL Property, Administrative Procedure – Document Control, ADMN-053.

LIST OF ABBREVIATIONS

AOC	Areas of Concern
Berkeley Lab	Lawrence Berkeley National Laboratory
CAP	Corrective Action Program
CVOCs	Chlorinated Volatile Organic Compounds
CMS	Corrective Measures Study
CMI	Corrective Measures Implementation
COC	Chemical of Concern
DCA	Dichloroethane
DCE	Dichloroethene
DOE	United States Department of Energy
DTSC	Cal/EPA Department of Toxic Substances Control
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
ESG	Environmental Services Group
HHRA	Human Health Risk Assessment
HI	Hazard Index
ICM	Interim Corrective Measure
ILCR	Incremental Lifetime Cancer Risk
IC	Institutional Control
LLRW	Low Level Radioactive Waste
MCS	Media Cleanup Standard
NFA	No Further Action
NFI	No Further Investigation
NTLF	National Tritium Labelling Facility
OEHHA	Office of Environmental Health Hazard Assessment
OSHA	Occupational Safety and Health Administration
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated biphenyls
PCE	Tetrachloroethene
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility investigation
SMP	Soil Management Plan
SWMU	Solid Waste Management Unit
SVOCs	Semi-volatile Organic Compounds
TCA	Trichloroethane
TCE	Trichloroethene
TSCA	Toxic Substances Control Act
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank

SECTION 1

INTRODUCTION

1.1 PURPOSE AND ORGANIZATION

This Soil Management Plan (SMP) describes specific institutional controls (ICs) for soil required for compliance with the Ernest Orlando Lawrence Berkeley National Laboratory's (Berkeley Lab) Resource Conservation and Recovery Act (RCRA) Part B Permit. These controls are based on the corrective measures recommended in the RCRA Corrective Measures Study (CMS) Report (Berkeley Lab, 2005), which was prepared as part of the RCRA Corrective Action Program (CAP). Preparation and implementation of the SMP is part of the Corrective Measures Implementation (CMI) phase of the CAP.

The SMP contains descriptions of the following elements:

- the distribution of soil contaminants at Berkeley Lab
- institutional controls, including primarily land-use restrictions that will be used to reduce potential risks from exposures associated with contaminated soil and reduce the potential for environmental impacts
- procedures for the management and disposal of waste soils generated during construction activities or other activities that might disturb contaminated soil at Berkeley Lab.

1.2 BACKGROUND

As a result of Berkeley Lab's mission as a research facility, many types of chemicals have been used or produced as wastes over the more than 60 years of operation. These include solvents, polychlorinated biphenyls (PCBs), gasoline, diesel, waste oil, and metals. Additionally, radionuclides have been used or produced as waste at Berkeley Lab. Some of these chemicals have been released to the environment. These releases originated from spills and leaks that mostly occurred decades ago. Since that time, Berkeley Lab has implemented numerous internal requirements to protect the environment. These requirements are specified in specific

documents, including: Environmental Monitoring Plan; Spill, Prevention, Control, and Countermeasure Plan; Health and Safety Plan; Integrated Safety Management Plan; Accidental Spill Prevention and Containment Plan; and the Storm Water Pollution Prevention Plan. In addition, Berkeley Lab has an extensive staff-training program. The following training is required for generators of hazardous wastes.

- EHS 604, Hazardous Waste Generator Training, is required for all generators of hazardous waste at Berkeley Lab.
- EHS 610, Waste Accumulation Area (WAA) Supervisor's Training, is required for WAA managers at Berkeley Lab.
- EHS 614, Satellite Accumulation Area (SAA) Management, is required of researchers and others who generate hazardous and mixed wastes and who are responsible for management of SAAs.

1.3 RCRA CORRECTIVE ACTION PROGRAM

Berkeley Lab's RCRA Hazardous Waste Facility Permit required that Berkeley Lab investigate and address the historical chemical releases (not including radionuclides) in accordance with the RCRA CAP requirements. The Permit is issued and enforced by the California Environmental Protection Agency Department of Toxic Substances Control (DTSC), including the activities required under the RCRA CAP. The Environmental Restoration Program (ERP) has been the Berkeley Lab program responsible for investigating and addressing the historical chemical releases under the CAP. The ERP has been part of a nationwide effort by the United States Department of Energy (DOE) to identify and clean up contaminated areas at its facilities.

The primary components of the RCRA CAP are:

- RCRA Facility Assessment (RFA)
- RCRA Facility Investigation (RFI)
- Corrective Measures Study (CMS)
- Corrective Measures Implementation (CMI).

The RFA, which was completed in 1992, and the RFI, which was completed in 2000, comprised the investigation phase of the CAP. The purpose of the RFA was to identify known and potential past releases of hazardous waste and hazardous constituents to the environment

from Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at Berkeley Lab. SWMUs, AOCs, and other areas of known or potential release of contaminants are collectively referred to as "units" in this report.

SWMUs identified at Berkeley Lab included above-ground and underground waste storage tanks, sumps, scrap yards, plating shops, the former hazardous waste handling facility, waste accumulation areas, hazardous waste storage areas, and waste treatment units. AOCs identified at Berkeley Lab primarily included chemical product storage tanks (e.g., fuel tanks), transformers, and hazardous materials storage areas. Areas of groundwater contamination were also considered as AOCs.

Results of the RFA are provided in the *RCRA Facility Assessment at the Lawrence Berkeley Laboratory* (Berkeley Lab, 1992). The RFA found that hazardous waste or hazardous constituents had been released to soil and groundwater. Based on these findings, DTSC concluded that an RFI was required to characterize areas at the site where releases had occurred.

The RFI, which was conducted between October 1992 and September 2000, included identification of the source and nature of the contaminants that had been released to the environment, and characterization of the magnitude and extent of those releases. The RFI was divided into three phases. The *RCRA Facility Investigation Phase I Progress Report* (Berkeley Lab, 1994) and the *RCRA Facility Investigation Phase II Progress Report* (Berkeley Lab, 1995) provided results for the first two phases of the RFI. The *RCRA Facility Investigation* (*RFI) Report* described the results of the final phase, and was submitted to the DTSC on September 29, 2000 (Berkeley Lab, 2000). A listing of the units evaluated during the RFI is provided in Table 1. The locations of the units are shown on Figure 1.

Table 1. Summary of Units Included in RFI

Soil Solid Waste Management Units	Location Reference Number	LBNL Unit Number	Oversight Agency	Units included in RFA (Berkeley Lab, 1992)	Units Approved for No Further Action During RFI [a]	Units Included in HHRA (Berkeley Lab, 2003a)	HHRA Result Risk from Soil for Residential Land Use is $<10^{-6}$ and HI<1	Units Included in CMS Report (Berkeley Lab, 2005a)	Units Restricted to Institutional Land Use	Contaminants	Reference Page in HHRA (Berkeley Lab, 2003a)	Reference Page in RFI Report [i]	Reference Page in CMS Report (Berkeley Lab, 2005a)
B7 Former Plating Shop	1	SWMU 2-1	DTSC	●		●			●	metals, VOCs, PCBs	4-95	Final B-13	
B52B Abandoned Liquid Waste AST and Sump	2	SWMU 2-2	DTSC	●		●			●	PAHs, PCBs	4-103	Final B-18	
B17 Former Scrap Yard and Drum Storage Area	3	SWMU 2-3	DTSC	●		●			●	PCBs,TPH	4-111	Final B-23	
Building 69A Former Haz Mat Storage and Delivery Area	4	SWMU 3-1	DTSC	●		●	●			PCBs, pesticides,SVOCs	4-187	not included	
B69 Former (Present) Waste Oil UST	5	SWMU 3-3	COB	●	●					TPH, O&G		Phase 1: 5-61	
B69/75A Former Scrap Yard and Drum Storage Area	6	SWMU 3-4	DTSC	●	●					VOCs, SVOCs		Phase 2: 5-35	
B69A Storage Area Sump	7	SWMU 3-5	DTSC	●		●			●	VOCs, PCBs, pesticides	4-193	Phase 1: 5-61	
B75 Former Haz Waste Handling and Storage Facility	8	SWMU 3-6	DTSC	●		●	(g)	●		PCBs, VOCs, SVOCs	4-201	Final C-10	200
B76 Oil/Water Separator, Basin, and Sumps	9	SWMU 4-2	DTSC	●	●					VOCs, TPH		Phase 1: 5-62	
B76 Motor Pool and Collection Trenches (and sump)	10	SWMU 4-3	DTSC	●		●			●	VOCs, TPH	4-213	Final C-15	
B76 Present and Former Waste Accumulation Area #3	11	SWMU 4-6	DTSC	●		●			●	VOCs	4-221	Phase 1: 5-63	
B42 Scrap Yard	12	SWMU 5-1	DTSC	●	●					VOCs		Phase 1: 5-63	
B77 Plating Shop Floor and Sump	13	SWMU 5-4	DTSC	●	●	●			●	VOCs, metals	4-227	Final C-18	
B77 Waste Accumulation Area	14	SWMU 5-6	DTSC	●	●					TPH-D, methylene chloride		Phase 2: 5-37	
B77G Waste Accumulation Area	15	SWMU 5-7	DTSC	●	●					none		not included (unit design evaluation only)	
B77 Sand Blasting Room	16	SWMU 5-9	DTSC	●	●					none		Phase 1: 5-65	
B77 Present and Former Yard Decontamination Areas	17	SWMU 5-10	DTSC	●	●	●			●	VOCs, cyanide, TPH	4-234	Phase 2: 5-37	
B88 Waste Accumulation Area	18	SWMU 6-2	DTSC	●	●					none		Phase 2: 5-38	
B58 Inactive Underground Rinseate Tank	19	SWMU 7-1	COB	●	●					TPH		Phase 1: 5-69	
B58 Sumps	20	SWMU 7-5	DTSC		●					VOCs, TPH		Final B-26	
B70A Former Waste Water Holding Tanks	21	SWMU 8-1	DTSC	●	●					not analyzed for organics		Phase 2: 5-41	
B51 Vacuum Pump Room Waste Oil Tank	22	SWMU 9-1	DTSC	●	●					none		Final A-10	
B51 Vacuum Pump Room Sump and Collection Basins	23	SWMU 9-4	DTSC	●		●			●	benzene	4-49	Final A-11	
B51 Motor Generator Room Sump	24	SWMU 9-6	DTSC	●		●			●	VOCs, PCBs	4-55	Final A-13	
B16 Former Waste Accumulation Area	25	SWMU 10-4	DTSC	●		●			●	PCBs, VOCs, TPH, metals	4-119	Final B-28	
B16 Present Waste Accumulation Area	26	SWMU 10-5	DTSC	●	●					VOCs, TPH		Phase 2: 5-44	
B25 Plating Shop Floor Drains	27	SWMU 10-10	DTSC			●	●			metals	4-127	Final B-31	
B50 Former Residual Photographic Solution UST	28	SWMU 12-1	COB	●	●	●	●			cyanide	4-242	Phase 2: 5-50	
B62 Waste Accumulation Area	29	SWMU 13-2	DTSC	●	●					VOCs		Final D-16	
	Total SWMUs	29		27		15		1	12				

Table 1. Summary of Units Included in RFI (Continued)

Soil Areas of Concern	Location Reference Number	LBNL Unit Number	Oversight Agency	Units included in RFA (Berkeley Lab, 1992)	Units Approved for No Further Action During RFI [a]	Units Included in HHRA (Berkeley Lab, 2003a)	HHRA Result Risk from Soil for Residential Land Use is <10^{-6} and HI<1	Units Included in CMS Report (Berkeley Lab, 2005a)	Units Restricted to Institutional Land Use	Contaminants	Reference Page in HHRA (Berkeley Lab, 2003a)	Reference Page in RFI Report [i]	Reference Page in CMS Report (Berkeley Lab, 2005a)
B46A Former Motor Pool Gasoline UST	30	AOC 1-1	COB	●	●					none		Final A-17	
B71 Linear Accelerator Cooling Unit	31	AOC 1-3	DTSC	●	●					VOCs		Final A-18	
B71 Former Hazardous Materials Storage Area	32	AOC 1-5	DTSC	●	●					none		Phase 1: 6-2	
B71 Transformers	33	AOC 1-6	DTSC	●	●					O&G		Final A-20	
B71 Mercury Contamination	34	AOC 1-10	DTSC		●					none		Final A-22	
B7E Former UST	35	AOC 2-1	COB	●		●			●	TPH, aromatic hydrocarbons	4-133	Final B-33	
B7 Former Hazardous Materials Storage Area	36	AOC 2-2	DTSC	●		●	●			VOCs	4-140	Phase 2: 5-33	
B7 Sump	37	AOC 2-5	DTSC			●		●	●	VOCs	4-146	Final B-39	116
B69/B75 Fire Drill Area	38	AOC 3-2	DTSC	●	●					TPH		Phase 2: 5-36	
B76 Former Gasoline UST	39	AOC 4-1	COB	●	●					TPH-D, VOCs, PAHs		Final C-20	
B76 Former Diesel UST	40	AOC 4-2	COB	●	●					TPH-G, VOCs, PAHs		Final C-20	
B79 Hazardous Materials Storage Area #2	41	AOC 5-3	DTSC	●	●					none		Phase 2: 5-37	
B77 Sanitary Sewer System	42	AOC 5-4	DTSC		●					VOCs		Final C-23	
B77 Generator Pad	43	AOC 5-5	DTSC		●					TPH-D		Phase 2: 5-38	
B88 Abandoned Diesel UST	44	AOC 6-1	COB	●	●					none		Phase 2: 5-38	
B88 Transformers	45	AOC 6-2	DTSC	●	●					none		Phase 2: 5-38	
B88 Hydraulic Gate Unit	46	AOC 6-3	DTSC	●		●	(g)	●		PCBs, O&G	4-247	Phase 2: 5-39	198
B88 Hazardous Materials Storage Area	47	AOC 6-4	DTSC	●	●					none		Phase 2: 5-40	
B46 Former Scrap Yard	48	AOC 7-1	DTSC	●	●					TPH		Final B-44	
B46 Hazardous Materials Storage Area	49	AOC 7-3	DTSC	●		●	●			VOCs	4-154	Phase 2: 5-40	
B58 Former Hazardous Materials Storage Area	50	AOC 7-6	DTSC	●		●	(f)			VOCs	4-160	Final B-46	
B70A Diesel UST	51	AOC 8-1	COB	●	●					TPH-D, VOCs, SVOCs		Final D-19	
B70 Diesel UST	52	AOC 8-2	COB	●	●					TPH-D		Final D-21	
B70A Transformer	53	AOC 8-3	DTSC	●	●					none		Phase 1: 5-71	
B70 Transformer	54	AOC 8-4	DTSC	●	●					none		Phase 1: 5-72	
B70 Hazardous Materials Storage Area	55	AOC 8-5	DTSC	●	●					SVOC, VOCs		Phase 2: 5-42	
B58/B70 Sanitary Sewer	56	AOC 8-6	DTSC			●			●	VOCs	4-253	Phase 2: 5-42	
B70A Sanitary Sewer	57	AOC 8-7	DTSC		●					none		Final D-23	
B51 Diesel UST	58	AOC 9-2	COB	●	●					TPH, PAHs		Final A-23	
B51 Former Hazardous Materials Storage Area	59	AOC 9-7	DTSC		●					VOCs		Final A-26	
Sanitary Sewer Lines West of Buildings 51 and 51B	60	AOC 9-8	DTSC		●					none		Final A-27	
B51 Sanitary Sewer and Drainage System	61	AOC 9-9	DTSC			●			●	PCBs, VOCs, PAHs, TPH	4-62	Final A-29	
B64 Catch Basin	62	AOC 9-10	DTSC							none		Phase 2: 5-43	
Former Cooling Towers Southeast of Building 51	63	AOC 9-11	DTSC		●					none		Final A-39	
B51/64 Former Temporary Equipment Storage Area	64	AOC 9-12	DTSC			●			●	VOCs,	4-75	Final A-42	
B52 Former Hazardous Materials Storage Area	65	AOC 10-2	DTSC	●		●			●	VOCs, PCBs, TPH	4-167	Final B-49	
B25A Sanitary Sewer	66	AOC 10-3	DTSC		●					none		Final B-52	
B25 Sanitary Sewer	67	AOC 10-4	DTSC		●					none		Phase 2: 5-47	
B74 (Former) Diesel UST	68	AOC 11-1	COB	●	●					TPH-D, aromatic VOCs		Final D-25	
B83 Diesel AST	69	AOC 11-2	DTSC	●	●					TPH-D		Phase 2: 5-48	
B83/83A Sanitary Sewers	70	AOC 11-3	DTSC		●					none		Final D-29	
B50 Sanitary Sewer Dislocations	71	AOC 12-4	DTSC		●					aromatic VOCs		Final D-32	
B62 Hazardous Materials Storage Area	72	AOC 13-1	DTSC	●		●	(h)			VOCs	4-259	Final D-34	
B62 Former Diesel UST	73	AOC 13-2	COB	●	●					TPH		Final D-35	
Building 62 Transformer	74	AOC 13-3	DTSC	●	●					PCBs, TPH		Phase 2: 5-50	
B62 Possible Solvent Spills East of B62	75	AOC 13-4	DTSC	●	●					none		Final D-38	
B62 Acid Sewer Lines West of B62	76	AOC 13-8	DTSC		●					VOCs, TPH		Phase 2: 5-50	
B62 Sanitary Sewers South of B62	77	AOC 13-9	DTSC		●					TPH-D		Phase 2: 5-50	
B10 and B80 Sanitary Sewers	78	AOC 14-6	DTSC		●					none		Final B-56	
B37 Proposed Electrical Substation	79	AOC 14-7	DTSC			●	●			TPH	4-173	Phase 1: 5-79	
	Total Soil AOCs	50		30		12		2	6				

