DEPARTMENT OF TOXIC SUBSTANCES CONTROL

STATEMENT OF BASIS

PROPOSED RCRA REMEDY SELECTION FOR SOIL AND GROUNDWATER

AT
Ernest Orlando Lawrence Berkeley National Laboratory

1 Cyclotron Road
Berkeley, California

EPA ID NO. CA4890008986

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STATEMENT OF BASIS

PROPOSED RCRA REMEDY SELECTION FOR SOIL AND GROUNDWATER

1. EXECUTIVE SUMMARY

The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) has prepared this Statement of Basis for the proposed Resource Conservation and Recovery Act (RCRA) remedy selection for soil and groundwater at the Ernest Orlando Lawrence Berkeley National Laboratory (LBNL). LBNL is located within the cities of Berkeley and Oakland, in Alameda County, California.

The objective of the corrective action process at a hazardous waste management facility is to identify releases or potential releases of hazardous waste or constituents requiring further investigation. These further investigations evaluate the nature and extent of the releases and also identify, develop, and implement appropriate corrective measures to protect human health and the environment. Figure 1 is a schematic of the overall RCRA Corrective Action Process and shows the progression from a RCRA Facility Assessment (RFA) through Remedy Selection.

In 1993, DTSC issued a Hazardous Waste Facility Permit to LBNL. As a condition of that permit, LBNL is required to investigate and address all historical releases of hazardous waste and chemicals that may have occurred at the site in accordance with RCRA corrective action process requirements. Investigation of the historical releases, determination of which releases require corrective action, and evaluation/recommendation of proposed remedies have been completed. The investigation and cleanup of radioactive contamination at LBNL is under the regulatory oversight of the United States Department of Energy and is not part of the RCRA corrective action process.

The Statement of Basis is a RCRA decision document that highlights the key information contained in previous reports submitted to DTSC by LBNL, primarily the Draft Corrective Measures Study (CMS) Report dated February 10, 2005.[1] The purpose of the Statement of Basis is to:

- Describe the remedies that were considered
- Identify the remedies that are proposed
- Explain the reasons for selecting the proposed remedies
- Solicit public review and comments on the proposed remedies
- Provide information on how the public can be involved in the remedy selection process.

LBNL submitted the initial draft of the Corrective Measures Study (CMS) Report to DTSC on July 17, 2004.[2] DTSC conducted a technical review of the document to ensure that it contained complete and technically accurate information. The San Francisco Bay Region of the California Regional Water Quality Control Board (Water Board) and the City of Berkeley also reviewed the document and provided their comments to DTSC. Their comments were transmitted to LBNL for response. LBNL responded to all the agency comments and submitted the revised draft CMS report on February 10, 2005.

The Water Board and the City of Berkeley have accepted the revised draft CMS report. DTSC has determined that the revised draft CMS report dated February 10, 2005 is technically complete. DTSC has prepared this Statement of Basis of its proposed decision regarding Remedy Selection. DTSC has also completed the Initial Study[3] for the proposed remedies to comply with the California Environmental Quality Act (CEQA). DTSC is now formally soliciting public comments on these documents during a 45-day comment period. If DTSC approves the CMS Report, LBNL would be authorized to implement the remedies recommended in that document and summarized in this Statement of Basis.

Public input on the proposed remedies, and on the information that supports the selection of those remedies, is an important contribution to the selection process. The

[1] . See reference no. 13 in Section 10.0
[2] . See reference no. 12 in Section 10.0
[3] . See reference no. 14 in Section 10.0

final remedies selected could be different from those that have been proposed, depending on the information that is received through the public participation process. After all public comments have been received DTSC will make the final remedy determination. The administrative mechanism for implementation of corrective measures at LBNL is the Hazardous Waste Facility Permit (Permit Number: 03-BRK-11) issued by DTSC jointly to the University of California, Ernest Orlando Lawrence Berkeley National Laboratory and the United States Department of Energy, pursuant to Section 25200 of the California Health and Safety Code. This permit would be modified at a future date to include the final selected remedies.

The draft CMS Report and the other project documents that were used as the source of information for this Statement of Basis are available for review at the following location:

BERKELEY PUBLIC LIBRARY
2nd floor Reference Desk
2090 Kittredge Street
Berkeley, California 94704.

In addition, the CMS Report is also available on-line at: http://www.lbl.gov/ehs/erp/html/documents.shtml and the CEQA Initial Study is available on-line at: http://www.dtsc.ca.gov/HazardousWaste/LBNL/index.html

To be considered in the decision making for this Project, all comments on the proposed remedy selection should be received, at the following address:

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2. FACILITY BACKGROUND

2.1 Site Description

LBNL is a multi-program National Laboratory managed by the University of California (UC) for the United States Department of Energy (DOE), with primary funding and oversight provided by the DOE. It is located in the Berkeley/Oakland Hills in Alameda County, California and encompasses approximately 200 acres adjacent to the northeast side of the UC Berkeley campus (Figure 1). The property consists of 29 parcels that are separately leased to the DOE from the University of California. In general, the structures are owned by the DOE, while the land is owned by UC and leased to DOE.

LBNL was moved to its present location in the early 1940s, when construction on the 184-Inch Cyclotron was started on a hill overlooking the UC Berkeley campus and the City of Berkeley. During a period of rapid growth between 1940 and 1946, the original hillside laboratory (Old Town area) became crowded with temporary wooden buildings erected in response to national defense needs. Further development during the 1950's was more carefully planned, with the construction of permanent concrete and steel-frame structures east and west of the earlier buildings. From 1948 until 1972, Berkeley Lab was known as the Lawrence Radiation Laboratory and was funded by the U.S. Atomic Energy Commission and its successor agencies. The name was changed to the Lawrence Berkeley Laboratory in 1972 and changed again in 1995 to the Ernest Orlando Lawrence Berkeley National Laboratory.

For more than sixty years, LBNL has been an active research institution, diversifying from an initial emphasis on high-energy and nuclear physics to include materials sciences, chemistry, earth sciences, biosciences, and energy conservation research. As a result of LBNL's mission as a research facility, many types of chemicals have been used or produced as wastes. These include gasoline, diesel, waste oil, polychlorinated biphenyls (PCBs), Freon®, solvents, metals, acids, caustics, and lead- and chromate-based paints. Additionally, radionuclides have been used or produced as waste. However, the investigation and cleanup of radioactive contamination at LBNL is under the regulatory oversight of the United States Department of Energy. As a result of past operations, hazardous materials such as degreasers and petroleum products were released to soil and groundwater, primarily by spills and leaks in piping systems. LBNL has subsequently improved control systems and operational practices to prevent spills and releases. Still, some chemicals from these historical releases remain in the soil and groundwater.

The principal chemicals that have been detected are industrial solvents such as chlorinated volatile organic compounds (VOCs) in the soil and groundwater, and PCBs in the soil. The VOCs that have been detected are 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 VOCs are solvents (and their degradation products) that were used as degreasers for cleaning equipment.

2.2 Setting

LBNL is located on the ridges and draws of Blackberry Canyon, which forms the central part of the Laboratory, and Strawberry Canyon, which forms the southern boundary. The western three-quarters is located in the City of Berkeley and the eastern quarter is in the City of Oakland.

Approximately half the site is developed and half is open space. The developed areas include buildings, paved areas, and landscaped areas. The buildings house laboratories, offices, meeting rooms, and fabrication/maintenance shops that support research activities. In addition, the site has a hazardous waste handling facility, a fire station, and a medical clinic. Adjacent land uses include residential areas to the north; UC Berkeley athletic fields, recreational facilities, and the UC Botanical Garden to the south; residential areas and UC Berkeley student housing, amphitheater, and classrooms to the west; and the UC Berkeley Lawrence Hall of Science Museum to the east. East of LBNL, the land is mostly undeveloped and includes Tilden Regional Park and open space.

Surface and subsurface drainage is carried by two main creeks and related tributaries. The main branch of Strawberry Creek is located south of the site and flows westwards, mostly underground, draining the eastern portion of the site; North Fork Strawberry Creek is located at the western edge of the site and also flows westwards, draining the western portion of the site. Surface runoff is conveyed from the developed areas via a stormwater drainage system that connects to North Fork Strawberry Creek in the Blackberry Canyon watershed in the northwestern part, and to several southward-flowing tributaries of Strawberry Creek in the Strawberry Canyon watershed on the southern side.

Water at LBNL and nearby communities is supplied by the East Bay Municipal Utility District (EBMUD). Groundwater is not used for drinking water at LBNL or downgradient in the City of Berkeley or at UC Berkeley.

2.3 Hydrogeology

Bedrock consists of Cretaceous and Miocene sedimentary and volcanic units. The rock units underlying most of the Lab facilities are the Moraga Formation, which consists primarily of volcanic rocks, and the Orinda Formation, which consists primarily of clastic sedimentary rocks. The Moraga Formation, which covers a relatively small portion of LBNL, is relatively permeable, and constitutes the main water-bearing unit at LBNL. In contrast, the Orinda Formation, which underlies the Moraga Formation rocks, is relatively impermeable over most areas of the site. Groundwater flow directions generally follow the direction of surface water flow (i.e. down the slope of the surface topography, with westward flow in the western portion of Berkeley Lab and southward flow elsewhere.