Table 1. Summary of Units Included in RFI (Continued)

Other Chemical Soil Units (Not designated as a SWMU or AOC)	Location Reference Number	LBNL Unit Number	Oversight Agency	Units included in RFA (Berkeley Lab, 1992)	Units Approved for No Further Action During RFI [a]	Units Included in HHRA (Berkeley Lab, 2003a)	HHRA Result Risk from Soil for Residential Land Use is $<10^{-6}$ and HI<1	Units Included in CMS Report (Berkeley Lab, 2005a)	Units Restricted to Institutional Land Use	Contaminants	Reference Page in HHRA (Berkeley Lab, 2003a)	Reference Page in RFI Report [i]	Reference Page in CMS Report (Berkeley Lab, 2005a)
Slope West of Building 53	80		DTSC			●	(f)			VOCs, metals	4-177	Final B-59	
Building 51L Groundwater Plume Source Area	81		DTSC			●		●	●	VOCs	4-83	not included	91
Building 52A Lobe Source Area	82		DTSC			(a)		●		VOCs		Final B-57	153
Building 71B Lobe Source Area	83		DTSC					●	●	VOCs		Final A-44	106
Chicken Creek Poultry Research Station	84		DTSC			(a)				pesticides		Final C-26	
	Total Other Soil Units	5		0		2		3	2				

Other Areas of Soil Contamination (Locations where Soil Samples were Collected during Costruction Activities)	Location Reference Number	LBNL Unit Number	Oversight Agency	Units included in RFA (Berkeley Lab, 1992)	Units Approved for No Further Action During RFI [a]	Units Included in HHRA (Berkeley Lab, 2003a)	HHRA Result Risk from Soil for Residential Land Use is $<10^{-6}$ and HI<1	Units Included in CMS Report (Berkeley Lab, 2005a)	Units Restricted to Institutional Land Use	Contaminants	Reference Page in HHRA (Berkeley Lab, 2003a)	Reference Page in RFI Report [i]	Reference Page in CMS Report (Berkeley Lab, 2005a)
Grizzly Substation	85		DTSC		●	(b)				PCBs, TPH		Final C-27	
Building 71 Utility Trench	86		DTSC			(a) (b)				PCBs, Vocs, TPH		Phase 2 5-31	
Building 56 Construction Site	87		DTSC						●	VOCs		Phase 1: 5-73	
Building 2 Diesel USTs	88	AOC 14-1	COB		●	(b)				TPH, PCBs		Phase 1: 5-77	
Building 58 Electrical Substation Construction	89		DTSC						●	TPH, metals, PAHs		Phase 1: 5-71	
Building 71 PCB Spill (2004-2005)	90		USEPA		●	(b)				PCBs		not included	January 2005 report to USEPA
	Total Other Soil Units	5		0		0		0	2				

Radiological Units	Location Reference Number	LBNL Unit Number	Oversight Agency	Units included in RFA (Berkeley Lab, 1992)	Units Approved for No Further Action [a]				Units Restricted to LBNL Institutional Land Use	Contaminants			Reference Page in Radionuclide Investigations Report (Berkeley Lab, 2003b)
B71 Radiation Release	91	AOC 1-7	DOE	●	●				● (c)	curium-244			29
B75A Radioactive Waste Storage Area	92	SWMU 3-9	DOE	●	●				● (e)	none			36
B74 Abandoned Rad Waste Holding Tanks	93	SWMU 11-2	DOE	●	●				● (d)	none			35
B74 Inactive Aboveground Rad Waste Holding Tanks	94	SWMU 11-3	DOE	●	●				● (d)	none			33
B5 Former Decontamination Area	95	SWMU 10-2	DOE	●	●				● (c)	VOCs			31
B5 Former Outdoor Radioactive Waste Storage Area	96	SWMU 10-3	DOE	●	●				● (c)	VOCs			31
B4 Former Radioactive Waste Storage and Staging Area	97	SWMU 10-1	DOE	●	●				● (c)	none			38
B75 National Tritium Labeling Facility	98	SWMU 3-7	DOE	●	●				● (c)	tritium			9
	Total Radiological Units	8		8		0		0	8				

(a) Concentrations below PRGs for residential soil and/or background levels.
(b) Concentration below TSCA PCB cleanup level of 1 mg/kg
(c) DOE's NFA approval indicated that release of the area to the general public was not authorized and is only intended for LBNL reuse.
(d) DOE's NFA approval did not release the structure, equipment, or area from any existing controls.
(e) Building 75A was designated for reuse by the Berkeley Lab Radiation Protection Group
(f) No unacceptable soil risks are present for residential receptors (Berkeley Lab, 2003a)
(g) Soil was cleaned up under Interim Corrective Measures (ICMs) to the Toxic Substances Control Act (TSCA) self-implementing cleanup level of 1 mg/kg for soil in high occupancy areas.
(h) Additional samples were collected in 2003 to show that the risk driver,1,2,3-trichloropropane, detected in a single sample in 1992 was no longer present.

i) Phase 1 (Berkeley Lab, 1994)
Phase 2 (Berkeley Lab, 1995)
Final (Berkeley Lab, 2000) showing Module number (A, B,C, or D)

As described in the RFI reports, the principal chemical contaminants in the soil at Berkeley Lab are chlorinated volatile organic compounds (CVOCs) and PCBs. The CVOCs include primarily tetrachloroethene (PCE), trichloroethene (TCE), carbon tetrachloride, 1,1-dichloroethene (1,1-DCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE), 1,1,1-trichloroethane (TCA), and 1,1-dichloroethane (DCA). Most of these CVOCs are solvents (and their degradation products) that were used as degreasers for cleaning equipment at Berkeley Lab. PCB contamination was primarily associated with spilled transformer oils and former waste oil tanks. Other contaminants that were detected in soil include petroleum hydrocarbons (mainly associated with former underground storage tank [UST] sites) and metals (mainly associated with plating shops); and to a much lesser extent semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), and pesticides.

During the RFI, Berkeley Lab implemented a screening process for each of the investigated units with contaminated soil to determine where further action was required. The screening process consisted of a comparison between the maximum concentration of each chemical detected in soil at each unit to the California-modified Preliminary Remediation Goals (PRGs) and United States Environmental Protection Agency (USEPA) Region 9 PRGs for residential soil. Concentrations of naturally occurring inorganic elements were also compared to Berkeley Lab background levels for soil (Berkeley Lab, 2002a). Those units that failed the screening process were considered to pose a potential risk to human health, and were designated as No Further Investigation (NFI) status by the DTSC. Those units that passed the screening process were considered to pose an insignificant risk to human health, and were therefore designated by the DTSC for No Further Action (NFA). The units that passed the screening process are listed in Table 1. Those units are considered acceptable for unrestricted land use (including residential use).

Based on results of the RFI, including the screening process described above, the DTSC determined that a Corrective Measures Study (CMS) would be required because chemicals detected in the soil and groundwater at Berkeley Lab posed a potential threat to human health or the environment. The soil units where it had been determined that there was a potential risk to human health (units designated as NFI) were included in the CMS, as well as areas of groundwater contamination. As the initial step in the CMS, Berkeley Lab completed both an Ecological and a

Human Health Risk Assessment (ERA and HHRA) (Berkeley Lab, 2002b and 2003a). The ERA provided estimates of risks to plants and animals based on an evaluation of potentially completed contaminant migration pathways to ecological receptors that could be present within habitat areas at Berkeley Lab. Based on this evaluation, it was concluded that no hazards existed to plants or animals from exposure to chemicals in soil, groundwater, or surface water at Berkeley Lab.

The risk estimates provided in the HHRA are based on an industrial-type institutional use scenario for Berkeley Lab. This scenario is considered to represent the current use, and the reasonable and likely future use for the facility. The HHRA included estimates of risk to humans for each unit that had been designated for NFI status. In addition, risk estimates were provided for four additional units that had been designated for NFA status. The additional units were included because either additional samples collected subsequent to the RFI exceeded PRGs, or because PRG values for some chemicals had been updated. The units evaluated in the HHRA are noted in Table 1.

The HHRA concluded that four of the areas of soil contamination posed a potential risk to the health of institutional workers. These four units were:

- The Building 88 Hydraulic Gate Unit
- The Building 75 Former Hazardous Waste Handling and Storage Facility
- The Building 7 Sump
- The Building 51L Groundwater Solvent Plume Source Area.

The chemicals of concern (COCs) at Building 88 and Building 75 were PCBs. Subsequent to the HHRA, soil at these units was cleaned up under an Interim Corrective Measure (ICM) to the Toxic Substances Control Act (TSCA) self-implementing cleanup level of 1 mg/kg for soil in high occupancy areas. This is the Media Cleanup Standard (MCS) for PCBs specified in the CMS Report, and is a level that is considered safe for unrestricted land use (including residential use). The Building 51L Groundwater Solvent Plume Source Area and the Former Building 7 Sump will be cleaned up to an institutional land-use level during the CMI phase according to the method specified in the CMS report (excavation and offsite disposal of contaminated soil).

1.4 RADIONUCLIDES

Concurrently with the investigation and assessment of chemical releases, Berkeley Lab investigated potential releases of radionuclides from eight units, under the regulatory authority of the DOE. The eight radiological units are listed in Table 1.

Results of the radiological investigations are provided in the *Summary of Radionuclide Investigations* report (Berkeley Lab, 2003b). As described in that report, the principal radionuclide contaminants in the soil at Berkeley Lab are tritium and curium-244. The tritium is present in the soil near Building 75 as a result of past emissions from the former National Tritium Labelling Facility (NTLF). The NTLF operated for almost 20 years until December 2001. The curium-244 is present in the soil near Building 71 as a result of a release that occurred inside the building in 1959.

Based on the information provided in the *Summary of Radionuclide Investigations* report (Berkeley Lab, 2003b), the DOE concurred with Berkeley Lab that the radiological units should be assigned NFA status. However, DOE also specified that for the two units at Building 74 it was not releasing the structure, equipment, or area from any existing controls; and for five other units (units at Buildings 71, 5 [two units], 4, and 75) release of the areas to the general public was not authorized. The eighth area, the Building 75A Radioactive Waste Storage Area, was specifically designated by Berkeley Lab for reuse by the Berkeley Lab Radiation Protection Group. The locations of the eight areas are shown on Figure 1.

SECTION 2

LAND-USE RESTRICTIONS

2.1 CHEMICAL CONTAMINATION

2.1.1 Land Use and Cleanup Levels

Both the HHRA and CMS Report were completed based on the assumption that Berkeley Lab would continue to operate as a research laboratory for the foreseeable future, a scenario that is consistent with the current and reasonably anticipated future land use at Berkeley Lab. This institutional/industrial land-use scenario was therefore used for the primary risk evaluations in the HHRA and the determination of the required cleanup levels for soil and groundwater in the CMS Report. Areas of contamination that pose a potential risk to institutional workers are therefore being cleaned up to an institutional/industrial land-use level. Subordinate to the institutional land-use evaluation, the HHRA also provided a risk evaluation based on a hypothetical (and unlikely) restricted residential land-use scenario (i.e., assessing risks to residents but assuming that domestic use of site groundwater would not occur). Results of the HHRA are summarized in Table 2.

DTSC has required corrective measures for those areas where chemical concentrations in soil or groundwater result in theoretical Incremental Lifetime Cancer Risks (ILCRs) greater than or equal to 10^{-6} or Hazard Indices (HIs) greater than or equal to 1.0 (in the absence of mitigating factors) for the institutional land-use scenario. The theoretical ILCR is an estimate of the chance of contracting cancer over a lifetime of exposure. The Hazard Index (HI) is a threshold level that indicates the concentrations above which non-cancer health effects may occur. Exposure to chemicals with an HI below 1.0 is considered unlikely to result in adverse non-cancer health effects over a lifetime of exposure.

USEPA considers an ILCR anywhere within the target range for risk managers (also known as the risk management range) of 10^{-4} (one-chance-in-ten-thousand) to 10^{-6} (one-chance-in-a-million) to be safe and protective of public health. The target cleanup levels were set at

concentrations that resulted in the lowest reasonably achievable ILCR level within the risk management range (i.e., 10^{-6}) and a Hazard Index (HI) of 1.0.

In addition to consideration of human health, corrective measures are required where soil contaminant concentrations could result in groundwater contaminant concentrations exceeding Maximum Contaminant Levels (MCLs) for drinking water in those areas where groundwater yields are sufficient to provide a potential drinking water supply. This addresses the State Water Resources Control Board (SWRCB) non-degradation policy (Resolution 68-16) under the Porter-Cologne Water Quality Control Act.

2.1.2 Institutional Use Restrictions

Institutional land use restrictions for soil are not currently anticipated following completion of corrective measures in 2006. However, since chemical concentrations currently exceed upper limit MCSs ($>10^{-4}$) at two units (Former Building 7 Sump and Building 51L Groundwater Solvent Plume Source Area), land use restrictions will be implemented if ILCRs still exceed the risk management range (i.e., $>10^{-4}$) following completion of corrective measures. If cleanup does not achieve the required MCSs, new buildings or other improvements intended for human occupancy may not be constructed at these locations until the target MCSs are achieved, or one or more of the following conditions are met:

- COC concentrations are lower than upper-limit MCSs
- mitigation methods are implemented to ensure that risks to future building occupants are within acceptable levels
- additional data are collected to document that risks to human health would be within acceptable levels.

Mitigation methods might include engineering controls used to eliminate contaminant migration pathways. Typically, such controls include installation of contaminant-resistant subslab organic-vapor barriers, lateral routing of utilities to avoid vapor barrier penetration, sealing of utility penetrations, and/or subslab ventilation systems (DTSC, 2004). Any mitigation measures implemented would require the approval of the DTSC. In addition, post-construction soil-gas and/or indoor air monitoring should be considered to document that risks to indoor workers are within acceptable levels.

Since the primary risk driver at the two units is due to the potential for infiltration of vapor volatilized from soil migrating into indoor air, soil gas samples could be collected to provide a more accurate estimate of risk than was derived based on the soil sampling results. Any soil-gas sampling should be conducted in accordance with guidelines specified in the DTSC Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (DTSC, 2004). The soil gas data should be compared to the most recent California Environmental Protection Agency (Cal/EPA) soil gas screening numbers (OEHHA, 2005) (or other applicable and appropriate screening numbers available) to assess whether risks exceed the screening levels.

2.1.3 Residential Use Restrictions

Results of the supplemental HHRA residential risk evaluation are used as the basis for restrictions proposed on hypothetical future residential land use in this plan. Residential land use restrictions are proposed where the theoretical ILCR is greater than or equal to 10^{-6} or the HI is greater than or equal to 1 for a hypothetical future resident.

Results of the HHRA's residential-risk evaluation are summarized in Table 2, and indicate that chemical concentrations in the soil at 18 units pose a potential risk to hypothetical future residential receptors, based on the conservative evaluation of risk provided in the HHRA. In addition, concentrations of contaminants exceeded PRGs for residential soil at two Berkeley Lab construction sites (Building 56 and Building 58) and the Building 71B lobe source area, which were not evaluated in the HHRA. The locations of these 21 units, which are designated "no" for residential use in Table 2, are shown on Figure 2. These 21 units are considered unsuitable for unrestricted land use unless measures are implemented to mitigate the risk or additional data are collected to show that the risk is within acceptable levels.

Table 2

Summary of Risk Assessment Results for Soil Pathways
Lawrence Berkeley National Laboratory

Unit Name	Area (a)	Unit Number	Location Reference Number (a)	Is Unit Acceptable for Residential Land Use (b)	Is Unit Acceptable for Institutional Land Use (c)	Primary Soil Risk Driver
Building 7 Former Plating Shop	OT	SWMU 2-1	1	**no**	yes	Inhalation of vinyl chloride via migration into indoor air.
Building 52B Abandoned Liquid Waste Above-Ground Storage Tank (AST) and Sump	OT	SWMU 2-2	2	**no**	yes	Ingestion of benzo(a)pyrene.
Building 17 Former Scrap Yard and Drum Storage Area	OT	SWMU 2-3	3	**no**	yes	PCBs via ingestion and dermal contact. (risk=1.03×10^{-6})
Building 69A Former Hazardous Materials Storage and Delivery Area	SS	SWMU 3-1	4	yes	yes	None
Building 69A Storage Area Sump	SS	SWMU 3-5	7	**no**	yes	Ingestion of dieldrin.
Building 75 Former Hazardous Waste Handling and Storage Facility	SS	SWMU 3-6	8	yes	yes	None
Building 76 Motor Pool and Collection Trenches and Sump	SS	SWMU 4-3	10	**no**	yes	Inhalation of benzene and PCE via migration into indoor air.
Building 76 Present and Former Waste Accumulation Area #3	SS	SWMU 4-6	11	**no**	yes	Ingestion of cadmium. Cadmium was detected slightly above background in one sample.
Building 77 Plating Shop	SS	SWMU 5-4	13	**no**	yes	Inhalation of benzene via migration into indoor air. Benzene was detected in only 1 of 25 samples. Risks are significantly overestimated.
Building 77 Former Yard Decontamination Area	SS	SWMU 5-10	17	**no**	yes	Inhalation of CVOCs via migration into indoor air.
Building 51 Vacuum Pump Room Sump and Collection Basins	B	SWMU 9-4	23	**no**	yes	Inhalation of benzene via migration into indoor air.
Building 51 Motor Generator Room Filter Sump	B	SWMU 9-6	24	**no**	yes	Inhalation of CVOCs via migration into indoor air.
Building 16 Former Waste Accumulation Area	OT	SWMU 10-4	25	**no**	yes	Ingestion of cadmium. Cadmium was detected above background in 1 of 39 samples. Risk is probably overestimated.
Building 25 Plating Shop Floor Drains	OT	SWMU 10-10	27	yes	yes	None
Building 50 Inactive Underground Residual Photographic Solution Storage Tank (TK-09-50)	WO	SWMU 12-1	28	yes	yes	None

Table 2 (cont'd.)

Summary of Risk Assessment Results for Residential Land Use Scenario for Soil Pathways
Lawrence Berkeley National Laboratory

Unit Name	Area (a)	Unit Number	Location Reference Number (a)	Is Unit Acceptable for Residential Land Use (b)	Is Unit Acceptable for Institutional Land Use (c)	Primary Soil Risk Driver
Building 7E Former Underground Storage Tank (UST)	OT	AOC 2-1	35	**no**	yes	Inhalation of VOCs via migration into indoor air.
Building 7 Former Hazardous Materials Storage Area	OT	AOC 2-2	36	yes	yes	None
Former Building 7 Sump	OT	AOC 2-5	37	**no**	**no**	Inhalation of CVOCs via migration into indoor air.
Building 88 Hydraulic Gate Unit	WO	AOC 6-3	46	yes	yes	None
Building 46 Hazardous Materials Storage Area	OT	AOC 7-3	49	yes	yes	None
Building 58 Former Hazardous Materials Storage Area	OT	AOC 7-6	50	yes	yes	None
Building 58/Building 70 Sanitary Sewer	WO	AOC 8-6	56	**no**	yes	Inhalation of methylene chloride via migration into indoor air.
Building 51 Sanitary Sewer and Drainage System	B	AOC 9-9	61	**no**	yes	Ingestion of/dermal contact with PCBs and inhalation of CVOCs via migration into indoor air.
Buildings 51/64 Former Temporary Equipment Storage Area	B	AOC 9-12	64	**no**	yes	Inhalation of CVOCs via migration into indoor air.
Building 52 Former Hazardous Materials Storage Area	OT	AOC 10-2	65	**no**	yes	Inhalation of chloroform via migration into indoor air.
Building 62 Hazardous Materials Storage Area	SEO	AOC 13-1	72	yes	yes	None
Building 37 Proposed Electrical Substation	OT	AOC 14-7	79	yes	yes	None
Slope West of Building 53	OT	not designated	80	yes	yes	None
Building 51L Groundwater Plume Source Area	B	not designated	81	**no**	**no**	Inhalation of CVOCs via migration into indoor air.
Building 71B Lobe Source Area	B	not designated	83	**no**	yes	Not evaluated in HHRA
Building 56 Construction Site	B	not designated	87	**no**	yes	Not evaluated in HHRA
Building 58 Electrical Substation Construction Site	OT	not designated	89	**no**	yes	Not evaluated in HHRA

(a) Locations are shown on Figure 1. B: Bevalac, OT: Old Town, SS: Support Services, WO: Western Outlying Area; SO Southeastern Outlying Area

(b) "No" indicates Theoretical Incremental Lifetime Cancer Risk (ILCR) exceeds 10^{-6} or the Hazard Index (HI) equals or exceeds 1.0 for residential land use for soil pathway

(c) "No" indicates soil concentrations exceed upper-limit Media Cleanup Standards, indicative of theoretical Incremental Lifetime Cancer Risk (ILCR) greater than 10^{-4} or the Hazard Index (HI) greater than or equal to 1.0 for institutional land use for soil pathway..

These measures might include:

- Excavating or remediating contaminated soil to levels that meet the criteria for unrestricted land use.

- Collecting soil gas samples at the units where inhalation of CVOCs via migration into indoor air is the risk pathway of potential concern. Soil gas sampling would provide the data to estimate risks more directly and accurately than the soil sampling data from which the potential risks were previously estimated.

- If not done previously, collecting additional soil samples to obtain a 95-percent upper confidence limit (UCL) on the arithmetic mean of the sample concentrations. This method is acceptable only if the sample size is greater or equal to eight and the percentage of non-detect values is less than or equal to 80%. As an alternative, calculating a spatially-weighted risk estimate might be proposed to DTSC, if the existing data do not indicate the presence of localized hot spots (areas of high concentration).

- If the unacceptable risk is based on a single sample result, collecting additional samples immediately adjacent to the outlier. This data would be used to show that either the elevated concentration is no longer present or the elevated concentration is extremely limited in horizontal and vertical extent. The area of the outlier could also be excavated if required by DTSC.

2.2 RESTRICTIONS AT RADIOLOGICAL UNITS

The United States Department of Energy (DOE) has specified restrictions on the use of the eight identified radiological units (Table 1). For the two inactive and abandoned radioactive waste storage tanks at Building 74, DOE did not release the structure, equipment, or area from any existing controls. In addition, the Building 75A Radioactive Waste Storage Area was specifically designated for reuse by the Berkeley Lab Radiation Protection Group, in accordance with Title 10 CFR 835 Occupational Radiation Protection at DOE Facilities. Institutional uses for these three units must comply with any controls set by the Berkeley Lab Radiation Protection Group. For the remaining five radiological units DOE stipulated that release of the areas to the general public was not authorized. All eight radiological units are therefore restricted from residential use. The locations of the eight units are shown on Figure 3.

SECTION 3

SOIL MANAGEMENT

3.1 OBJECTIVE

Berkeley Lab policy and federal and state regulations mandate that Berkeley Lab complies with environmental regulations governing the handling, transportation, and disposal of potentially contaminated soil. The objective of this section is to establish a policy and set of procedures for the management and disposal of waste soils generated during construction activities or other activities that might disturb contaminated soil at Berkeley Lab. Based on the site characterization data collected during the RFI, and the soil cleanups that have been completed, it is not anticipated that soil containing contaminants at hazardous levels will be encountered during future construction activities. However, soil containing contaminants that exceed regulatory levels for special handling, transportation, and disposal requirements may be encountered. Since the Berkeley Lab Waste Management Group has established policies and procedures for management and disposal of hazardous, radioactive, and mixed wastes generated by all Berkeley Lab activities, this Soil Management Plan provides the requirements only for non-hazardous and clean waste soil.

3.2 CLEAN, NON-HAZARDOUS, AND RADIOACTIVE SOIL

A *Soil Disposal Plan* (Berkeley Lab, 1993) was prepared by the ERP in December 1993 to manage the removal and disposition of waste soils generated during ERP field activities. The Soil Disposal Plan provides a detailed methodology for the selection of chemical analyses required to classify excavated soils. The detailed methodology is not included in this Soil Management Plan; however, the applicable excavated soil classifications are noted below.

<u>Clean Soil</u>

Clean soil is defined as soil which contains metals at concentrations within Berkeley Lab background levels and which is also not contaminated with hazardous organic compounds or radioactive substances. Table 3 lists the upper estimate of background concentrations of metals

in the soil at Berkeley Lab (Berkeley Lab, 2002a). These values supersede the background soil values included in the Soil Disposal Plan (Berkeley Lab, 1993).

Table 3
Upper Estimates of Background Concentrations of Metals in Soil at Berkeley Lab (Berkeley Lab, 2002a)

Metal	Concentration (mg/kg)
Antimony	< 10
Arsenic (Great Valley Group)	42
Arsenic (other units)	24
Barium	410
Beryllium	1.1
Cadmium	5.6
Chromium	120
Cobalt	25
Copper	63
Lead	57
Mercury	0.5
Molybdenum	< 5
Nickel	270
Selenium	5.1
Silver	3
Thallium	10
Vanadium	90
Zinc	140

Non-Hazardous Soil

Excavated soil with detectable levels of hazardous substances that are below applicable Federal and California hazardous waste standards are classified as non-hazardous materials. This category would also include soil with concentrations of metals above the upper estimate of the Berkeley Lab background level but below the Federal and California hazardous waste standards. Hazardous waste standards are described in the Soil Disposal Plan (Berkeley Lab, 1993). Regulatory limits/standards noted in the Soil Disposal Plan should be confirmed to ensure that they are current. It should be noted that since the upper estimate of background is a statistically estimated value, concentrations above this value could still represent naturally occurring levels.

Radioactive Soil

Radioactive soil is defined as soil with detectable activities of radionuclides (i.e., curium-244 or tritium) above background levels.

3.3 EXCAVATION AND CONSTRUCTION ACTIVITIES

Preconstruction Evaluation of Soils

Prior to beginning any penetration action of ground or existing surfaces at Berkeley Lab, a Permit to Penetrate Ground or Existing Surfaces of LBNL Property must be obtained in accordance with requirements of Administrative Procedure (ADMN-053). Section 4.0 of the Procedure is a Ground or Existing Surfaces Penetration Job Safety Analysis (JSA) Checklist, which includes an Existing Contamination Evaluation as Item 48. The Administrative Procedure (ADMN-053) is included as **Attachment 1** to this Soil Management Plan.

After it is determined that soil is to be disturbed at a project site, the responsible individual/project manager or sponsoring-group representative will notify the Environmental Services Group (ESG) to initiate a preconstruction site evaluation. The ESG will then evaluate the proposed project location to determine:

- The nature and extent of any contamination known or suspected to be present in the soil
- Whether any preconstruction soil sampling is required

The initial evaluation will consist of a review of attached Figures 4 through 8, which show the known locations of CVOCs (Figure 4); PCBs (Figure 5); petroleum hydrocarbons (Figure 6); PAHs, SVOCs, metal/cyanide, pesticides (Figure 7), and radionuclides (Figure 8) in the soil at Berkeley Lab. The location numbers on the figures are cross-referenced to Table 1, which lists where detailed information on the nature and extent of contamination at each of the identified units can be obtained. The reference sources include the various RFI reports (Berkeley Lab, 1994, 1995, and 2000), the *Human Health Risk Assessment* (Berkeley Lab, 2003a), and the CMS Report (Berkeley Lab, 2005). Additional supporting information can be found in the RFA

Report (Berkeley Lab, 1992). Information on contamination of the soil by radionuclides can be found in the *Summary of Radionuclide Investigations* report (Berkeley Lab, 2003b).

Other factors will also be considered in the evaluation of sampling requirements. If a project site is located over an area of CVOC-contaminated groundwater, particularly over the core area of the contamination (See the *Groundwater Monitoring and Management Plan* [Berkeley Lab, 2006]), the presence of VOC contaminated-soil should be suspected. The historical function of buildings or other facilities present on the project site should also be considered. CVOC-contaminated soil should also be suspected to be present throughout most of the Old Town area of Berkeley Lab (area of Buildings 7, 14, 16, 25, 25A, 44, 52, and 53).

In certain cases, soil excavated from sites may not require sampling. For example, soil analysis may not be necessary if there is no known or suspected contamination, the soil is to be reused on site, and the excavation area is small. Previous analyses of soil in the area may also preclude the need to collect additional samples or may limit the number of supplemental samples that need to be collected.

Construction Activities

After completion of soil cleanup specified in the CMS Report, levels of known soil contamination will be at concentrations that do not pose a risk to site workers, including construction or landscape maintenance workers. Therefore, Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training will generally not be required of construction workers whose activities disturb the soil. However, HAZWOPER training may be required if there is also potential for contact with contaminated groundwater (Berkeley Lab, 2006).

If a sufficient number or type of pre-excavation soil samples was not collected to comply with landfill acceptance criteria or to document that the soil is clean, additional soil sampling will be required. Such samples can be collected from the soil as it is being excavated or from the soil stockpiles/bins. Excavated soil shall be managed in a way that will not cause sediment in storm water runoff. Excavated soil that is suspected or known to be contaminated shall be

placed in covered bins or other sealed containers, or stockpiled and covered with plastic sheeting held in place.

Although project sites should be adequately characterized prior to construction, contaminated soil could be unexpectedly encountered during excavation. The Project Manager or sponsoring group representative is required to notify ESG immediately when suspected contamination is discovered. Construction or other work in the affected area shall be stopped, and the area shall be cordoned off until an evaluation can be made.

3.4 SOIL DISPOSAL

Clean Soil

Berkeley Lab has a strong commitment to waste minimization and pollution prevention to substantially reduce waste generation, increase recycling, and purchase "green" products. This policy applies to all site operations, associated support operations, and site contractors who generate any type of waste, including solid (office trash, construction and maintenance debris), hazardous, radioactive, and mixed waste. To support this policy, clean excavated soil will be reused onsite (such as for fill or other construction purposes), to the extent practicable. If on-site reuse is not practical or cost effective, clean waste soil will be disposed of in a Class III or other acceptable landfill. The landfill may require specific analytical testing to document that chemical concentrations do not exceed their waste acceptance criteria.

Non-Hazardous Soil

Non-hazardous contaminated soil will be disposed of in a Class II or other acceptable landfill, depending on the acceptance criteria of the landfill. The landfill may require analytical testing of the soil to document that chemical concentrations do not exceed their waste acceptance criteria.

Radioactive Soil

Radioactive soil will be disposed of in a facility licensed to dispose of Class A low-level radioactive wastes (LLRW), such as the Envirocare facility located in Clive, Utah. Approval for disposal must be obtained from DOE prior to offsite transport.

SECTION 4

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LIST OF FIGURES

Figure 1. Locations of Chemical and Radiological Soil Units, Lawrence Berkeley National Laboratory.

Figure 2. Locations of Units Restricted to Institutional Land Use.

Figure 3. Locations of Radiological Units Not Released for Reuse by General Public.

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Figure 5. Locations of Polychlorinated Biphenyls (PCBs) in the Soil.

Figure 6. Locations of Petroleum Hydrocarbons (TPH) in the Soil.

Figure 7. Locations of Other Contaminants in the Soil.

Figure 8. Locations of Radionuclides in the Soil.

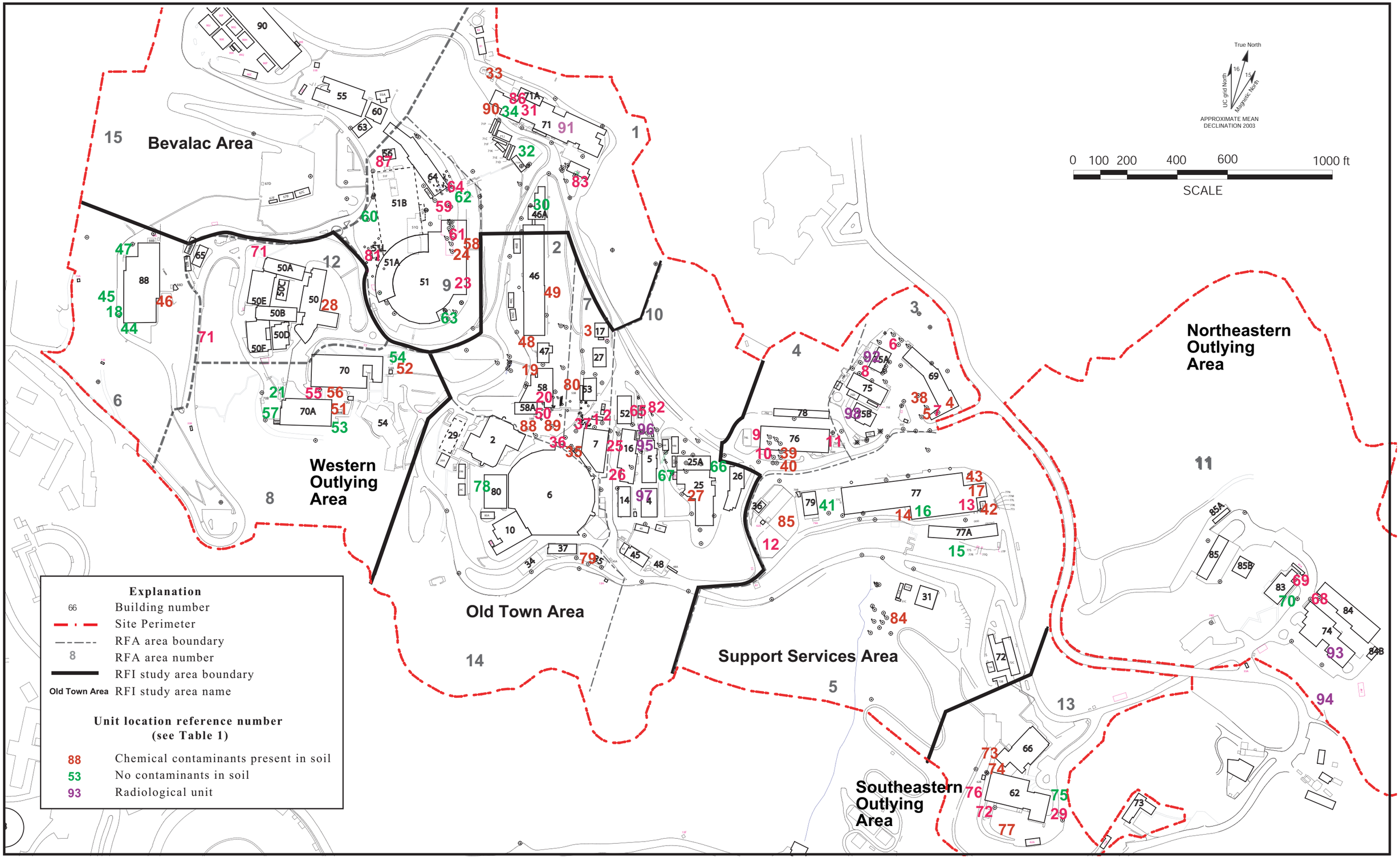

Figure 1. Locations of Chemical and Radiological Soil Units, Lawrence Berkeley National Laboratory.

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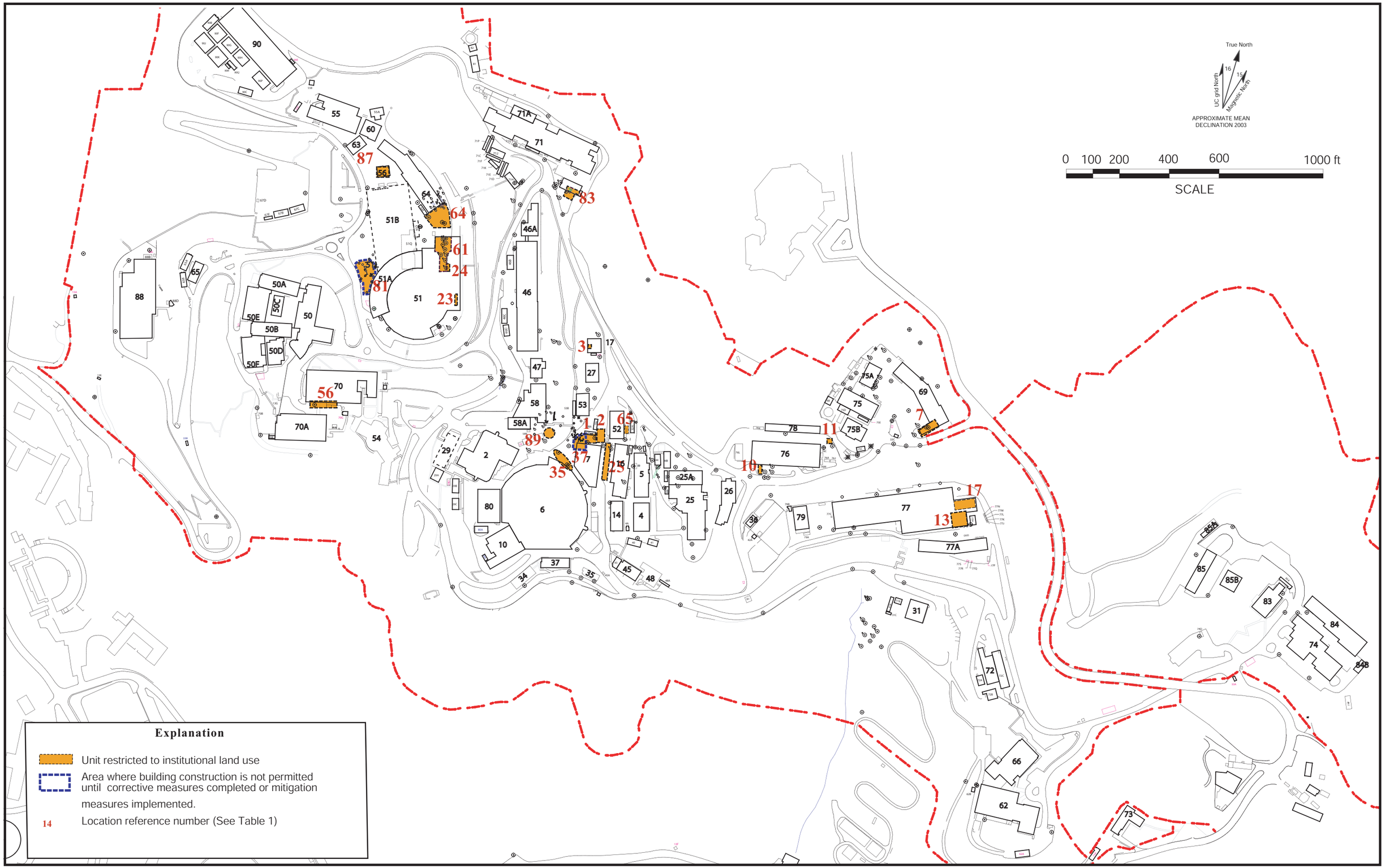

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Figure 2. Locations of Units Restricted to Institutional Land Use.

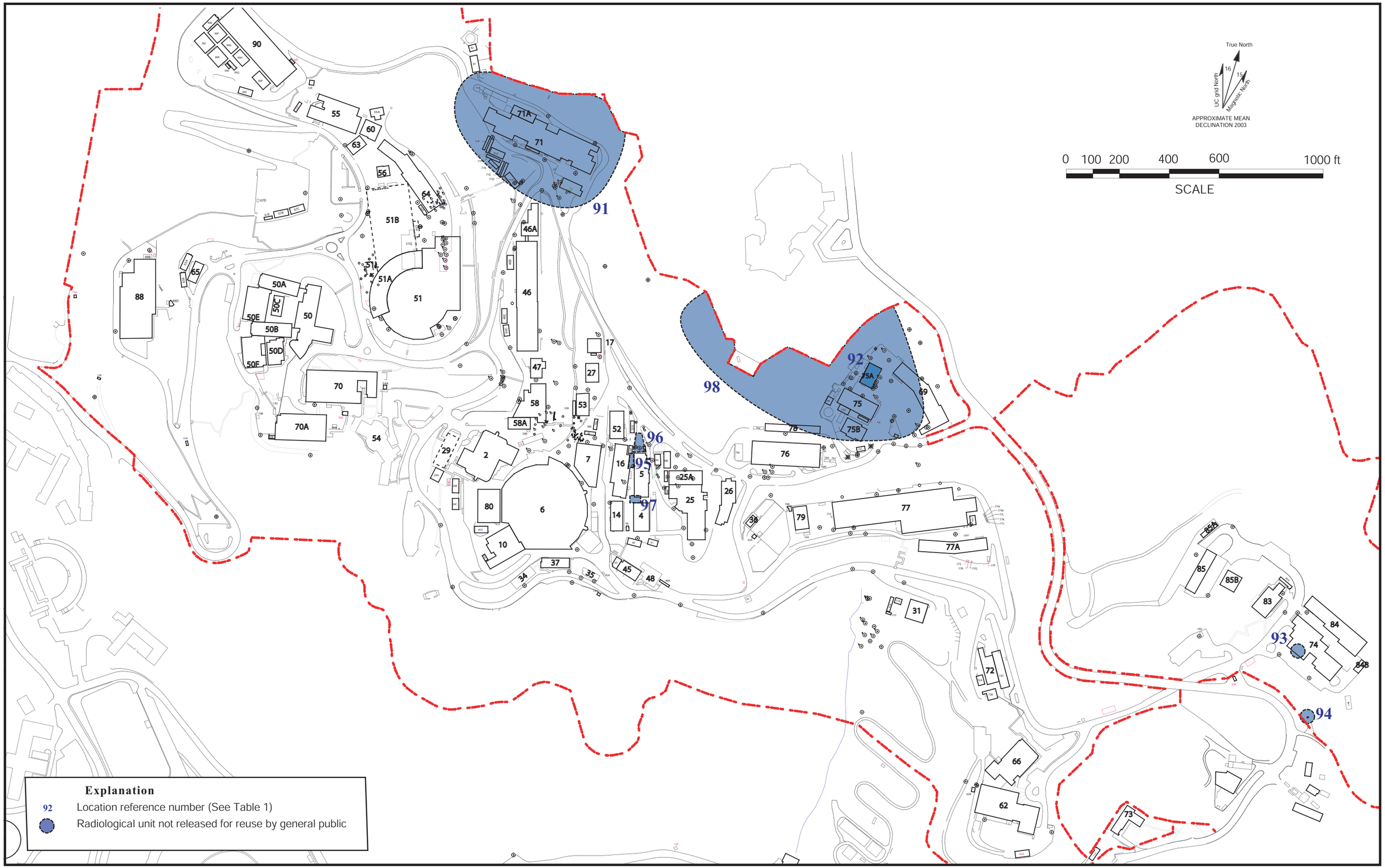

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Figure 3. Locations of Radiological Units Not Released for Reuse by General Public.

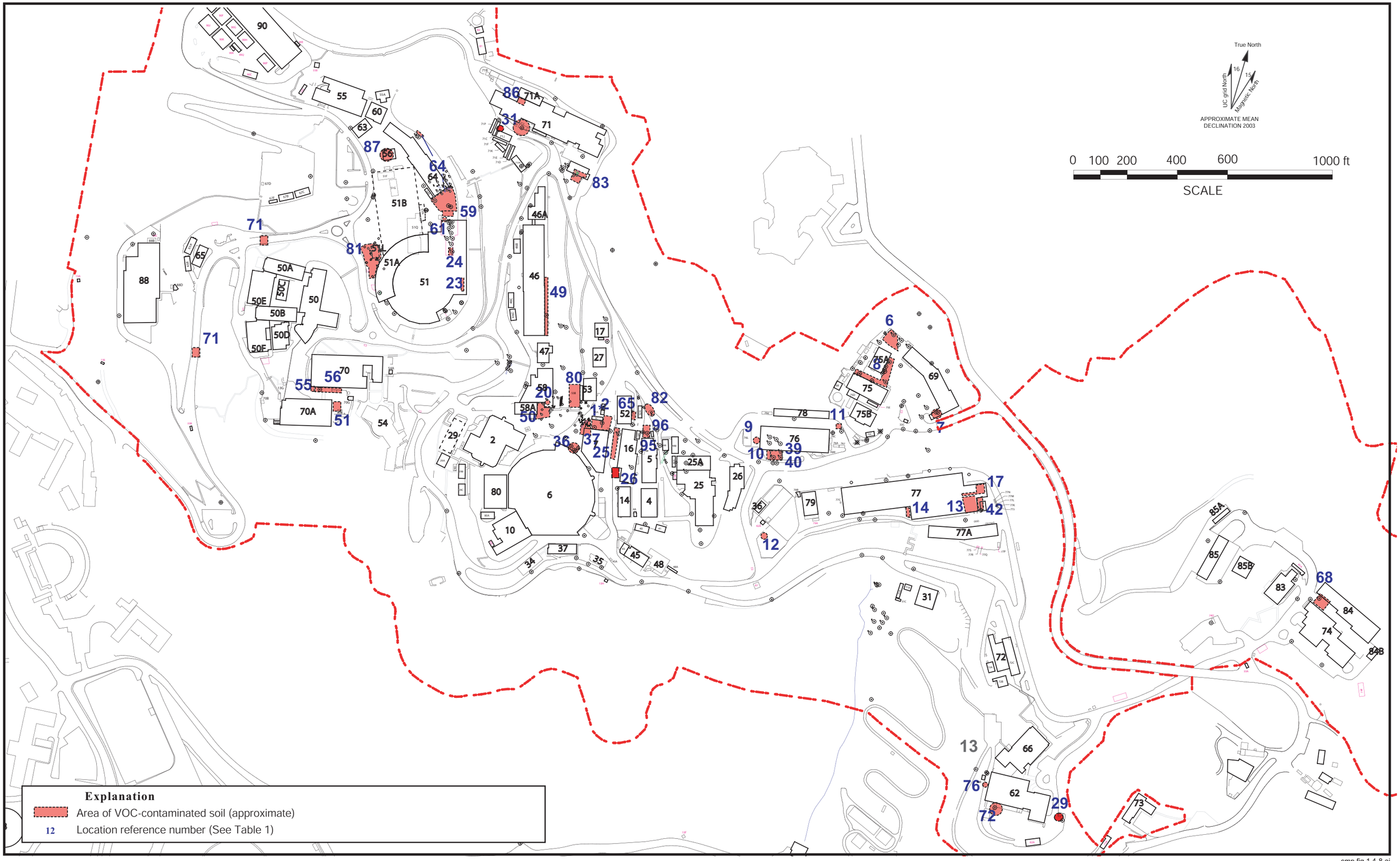

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Figure 4. Locations of Volatile Organic Compounds in the Soil.

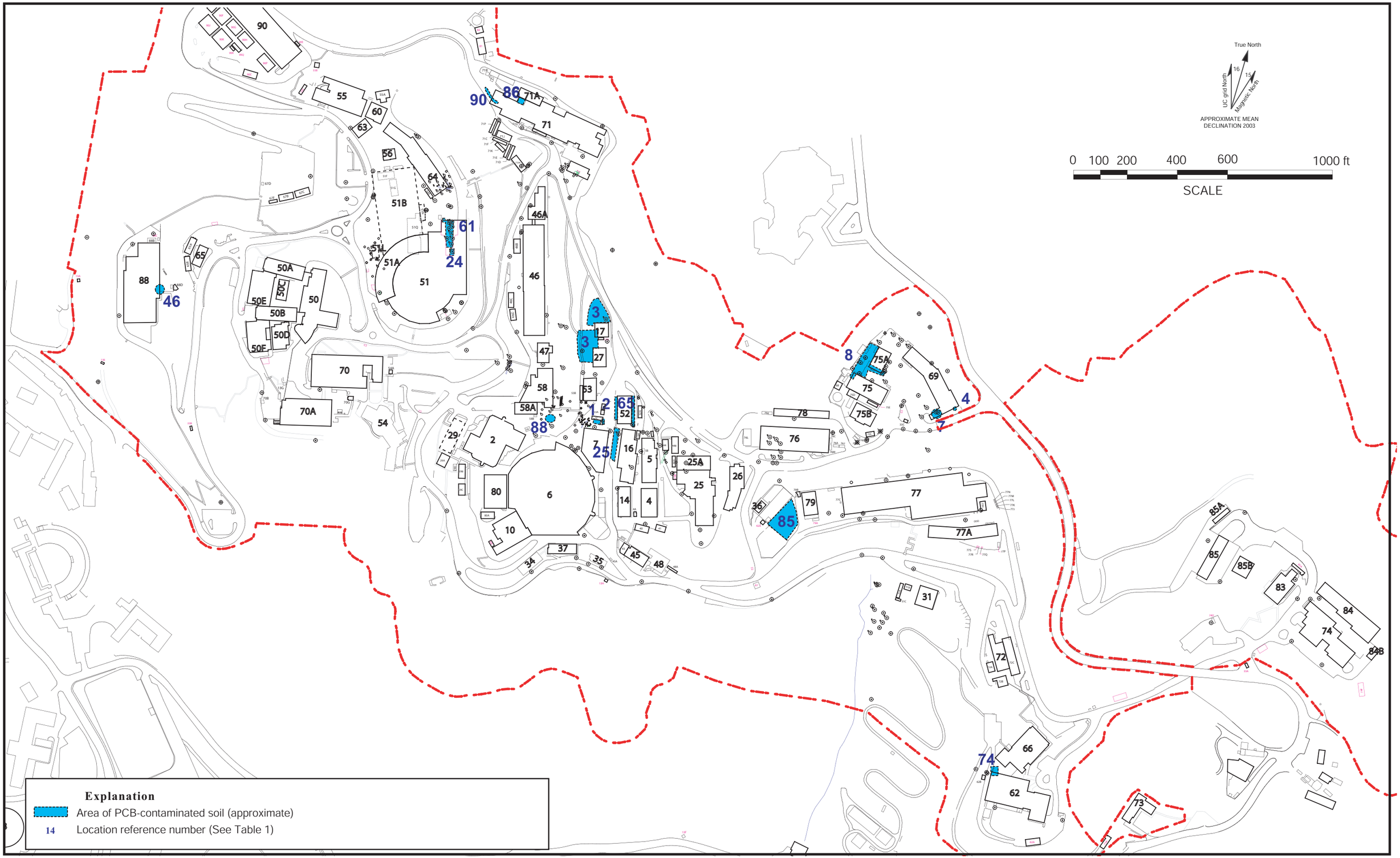

Figure 5. Locations of Polychlorinated Biphenyls (PCBs) in the Soil.

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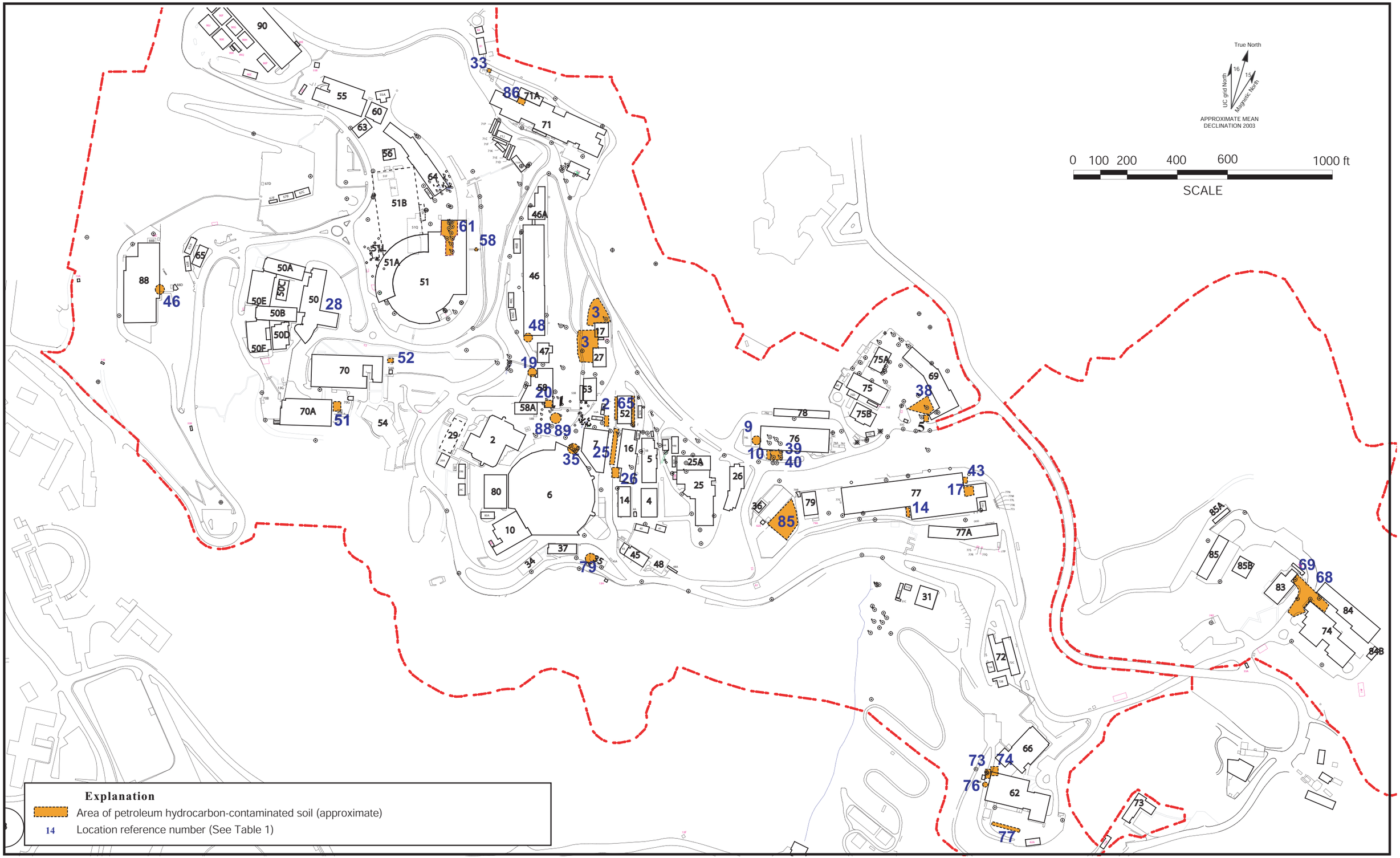

Figure 6. Locations of Petroleum Hydrocarbons (TPH) in the Soil.

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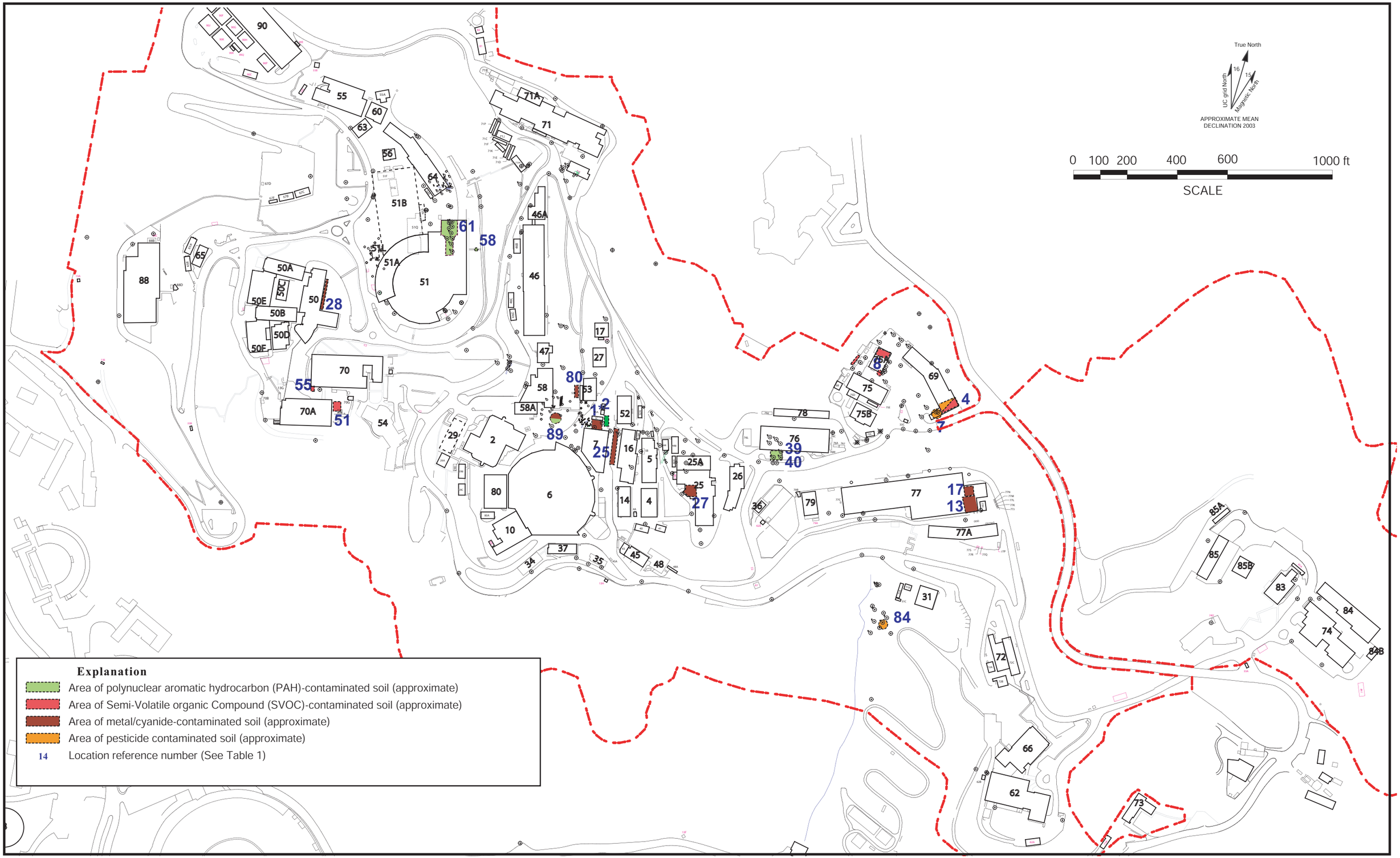

Figure 7. Locations of Other Contaminants in the Soil.

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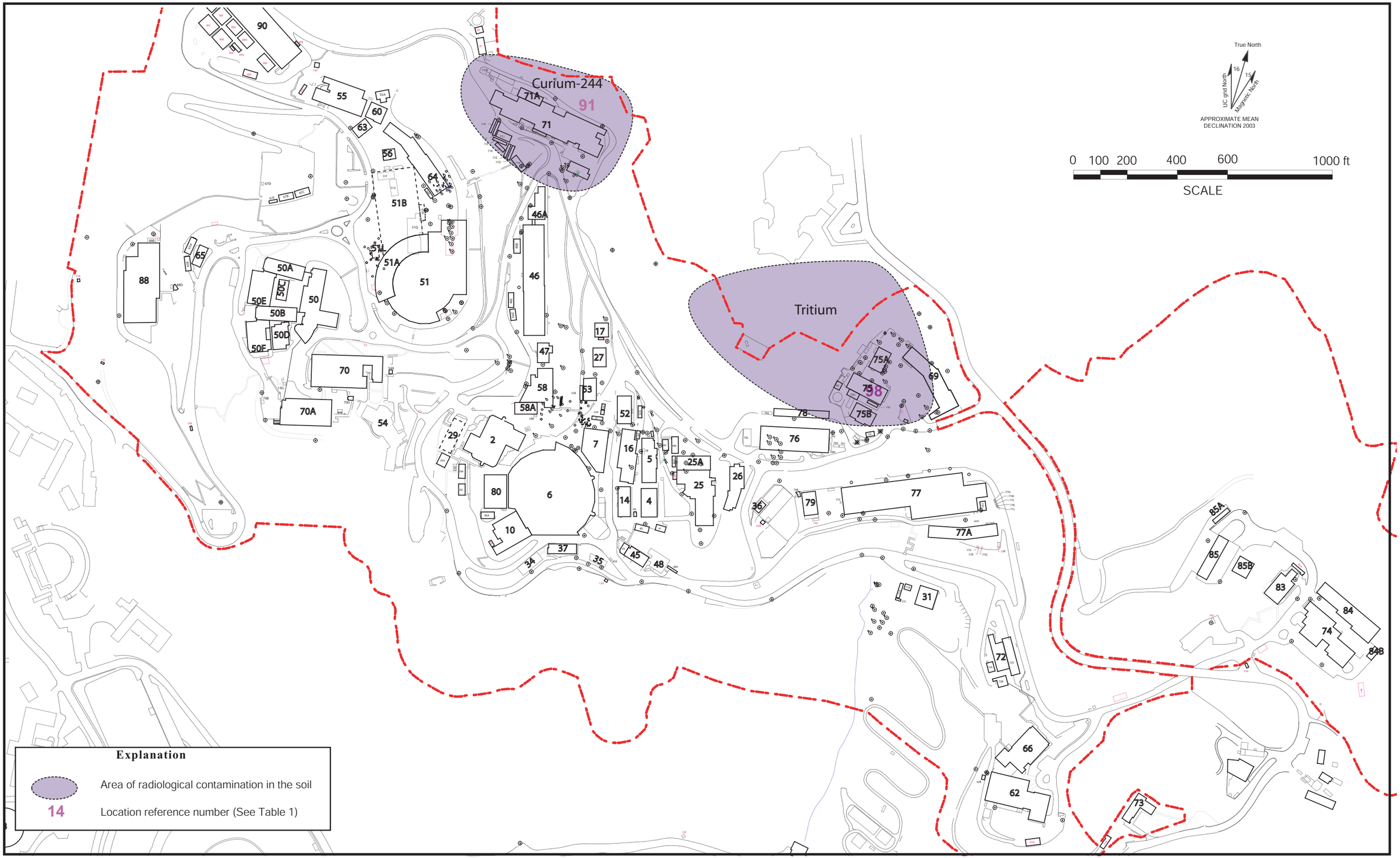

Figure 8. Locations of Radionuclides in the Soil.

smp fig 1,4-8.ai
1/06

Attachment 1

Permit To Penetrate Ground or Existing Surfaces of LBNL Property,

Administrative Procedure – Document Control, ADMN-053.

PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY

ADMINISTRATIVE PROCEDURE – DOCUMENT CONTROL

1.0 OBJECTIVE:

This procedure defines the steps necessary for the safe penetration of ground or existing surfaces of LBNL properties and covers those institutional requirements that must be completed prior to beginning any penetration action in any surfaces in LBNL. Of particular concern is the prevention of contact with live electrical conductors or other significant hazards (i.e., natural gas, water lines, compressed air lines, etc). The intent of this procedure is to minimize the chance of injury or death to personnel and to protect known or unknown buried utility lines. This will minimize disruption of essential services when penetrating or excavating the ground surface of LBNL property. The objectives of this procedure are to assist Laboratory Management with the accomplishment of the following:

A. Maintain employee health/safety.

B. Protect the environment and real property.

C. Ensure operational reliability of concealed utility systems.

D. Ensure that Penetration Permits are tracked, reviewed, approved, distributed, and revised as necessary according to standard Facilities Division document control procedures.

E. Improve communication with personnel involved in the permit process.

1.1 Application:

This procedure applies to all work that requires penetrations of existing surfaces of LBNL and LBNL leased buildings where the surface penetration work is managed, supervised and controlled by LBNL personnel. The LBNL Permit to Penetrate Ground or Existing Surfaces of LBNL Property (here known as Penetration Permit) is required for all penetration of any surfaces of depth greater than 1-1/2 inches at LBNL.

1.2 Scope:

1. The permit is required for all work performed at LBNL that involves penetration of any landscape ground surfaces, walls, columns, floors, and ceiling deeper than 1-1/2 inches.
2. The permit must list special conditions and potential hazards, and clearly identify equipment and underground utilities that will be affected.
3. The permit must be carefully reviewed by Facilities Division personnel, its distribution must be properly controlled, and the fulfillment of these conditions must be documented.

1.3 Special Instructions:

1. Equipment and training required:
   a. Electronic sensing device (Locator).
      Operator must be trained and must be certified as defined by the professional locator competency standards and performance criteria of the National Utility Locating Contractors Association (NULCA) and instrument manufacturer.
   b. Confined Space training and procedures.
   c. Understanding the use of barricades, sand, base rock, concrete, asphalt paving (blacktop), etc.
2. Any core drilling or saw-cut operations including ALS that remove concrete volumes greater than 4″ in diameter shall require the approval of the LBNL Design and Construction Department Structural Engineer.
3. Excavation within 30 inch radius of the marked utility must be excavated by hand using a flat tipped shovel, vacuum, or excavated with appropriate safe technology, such as an air knife until

the utility is located or the excavation has reached the required depth. High pressure water excavator is specifically prohibited due to the possibility of water leaking into high voltage underground electrical duct banks/conduits.

For gypsum board (sheet rock) wall surface penetration; a penetration less than the 1-1/2 inches in depth will be made with an acceptable area removed to expose the interior wall cavity for utility location(s) if necessary. As a result, an electronic survey may be conducted, but a penetration permit will not be required.

If the destructive process is to be used for excavation after underground utilities are located, approval must be obtained from the Project Manager to proceed. The Utilities Coordinator must shut-off and/or secure located utilities by Lockout/Tagout (LOTO) procedures if applicable.

4. Contract Document Requirements.

The LBNL Master Specification includes the requirement that the Subcontractor obtains an approved Penetration Permit prior to any ground penetration, adhere to the conditions during work, and take financial responsibility for any damage to utilities or other resulting losses.

PM shall ensure that the following sections of the specifications are in place, revise if necessary for specific project needs.

a. Master Specification Section M01020, paragraph 1.19.A, Permit to Penetrate Ground or Existing Concrete Surface.

b. Master Specification Section M01210, paragraph 3.01, Safeguards – Existing Equipment, Underground Utilities and Artifacts.

1.4 Addendum:

1. Draft Memorandum of Understanding and Request for Pub. 3000 Variance between the LBNL Advance Light Source Division, the Facilities Division, and the EH&S Division, dated March 28, 2005.

1.5 Responsibilities and controls:

Originators:

Michael C. Dong **Facilities Mechanical Section Chief, Facilities Division, Design & Construction Department**	**Date**
Dennis Nielsen **Technical Services Manager, Facilities Division, Plant Operation Department**	**Date**

Concurred by:

Jerry Ohearn **Department Head, Facilities Division, Design & Construction Department**	**Date**

Approved by:

Steve Black **Department Head, Facilities Division, Plant Operation Department**	**Date**

Glossary of Terms

Utility Coordinator: Person who is trained to use special designed instruments to find utility lines buried underground and responsible for completion of Penetration Permit in accordance with ADMN-053.

Non-destructive Means of Soil Removal: Soil removal by use of vacuum, or excavated with appropriate safe technology, such as an air knife, vacuum or hand digging (flat tipped shovel). Use of high pressure water excavator hand tools is specifically disallowed due to possibility of water leaks into underground high voltage electrical duct banks/conduits.

Destructive Means of Soil Removal: Soil removal by use of powered or heavy equipment.

Soil Excavation: Soil removal by use of non-destructive and /or destructive means.

Area Utility Sheets (U-sheets): Drawings that shows the existing underground utilities in an area of 1,000 feet wide in the East-West directions and 400 feet high in the North-South directions.

Exterior surfaces: 5’ or more from the building exterior wall surfaces.

Interior surfaces: All indoor surfaces including up to 5’ from the building exterior wall surfaces.

LBNL Property: LBNL property is defined to include all properties within the LBNL site and the leased buildings.

Locator: Special designed instruments used to find utility lines buried underground.

2.0 PERMIT PROCESS:

The following process defines the steps for penetration or excavation of any depth greater than 1-1/2 inches at LBNL.

STEP	RESPONSIBLE PERSON	ACTION
1	Project Manager (PM) Subcontractor PM/Requestor Subcontractor/ Requestor PM/ Superintendent/ Requestor	**STEP 1: PENETRATION PERMIT REQUEST WRC** The PM shall ensure that subcontractors are informed about LBNL Penetration Permit requirements so that they will allow for these costs in their bids. The requirement for the LBNL Penetration Permit and underground utilities location prior to excavation must be reviewed at Pre-bid meetings. The subcontractor is instructed to obtain the Penetration Permit from the Project Manager (PM). 1. The Subcontractor requests the PM to initiate the permit request. The request may be made any time after excavation is scheduled, but not so early that conditions may change prior to excavation. For efficiency of scheduling, the request should be made at least 10 working days before digging is scheduled to begin. The Subcontractor shall mark on the ground the extent of the excavation with **"WHITE"** color paint only (per Uniform Paint Color of California Government Code 4216, Underground Service Alert). **Note**: Once the Penetration Permit is issued, the subcontractor is responsible for all new underground utilities installed. As a result, additional Penetration Permit will not be required if the excavation is within the original boundaries of the initial Penetration Permit. If excavation extends beyond the original boundaries of the initial Penetration Permit, a new Penetration Permit with the new white painted boundaries shall be started. 2. The PM or Requestor (for LBNL In-house Labor job) shall obtain a copy of the "Ground or Existing Surface Penetration Job Safety Analysis Checklist" (hereafter known as JSA Checklist) from the Utilities Coordinator Shop Supervisor. The PM shall provide the Job Safety Analysis Reference Checklist to the Subcontractor and/or his subcontractor. 3. The Subcontractor and/or his Subcontractor or Requestor (for LBNL In-house Labor job) shall complete the JSA Checklist and forward the completed checklist to the PM and the PM shall forward the checklist to the Utilities Coordinator Shop Supervisor. The JSA Checklist shall be completed prior to any penetrations. 4. PM/Superintendent/Requestor shall request the Penetration Permit through the Work Request Center by completing the Permit Application form and fax it to the Work Request Center or use the Facilities web-page electronic version and paste into the online Work Request. For efficiency of scheduling, the request should be made at least 10 working days before digging is scheduled to begin. There is typically a 5 working day turnaround for the permit to be issued pending area access and locator sensing survey. For emergencies, there can be a 72 hour (workday) turnaround with Plant Operation Department Head approval. Poor planning does not constitute an emergency. 5. The PM/Superintendent/Requestor shall notify the closest Building Manager(s) of the upcoming construction activities.
2	Utilities Shop Supervisor	**STEP 2: WO TO UTILITIES COORDINATOR SHOP SUPERVISOR** 1. Utilities Coordinator Shop Supervisor gives Work Order and JSA Checklist to Facilities Utilities Coordinator if the exterior surface penetration is in the ground area and within LBNL site. For exterior concrete surface penetration, go to Step 2.2. For exterior surface penetration of LBNL leased building, the PM may proceed to authorize the Subcontractor to contact Underground Service Alert (USA) for underground utilities mark out. The Utilities Coordinator work scope consists of verification of the USA's underground utility mark out and issuance of the

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		Penetration Permit. Go to Steps 3 & 6. 2. For projects that require penetration through existing interior surfaces such as floors, walls and ceiling or exterior concrete surfaces in LBNL site and leased buildings, Utilities Coordinator Shop Supervisor shall initiate a task request to an outside Subcontractor who is qualified to determine the sub-surface utilities and structural components regarding specific location and depth prior to permit issuance. The task request shall include a completed JSA Checklist. The Utilities Coordinator Shop Supervisor will approve Subcontract Locators for work onsite at LBNL only if they have met all training and certification requirements. Under this procedure, Subcontractor firms performing work for LBNL retain responsibility for the health and safety of their personnel while on the job site. For interior surface penetration of the LBNL leased building, the Utilities Coordinator shall provide complete issuance of the Penetration Permit. Go to Steps 3 & 6.
3	**Utilities Coordinator**	**STEP 3: UTILITIES COORDINATOR PERMIT HOUR CLOCK** Utilities Coordinator Shop Supervisor starts the schedule for the permit at this time. Confirmation of receipt of the permit will be made to the requestor 24 hours after the receipt of the Work Order from Work Request Center. For efficiency of scheduling, the request should be made at least 10 working days before digging is scheduled to begin. There is typically a 5 working day turnaround for the permit to be issued pending area access and locator sensing survey. For emergencies, there can be a 72 hour (workday) turnaround with Plant Operation Department Head approval. Poor planning does not constitute an emergency.
4	**Utilities Coordinator**	**Step 4: Site Drawing Review** 1. Review available sub-surface utility maps (Area Utility Sheets (U-sheets)) for exterior underground infrastructure utilities and/or building underground utilities if the permit application is for interior surface penetrations. 2. Review drawings and other historical documentation which are available in B90F, Project Stick Files, and microfiche system. 3. Collect information from knowledgeable employees based on personal recollection of construction in a particular area. 4. Locate, on prints/maps, all underground utilities in work area. 5. Make copies of all relevant drawings. 6. Mark area defined by work requested on drawings to be included with permit. 7. Review any unexpected problems with PM/Superintendent/Requester.
5	**Utilities Coordinator**	**STEP 5: SITE LOCATOR SENSING SURVEY** 1. Thoroughly sweep work area with applicable Locator(s). Look for signs of recent excavations, patched asphalt, etc. particularly around nearby mechanical and electrical equipment pads or substations. Any new unrecorded utilities in these areas may extend into the permit area. Disconnected electrical circuits may need to be turned on to provide a flow signal where they could be crossing the permit area but not be detectable due to lack of current flow. Do not assume anything, if in doubt, get assistance from the appropriate building trades' supervisor and together clear the discrepancies. 2. Compare the location and depth of underground utility lines found using Locator with the location and depth shown on prints/maps. 3. Clear up all discrepancies between Locator findings and locations shown on prints/maps. 4. Mark the center line of buried utilities above ground using Uniform Color Code and marking standard consistent with California Government Code, 4216. Extend marks beyond area to be excavated so they will be visible throughout work. 5. Clearly indicate utility lines and shut-off valves on prints/maps. 6. All electrical wiring is to be considered energized until de-energized and Locked

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		out/Tagged out by a qualified electrical worker. 7. Mark area defined by work requested on surface to indicate extent of excavation. 8. Review any unexpected problems with PM/Superintendent/Requestor.
6	Utilities Coordinator	**STEP 6: PERMIT PREPARATION** Utilities Coordinator completes the permit, including: 1. Fill out the Penetration Permit. 2. Prepare notification list of persons/agencies to be notified before digging begins (if necessary). 3. Review available utility maps. 4. Locate utilities in the field. 5. Mark area defined by permit on maps to be included with permit. 6. Define requirements during initial survey of specific area with details for concrete excavation and any other special conditions to be met on the Penetration Permit. 7. Review any unexpected problems with PM/Representative/Requestor. 8. Complete the Permit Checklist. 9. Notify PM/Representative/Requestor that Permit is ready. 10. Give Penetration Permit, marked-up copy of prints/maps, and, if necessary, special conditions sheet and notification list to PM/Superintendent/Requester.
7	PM/Superintendent/Requestor Utilities Coordinator PM, Utilities Coordinator PM, Subcontractor	**STEP 7: SITE MEETING W/SIGNATURES** 1. Read and become familiar with this procedure. 2. Read and thoroughly understand Penetration Permit, marked-up copy of prints/maps, JSA Checklist, hold points and, if included, special conditions sheet, and notification list from Facilities Utilities Coordinator. Read and thoroughly understand all documents. 3. Discuss job with Facilities Utilities Coordinator, and clarify all uncertainties. 4. The PM/Requestor sets up a Pre-Dig Job Site Meeting at surface penetration site to issue the permit. The Pre-Dig Job Site Meeting shall include the Utilities Coordinator, PM/Requestor, excavation Subcontractor (person responsible for work); the General Contractor's Superintendent, LBNL Construction Safety Engineer and Inspector for the project. 5. The Utilities Coordinator reviews the permit, discussing details and answering any questions. All verbal directions issued during the site meeting, other than those in the permit, must be recorded in the permit. 6. The Utilities Coordinator and PM/Requestor sign the permit, completing LBNL approval. 7. The PM issues the permit to the Subcontractors, and obtains the Subcontractor's and sub-Subcontractor's signature accepting the terms of the permit.
8	Utilities Coordinator	**STEP 8: POSTING OF PERMIT** 1. The Utilities Coordinator notifies the PM/Requestor of the date that the permit will be posted; typically the same as the Job Site Meeting or job start date. 2. The Utilities Coordinator copies the permit, retaining the original in the Utilities Coordination Office, and provides a copy of the approved and official permit to the PM/Requestor and Inspection Section of the Design & Construction Department. 3. The Utilities Coordinator posts or arranges for posting the permit at the job site prior to the start of excavation.
9	Inspector, PM/	**STEP 9: PM/SUPERINTENDENT/INSPECTOR/REQUESTOR COMPLIANCE** 1. Read and thoroughly understand Penetration Permit, marked-up copy of

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
	Superintendent	prints/maps, JSA Checklist, hold points and, if included, special conditions sheet, notification list from Facilities O&M Utilities Coordinator. Read and thoroughly understand all documents. 2. The LBNL Inspector and LBNL PM/Superintendent/Requestor shall confirm permit compliance with signatures, dates, and times. The LBNL Inspector and PM/Superintendent/Requestor will verify that the approved Penetration Permit is posted conspicuously at the excavation site, readily available to the person doing the digging, and will inspect the excavation site as necessary to verify Permit conditions are met and safe practices are followed, stopping work and resolving problems as necessary with Utilities Coordinator, and Subcontractor.
10	**Utilities Coordinator, Inspectors, PM/Superintendent/Requestor** **Subcontractor or In-house Craft Shops**	**STEP 10: HOLD POINT ADMINISTRATION** 1. Hold points identified on the permit will typically be administered as follows, although the LBNL representative who initiates the hold may specify release as appropriate to the circumstances: a. Utilities Lockout/Tagout, authorization to proceed: Utilities Coordinator or M&O Maintenance or LBNL leased building manager/project superintendent. b. Exposed utilities inspected, authorization to proceed: Utilities Coordinator or LBNL leased building manager/project superintendent. c. Inspection of excavation prior to backfill, utility's three-dimension coordinates recorded by LBNL Subcontracted Surveyor, authorization to proceed: Inspector. For LBNL leased building, Inspector shall confirm as-built conditions are marked on the Subcontractor's set of as-built drawings. d. Resolution of unusual conditions encountered, authorization to proceed: PM or as designated by PM. Resolution will be coordinated by the Utilities Coordinator, or PM/Superintendent/ Requestor, Inspectors or LBNL leased building manager/project superintendent. M&O craft supervisors (e.g. electricians or plumbers) and/or D&C Department A&E Chief Engineers (Mechanical, Electrical or Civil/Structural) will be contacted as appropriate. e. Resolution of encountered artifacts is with the LBNL archeologist as necessary. Authorization to proceed: PM. PM shall contact Facilities Planning: Environmental Regulations Specialist to contact LBNL Archeologist. 2. **IF** utility line(s) are found and identified, notify Facilities O&M Utilities Coordinator immediately. Place **HOLD** on job until LBNL Surveyor determines and records the actual alignment and depth of the located utility line(s). For LBNL leased buildings, the LBNL leased building manager/project superintendent shall confirm that the information is recorded on the Subcontractor's set as-built drawings. 3. PM/Superintendent/Requester shall contact LBNL subcontracted Surveyor to record the actual alignment and depth of the located utilities. Not required for LBNL leased buildings. Authorization to release: PM or Inspector. 4. At completion of work, place **HOLD** on job until LBNL subcontracted Surveyor determines and records the actual alignment and depth of the utility line(s). HOLD will be released after the requirements are met. Not required for LBNL leased buildings. Authorization to release: PM or Inspector. The PM or Inspector may release the HOLD if the following alternative work is performed by the Subcontractor. Alternatively, Subcontractor shall install reference points consisting of nail and hub/flagging at all changes in grade or alignment of the new pipeline and for all other utilities exposed by the excavation. The Subcontractor shall keep a separate written record referenced to each point with the following information:

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		(1) Offset and depth to top and centerline of utility, accurate to 0.1 feet (2) Type of utility (i.e. gas, water, etc.) (3) Size of utility (i.e. 2", 4", 16" wide duct, etc.) (4) Type of material of utility (i.e. cast iron, PVC, etc.).
11	**Subcontractor or In-house Labor Shop**	**STEP 11: PENETRATION WORK BEGINS** **HAND DIG ONLY:** 1. Depth of utility is known: Excavation within 30 inches radius of the marked utility must be excavated by hand using flat tipped shovel, vacuum, or excavated with appropriate safe technology, such as an air knife until the utility is located or the excavation has reached the required depth. Picks should be used with caution under these circumstances. High pressure water excavator is specifically prohibited due to the possibility of water leaking into high voltage underground power lines. 2. Depth of utility is unknown: If the depth of the utility is unknown at both ends of the job area which has been defined by the Requestor or Subcontractor, potholing must be performed using non-destructive vacuum, or excavation must be done with appropriate safe technology, such as an air knife, hand digging (flat tipped shovel), or compressed air tool such as bushing hammer with a spade bit (high pressure water excavator shall not be used) until excavation is exposed at the two ends of the utility and at every change of direction of the utility. When depth is verified, the PM may authorize destructive means to within a 30 inch radius around the utility. When 30 inch radius has been reached, non-destructive means must be used to expose the utility. **NOTE**: Where possible, shut-off and / or secure located utilities by Lockout/Tagout (LOTO) procedures before the excavation by destructive process is to start (per the Health & Safety Manual, Pub-3000, Chapter 18). All LOTO procedures shall be performed by LBNL Plant Maintenance Technicians (PMT)/Electrical Shop Electricians and coordinated by the Utilities Coordinator. For LBNL leased buildings, LOTO shall be performed by the LBNL leased building manager/project superintendent. 3. If it is necessary to hand dig 5 feet or deeper, follow the procedures outlined under OSHA and LBNL PUB-3000 Chapter 4, Section 10. 4. Watch for utility lines and indication of utility lines (sand backfill and warning identification tape) while carefully digging.
12	**Subcontractor, PM, Utilities Coordinator** **PM, Utilities Coordinator, Utilities Coordinator Shop Supervisor**	**STEP 12: PERMIT/PROGRESS VALIDATION** 1. All verbal conversations that allow modifications to the Penetration Permit shall be written on the permit. The specific details of the task and area shall then be authorized by signature (with date and time) of responsible parties involved. ANY and all change requests to a Penetration Permit, or extension of an existing permit, to be documented on the Penetration Permit, must receive the same level of review as in the original Penetration Permit process. 2. The Inspector evaluates whether the conditions of the Penetration Permit have changed such that continued work cannot be performed according to the original permit, and requires that a new permit to be issued. A new permit will require a total review of utilities drawings and locator survey if excavation area exceeds the original area approved and as indicated on the original Penetration Permit. The Utilities Coordinator issues a new permit if one is required by the Inspector. Otherwise, the Utilities Coordinator adds the extension dates on the permit original, and obtains the signatures required for the permit extension approval. Only a one-time consecutive 7 day extension is allowed. The Utilities Coordinator updates the permit and posts it at the job site.

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		3. The Subcontractor is responsible to ensure that a valid permit is obtained for the work being performed.
13	**Subcontractor** **Inspector, PM/ Superintendent**	**STEP 13: SUB-SURFACE WORK COMPLETE** 1. Pothole: **HOLD per Step 10.** HOLD shall be for a minimum of two hours. After two hours, the PM or Inspector may release the HOLD if the PM or Inspector verified that it is in compliance with Step 10. After each pothole, backfill with sand and mark results on the ground surface near the pothole with spray paint. Backfill immediately to prevent tripping or falling into hole. 2. Subsurface excavation: Three days before backfilling, the Project Manager shall be notified so that the LBNL subcontracted Surveyor can obtain the three-dimensional coordinates of all buried utilities. Buried utilities including the pipeline and any other utilities exposed during construction shall not be covered with backfill without the prior approval of the LBNL Inspectors. Coordination of this survey requirement is the responsibility of the Subcontractor. LBNL subcontracted Surveyor will be provided by the University when scheduled. The cost for delay or dig-up related to the Subcontractor's failure to schedule the utility survey shall be paid by the Subcontractor. At completion of all subsurface excavation / penetration work, place **HOLD** on job until LBNL subcontracted Surveyor determines and records the three-dimensional coordinates of the utility line(s) per Step 10. Survey is not required for LBNL leased buildings. 3. Inspector will notify PM/Superintendent to contact LBNL subcontracted Surveyor for the utility survey. Not required for LBNL leased buildings.
14	**LBNL subcontracted Surveyor** **PM/ Superintendent**	**STEP 14: RECORD(S) UPDATED W/AS-BUILTS** **HOLD per Step 10.** 1. LBNL subcontracted Surveyor determines and records the three-dimensional coordinates of the utility line(s). Not required for LBNL leased buildings. The LBNL leased building manager/project superintendent shall ensure that the Subcontractor's set of as-builds are updated to include the utility routing. Not required for LBNL leased buildings. 2. PM/Superintendent shall notify the LBNL subcontracted Surveyor to forward the recorded field information in AutoCAD format to the Utilities Engineer for the as-built of the Area Utilities Drawings (U-Sheets). Not required for LBNL leased buildings.
15	**Subcontractor or In-house Craft Shops**	**STEP 15: SUB-SURFACE UTILITY MARKING INSTALLED** **HOLD per Step 10.** Before backfilling for buried utilities over identification tape, the Inspector will verify that identification tape and tracer wire have been installed. Buried non-metallic utilities (electrical, mechanical, and civil) shall receive a tracer wire. 1. The tracer wire shall be installed on top of the buried utility crown. 2. The tracer wire shall be positively attached to the non-metallic buried utilities by plastic wire ties of similar type of attachment every 6 feet for straight run of utility and at all changes of direction. Tape shall be Polyken "930-35," Protecto-Wrap "310", or equal. 3. The ends of the tracer wire shall be exposed above the finished grade. 4. Install pre-cast concrete boxes at all locations where the ends of the tracer wire are exposed above the finished grade. The pre-cast concrete boxes shall not be more than 200 feet apart and shall contain a 24" coil of wire from each end of the tracer wire.

PERMIT PROCESS *Continued*

STEP	RESPONSIBLE PERSON	ACTION
		5. Tracer wire shall be continuous between boxes and shall be tested for continuity in the presence of Berkeley Lab's inspector. 6. Tracer wire shall be No. 10 AWG, copper wire with TW insulation. 7. Tracer wire shall be exposed above finished grade in the pre-cast concrete boxes at the transition where the non-metallic buried utility connects to the existing metallic utility. 8. Extend wire into valve boxes and terminate with a wire connector. Terminate wire from lines extending from mains to fire risers or building services 12" (300mm) above grade and cap with a wire connector. 9. Identification tape shall be installed 12" above the buried utility crown. The identification tape shall be continuous for the entire length of utility.
16	**Inspector**	**STEP 16: INSPECTION COMPLETE** At completion of work, HOLD will be released after inspection is completed, and the following determination made: 1. No defects found. 2. Minor repair required. 3. Major repair required. 4. Replacement required.
17	**Subcontractor or In-house Labor Shop**	**STEP 17: SUB-SURFACE WORK BURIED** All LBNL subsurface excavation backfill shall be per Contract Documents or LBNL standard drawing # 4BSTP039 for In-house work.
18	**Inspector** **Utilities Coordinator**	**STEP 18: PERMIT REMOVED AND CLOSED** 1. The Inspector will confirm with the Subcontractor that excavation is complete, including backfill, and remove the permit. 2. The Utilities Coordinator will set the electronic permit version to inactive (not current).
19	**Mechanical and Electrical Section Designer and Mechanical Section Chiefs**	**STEP 19: U-SHEETS UPDATE NOTIFICATION** The Mechanical and Electrical Section Designer will incorporate the as-build conditions to the U-sheets with the survey information from the LBNL subcontracted Surveyor. The Mechanical Section Chief will notify the Utility Coordinator Shop Supervisor that the U-sheets had been updated electronically and is ready for use. Not required for LBNL leased buildings.

3.0 PERMIT CHECKLIST:

Items	Checklists	Yes	No	Comment
1.	Has a Job Safety Analysis (JSA) Reference Checklist been completed?			
2.	Is Archaeologists Report (where necessary) required?			
3.	Is Wildlife Biologists Report (where necessary) required?			
4.	Is a Soil Engineering Excavation Evaluation (SEEE) (where applicable) required?			
5.	Have utility location maps, sketches, photos, etc included?			
6.	Has a soil penetration field survey been performed with applicable electronic locator?			
7.	Have As-Built building drawings or Area Utility Sheets (U-sheets) been reviewed?			
8.	Have historical construction project drawings and documents been reviewed?			
9.	Has information from knowledgeable employees based on personal recollection of construction in a particular area been collected?			
10.	Has a site map with enlarged project section showing the extent of the excavation been included?			
11.	Pre-start and Completed Project Notification List (Contact Names & Tel. #s).			
12.	Has a Hazard Assessment been completed?			
13.	Has LBNL Inspection Section of the Facilities Design & Construction Department been notified of permit issuance?			
14.	Has a copy of the approval permit been transmitted to the LBNL Inspection Section of the Facilities Design & Construction Department?			
15.	Utility Outages (where required) for: a. Voltage (High and/or Low) b. Compressed Air c. Water (Domestic, Industrial, Low Conductivity, and Treated) d. Natural Gas (High and/or Low pressure) e. Etc.			
16.	Has the Permit to Penetrate Ground or Existing Surfaces of LBNL Property been approved?			
17.	Has the PM notified the Building Manager, or Building Manager(s) closest to where there will be construction activities?			

4.0 GROUND OR EXISTING SURFACES PENETRATION JOB SAFETY ANALYSIS (JSA) CHECKLIST

This checklist is a reference only. Any additional requirements that the PM or Requestor deems necessary to assure safe-working conditions must take place. Federal OSHA requires that a qualified person perform a safety review of work and that a competent person supervise the work.

Prepared By: _____ **Date Prepared:** _____ **Permit #:** **WO:** _____

Signature: _____

		YES	NO	COMMENTS
1.	Have employees been trained in safe work practices and hazard recognition associated with working in and around excavation?			
2.	Have employees been familiarized with the appropriate excavation emergency procedures?			
3.	Does your excavator/laborer know about and is he/she following the 30″ buffer rule?			
4.	Is an observer present at all times during excavation?			

SURFACE ENCUMBRANCES (TREES, BOULDERS, HEAVY EQUIPMENT)

5.	Have all surface encumbrances, which may potentially pose a threat to employees working in or around the excavation, been removed or supported?			

UNDERGROUND INSTALLATION (SEWER, TELEPHONE, FUEL, ELECTRIC, WATER LINES, ETC.)

6.	Were the estimated location(s) of underground utility installations denoted prior to the opening of the excavation?			
7.	If on program facility, were program representatives contacted to assist in the location of any underground utilities prior to the opening of the excavations?			
8.	Have exposed underground utilities been adequately guarded or supported to protect employees?			
9.	Has an Outage request been submitted?			
10.	If an outage has not been requested, why?			
11.	If work will impact the Drainage Retention Basin or the berm around the Basin, contact PM.			

ACCESS AND EGRESS

12.	At a minimum, are all trench excavations of 4 feet deep or greater equipped with a stairway, ladder, or ramp every 25 feet of lateral travel?			
13.	Has a competent person designed all ramps/runways utilized for access and or egress for both personnel and equipment?			
14.	Have all steep-walled holes or trenches greater than 2 feet in depth been covered for the night or been provided with a ramp for sensitive species egress.			
15.	Have all ramps and/or runways constructed of two or more structural members been joined to prevent displacement?			
16.	Are all structural members utilized in construction of ramps and runways of uniform thickness?			

		YES	NO	COMMENTS
17.	Are all cleats and or other appropriate devices serving to connect runway structural members attached to the bottom of the runway to prevent trips or falls?			
18.	Are all structural ramps and runways constructed in a slip-resistant manner?			

EXPOSURE TO VEHICULAR TRAFFIC

19.	Are all employees associated with excavation activities and who may be exposed to vehicular traffic wearing appropriate high-visibility clothing?			
20.	Vehicle traffic (e.g., buses, trucks, autos) may also cause vibrations and trench/excavation wall loading: are safeguards in place, was traffic re-routed?			
21.	Is LBNL vehicle traffic warned of potential hazard with: road barriers, steel plates and operational flashing warning light?			

EXPOSURE TO FALLING LOADS

22.	Are employees working a safe distance from suspended loads handled by lifting and/or digging equipment?			
23.	Are employees maintaining a safe distance from vehicles, which are loading and unloading?			
24.	If occupied during loading and unloading, are haulage truck cabs equipped with a cap shield or canopy adequate to protect the operator from falling materials?			

WARNING SYSTEM FOR MOBILE EQUIPMENT

25.	Does the mobile equipment operator have a clear view of the edge of the excavation?			
26.	If not, are adequate hand signals, mechanical signals, and/or barricades in place?			

HAZARDOUS ATMOSPHERES, TESTING & CONTROLS

27.	Have all excavations in which potentially oxygen deficient, toxic or explosive atmospheres may exist, had adequate air monitoring performed?			
28.	Have adequate precautions been taken to prevent potential employee exposure to oxygen deficient, toxic or explosive atmospheres (i.e., ventilation/PPE)? Please, describe.			
29.	Is air monitoring conducted with sufficient frequency to ensure that work atmospheres remain safe? Please, describe.			

EMERGENCY RESCUE EQUIPMENT

30.	In excavation where hazardous atmospheres may exist or develop, is emergency rescue equipment including, but not limited to SCBAs, safety harness, and lifeline or basket stretcher available?			
31.	Are employees working in bell-bottom pier holes or similar deep and confined footing excavations wearing a safety harness and lifeline with a dedicated spotter in attendance?			

		YES	NO	COMMENTS
PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION				
32.	Are personnel prohibited from working in excavations where standing water is present?			
33.	Have adequate precautionary measure been implemented in excavations where standing water is present and in which personnel are required to work (e.g., trench, excavation shields, pumps, and/or safety harnesses and lifelines)? Please circle those that apply.			
34.	If water removal equipment is utilized to control the standing water in a trench excavation, does a competent person monitor this equipment to ensure correct operation?			
35.	If an excavation disturbs natural surface drainage, have ditches, dikes and/or sandbags been utilized to divert this drainage from entering the excavation?			
36.	Are excavations which have been subject to runoff from heavy rains or freeze thaw conditions been re-inspected by a competent person?			
STABILITY OF ADJACENT STRUCTURES				
37.	Are excavations which may undermine sidewalks or pavements prohibited?			
38.	Are excavation adequately protected via the installation of shoring or bracing where the stability of adjacent structures is endangered? Engineering Survey is required.			
39.	Are all excavations below the level of foundations or retaining walls prohibited?			
40.	If excavations are dug below the level of foundations or retaining walls, do they meet the following criteria? a. Is the excavation adequately supported (i.e., underpinning)? b. Is the excavation in stable rock? c. Has a registered professional engineer determined that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity. d. Has a registered professional engineer determined that the excavation poses no hazard to employees?			
PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL				
41.	Are all loose material, soil and equipment prevented from falling or rolling into the excavation by removing this material to a minimum of 2 feet from the edge of the excavation?			
INSPECTIONS				
42.	Are pre-work daily inspections of the excavation(s) performed and documented by the subcontractor superintendent and/or LBNL Construction Safety Engineer?			
43.	Are inspections of each excavation performed and documented on as-needed basis to check for evidence of the failure of protective systems, or the accumulation of hazardous atmosphere and other hazardous conditions?			

GROUND OR EXISTING SURFACES PENETRATION JOB SAFETY ANALYSIS CHECKLIST *Continued*

		YES	NO	COMMENTS
44.	Are inspections of each excavation performed and documented after every rainstorm or other occurrence, which may increase hazards?			
45.	Have adequate precautionary measures been implemented to protect workers where there is evidence of a potential hazard posed to employees working in and around an excavation.			

FALL PROTECTION

46.	Are the walkways or bridges equipped with standard guardrails where employees or equipment are required or permitted to cross over excavation?			
47.	Are remotely located excavations adequately barricaded or covered?			

EXISTING CONTAMINATION EVALUATION

48.	Has an EH&S evaluated the project site for possible contamination?			

PERSONAL PROTECTIVE EQUIPMENT

49.	Are the gloves and boots insulated and rated a minimum of Class 2 17kV with moisture absorbing liners and protective leather outers?			
CONCRETE PENETRATION				
50.	Have employees been trained in safe work practices and hazard recognition associated with concrete penetrations?			
51.	Have employees been familiarized with the appropriate emergency procedures?			
52.	Has proper coordination with Facilities personnel and other trades been met?			
53.	Has the location of embedded utilities been found? If yes, have LOTO procedures been followed for de-energization?			
54.	Are personnel performing penetration using proper personal protective equipment? The right safety gloves, safety shoes, safety glasses, ground fault interruption, & respirators?			
55.	Have all other methods the PM or requestor deems necessary to assure safe working conditions been met?			
56.	Has the nearest first aid kit, eyewash and telephone been located?			
57.	Does the working area require barricades? If yes, are they in place?			
58.	Have all special requirements for water dust control been met?			
59.	Is there adequate ventilation in the work area?			
60.	Is there adequate lighting in the work area?			

FACILITIES DIVISION

APPLICATION FOR PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY

THIS IS NOT A PERMIT ***DATE:*** _____

This is an ***application*** for a permit. After the proposed scope of work and the site have been reviewed, and the proposal found acceptable by the Facilities Division, Utility Coordinator, a permit ***may*** be issued.

Instructions

1. This application must be completed by the LBNL Project Manager (PM), LBNL Superintendent, or LBNL Requester.
2. Fax or email to Work Request Center, wrc@lbl.gov.
3. The WRC will send confirmation and job number. You will be contacted by the Utility Coordinator Shop Supervisor within 24 hours.

LBNL contact responsible for job/project: _____ (NAME) _____ (PHONE)

Title: _____ Cell Phone No: _____ Mail Stop: _____

Work to be performed by:

_____ (GROUP OR CONTRACTING AGENCY) _____ (RESPONSIBLE PERSON/CONTACT) _____ (PHONE)

Project Number _____ Account Number _____

Anticipated Start Date: _____ Anticipated Completion Date: _____

Description of Scope of Work: **Closest Building** _____

Penetration or excavation work is to be performed only inside the permit area as marked and defined below by building numbers, room numbers, and attached maps as necessary.

_____

_____

_____

Road/Deck/Surface Work: Type of Surface (Check all that apply)

Asphalt_____ Concrete_____ Landscape Surface_____

Total Length_____ Total Width_____ Depth (Max)_____

Structural Work: (Check all that apply)

Wall_____ Floor_____ Deck_____ Walkway_____

Core Drilling/Saw Cutting:

Area Size: W_____ L_____ Depth:_____ Diameter:_____

Anchoring:

Diameter:_____ Length:_____ Amount/Total number holes:_____

BERKELEY LAB	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	EMERGENCY NUMBERS LBNL On-Site Fire & Medical 7-911 LBNL Off-Site Fire & Medical 9-911 Campus Fire & Medical 9-911 LBNL Security 486-5472 Facilities Utilities 24-hr 486-5481

Instructions

This permit must be completed by the LBNL Utilities Coordinator, approval signatures obtained, and the permit posted at the job site before work is started that will require penetration or excavation of any ground surface, concrete wall, column or slab depth greater than 1-1/2 in. at LBNL, including the use of stakes or poles.

Work

LBNL contact responsible for job/project: _____ _____
NAME PHONE

Work to be performed by:

_____ _____ _____
GROUP OR CONTRACTING AGENCY RESPONSIBLE PERSON/CONTACT PHONE

Project Number _____ Account: _____ Permit: _____

Description of work approved by this permit:
_____
_____

Area Description

Closest Building _____

Penetration or excavation work is to be performed only inside the permit area as marked and defined below by building numbers, room numbers, and attached maps as necessary.
_____
_____
_____

Utilities

The following utilities are mapped as located in the permit area:

Utilities with valves to secure
- ☐ City water
- ☐ Treated water
- ☐ Low conductivity water (LCW)
- ☐ Natural gas
- ☐ Compressed air

Utilities with no valves to secure
- ☐ Sanitary sewers
- ☐ Storm drains
- ☐ Other _____

Utilities with disconnects, switches or breaker to secure
- ☐ Electrical conduits/ductbanks
- ☐ Telephone conduits/ductbanks
- ☐ Fiber Optic conduits
- ☐ Other _____

Prints/maps are attached, indicating approximate location of utility lines and shutoff valves. Valves are to be operated by LBNL personnel only.
CAUTION: Location of existing utility lines shown on maps may not be accurate. Drawings are to be used for reference only. Prior to digging all utility lines shall be located by the LBNL Utilities Coordinator to the best of LBNL's ability, and confirmed in the field by hand digging of test holes by the group or contracting agency prior to start of work (see Cautions and Special Conditions section, Hold Points).
Specifications for the utilities checked above:
_____
_____

BERKELEY LAB	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	_____ - _____ PERMIT NUMBER

Cautions and Special Conditions

HAND DIG ONLY:

1. Depth of utility is known:
   Surface excavation or drilling within 30 inches radius of the marked utility must be excavated by hand using flat tipped shovel, vacuum, or excavated with appropriate safe technology, such as an air knife, or high pressure water excavator until the utility is located or the excavation has reached the required depth. Picks should be used with caution under these circumstances.
2. Depth of utility is unknown:
   If the depth of the utility is unknown at both ends of the job area which has been defined by the Requestor or Subcontractor, pothole must be performed using non-destructive vacuum, or excavated with appropriate safe technology, such as an air knife, hand digging (flat tipped shovel), or high pressure water excavator means of excavation to exposed the two ends of the utility and at every change of directions to ascertain the location and depth of the utility. When depth is verified, the PM may authorize destructive means of soil removal to within a 30 inch radius around the utility. When 30 inch radius has been reached, non-destructive means of soil removal must be used to expose the utility.
   NOTE: Where possible, shut-off and / or secure located utilities by applying Lockout/Tagout (LOTO) procedures before the excavation by destructive means of soil removal. All LOTO procedures shall be performed by LBNL Plant Maintenance Technicians (PMT) and coordinated by the Utilities Coordinator.
3. If it is necessary to hand dig 5 feet or deeper, follow the procedures outlined under OSHA and LBNL PUB-3000 Chapter 4, Section 10.
4. Watch for utility lines and indication of utility lines (sand backfill and tape) while carefully digging.

Special conditions

In addition, the following special conditions must be observed, including environmental and safety concerns.

_____

_____

_____

_____

_____

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_____

_____

_____

_____

Hold Points

No work is to proceed from one hold point to the next without authorization from the LBNL representative below.

☐ **Utilities secured as required above in Cautions and Special Conditions**.

LBNL REPRESENTATIVE

☐ **Utilities exposed by hand digging**.

LBNL REPRESENTATIVE

☒ **Prior to backfill**. Hold for inspection and recording of utility coordinates by LBNL subcontracted Surveyor:

LBNL REPRESENTATIVE

☐ **Unusual conditions encountered**. Hold for resolution and authorization to proceed:

LBNL REPRESENTATIVE

☐ **Bones or artifacts encountered**. Hold for PM's authorization to proceed:

LBNL REPRESENTATIVE

PERMIT *Continued*

BERKELEY LAB	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	_____ - _____ PERMIT NUMBER

Permit Approval and Duration

Subject to the above specified conditions, approval is granted for penetration/excavation of the area described above.

Permit is valid from: _____ to: _____

LBNL Facilities/Utilities Coordinator: _____ _____
SIGNATURE DATE

LBNL Facilities/Utilities Coordinator Shop Supervisor: _____ _____
SIGNATURE DATE

Acceptance of Terms of Permit:

I have read and understood the conditions of this Permit to Penetrate or Excavate Surface of LBNL Property per ADMN-053.

LBNL Project Manager/Superintendent/Requestor: _____ _____
SIGNATURE DATE

Subcontractor representative: _____ _____
SIGNATURE DATE

Permit Extension:

At expiration date a one-time consecutive seven day permit extension may be granted by the Utilities Coordinator. Beyond that, a new permit must be processed again.

7 day Extension:	**Signature**	**Date**
Subcontractor Representative:		
Utilities Coordinator:		
PM/Superintendent/Requestor:		
Utilities Coordinator Shop Supervisor:		

Permit Extension is valid from: _____ to: _____

	FACILITIES DIVISION ***PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF LBNL PROPERTY***	_____ - _____ PERMIT NUMBER

Compliance observation sign-off when site is visited by LBNL personnel

LBNL PM/Superintendent/ Requestor/Supervisor	TIME & DATE OF VISIT	COMPLIANCE YES OR NO	LBNL Inspector	TIME & DATE OF VISIT	COMPLIANCE YES OR NO

Off-shift or night-time phone numbers are 510/486-7941 and 510/486-5481.