3. RCRA FACILITY ASSESSMENT (RFA) (1991 and 1992)

The RFA evaluates past operating practices and historical uses of the site. It identifies where spills, leaks, or other chemical releases either occurred or could have occurred. In November 1991, DTSC completed a RFA of the facility.[4] In September 1992, LBNL prepared an independent RFA to supplement the DTSC findings.[5] The RFAs identified a total of 163 units, that is, 88 Solid Waste Management Units (SWMUs) and 75 Areas of Concern (AOCs) potential or known releases had occurred. A SWMU is defined as any discernable waste management unit (e.g. tanks, containers, etc.) at a RCRA facility from which hazardous constituents might migrate, irrespective of whether the unit was intended for the management of solid and/or hazardous waste. Releases at SWMUs are defined as routine, systematic, and deliberate discharges from process areas. An AOC is an area (e.g. product storage tanks, production equipment) where there has been a release of a hazardous constituent by accidental spills. Eight (8) of these 163 units were identified as radiological units that are addressed under the authority of the United States Department of Energy. The remaining 155 units were associated the release of chemically hazardous constituents. The RFAs determined that there had been past releases to soil and/or groundwater, or there had been a high potential for past releases, at 28 of the identified SWMUs and 55 of the AOCs. Based on these findings, DTSC concluded that remedial investigations were warranted for those 83 units, and required LBNL to conduct a RCRA Facility Investigation (RFI).

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[4] . See reference no. 1 in Section 10.0
[5] . See reference no. 2 in Section 10.0

4. RCRA FACILITY INVESTIGATIONS (RFI) (1992 to 2000)

The RFI defines the source, nature, and extent of contamination. Beginning in 1992 and continuing until 2000 LBNL conducted RFI activities. Due to the large size of the LBNL site and the complexity of the investigations, these investigations were divided into three work phases. LBNL submitted RFI workplans for Phases I, II, and III in November 1992, October 1994, and October 1995 respectively. [6] During the RFI, a screening process was implemented to determine which units with soil contamination should be evaluated further due to potential risks to human health and the environment, and which units should be excluded from any further action. The soil screening process consisted of a comparison of the concentrations of chemicals detected in soil to all three standards: LBNL background levels, United States Environmental Protection Agency (USEPA) Region 9 Preliminary Remediation Goals (PRGs) for residential soil, and California-modified PRGs for residential soil. Background levels for naturally occurring inorganics was determined by an extensive soil sampling program of ares not impacted by LBNL operations. As a result of the screening process, the RFI Report concluded that out of the units included in the RFI, no further action was required at 54 of the units (17 of the SWMUs and 36 of the AOCs). On September 29, 2000 LBNL submitted the final RFI Report summarizing investigation results for Phases I, II, and III.[7] Chemicals detected in the soil and groundwater at the remaining 30 units were considered to a potential threat to human health or the environment. DTSC concluded that a CMS was required to further evaluate these 30 units (11 SWMUs and 19 AOCs).

[6] . See references no. 3, 4, and 5 in Section 10.0

[7] . See reference no. 8 in Section 10.0

5. HUMAN AND ECOLOGICAL RISK ASSESSMENTS (2002-2003)

LBNL completed both an Ecological Risk Assessment (ERA) and a Human Health Risk Assessment (HHRA) in accordance with DTSC's approved workplans that evaluated the findings of the RFI Report. The ERA evaluated the potential for chemical contaminants detected in soil, sediment, surface water, and groundwater to adversely affect the reproduction, growth, or survival of plant and wildlife individuals and populations (ecological receptors). The ERA concluded that no adverse impacts exist for ecological receptors from exposures to chemicals in soil, groundwater, or surface waters at LBNL.[8] DTSC approved the ERA on April 14, 2003. The HHRA estimated risk to human health from potential exposure to chemicals in soil, groundwater, surface water, and air.[9] The HHRA identified the current and reasonably likely land use at LBNL as industrial-type institutional land use. The potential receptors associated with this land use scenario are LBNL employees (laboratory workers, office workers, and outdoor workers such as landscape maintenance workers) and construction workers. Off-site receptors (i.e., local residents) were not evaluated in the HHRA because there was no complete exposure pathways to those individuals and none are anticipated in the future. The HHRA also addressed protection of beneficial uses of groundwater by comparing chemicals of concern concentrations to drinking water standards. The HHRA determined that 15 units (4 soil and 11 groundwater) should be further evaluated in the CMS Report. DTSC conditionally accepted the HHRA on August 19, 2003, pending final approval of RCRA selected remedies.

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[8] . See reference no. 10 in Section 10.0

[9] . See reference no. 11 in Section 10.0

6. INTERIM CORRECTIVE ACTION MEASURES (1992-2000)

Throughout the RFI phase, LBNL has implemented interim corrective measures for several buildings with sumps and underground tanks, and solvent contaminated groundwater plumes. These measures included removing sources of soil contamination, stopping discharge of contaminated groundwater to surface waters, eliminating pathways that could contaminate groundwater, and preventing further migration of contaminated groundwater. See section 1.3.3 of the CMS Report dated February 10, 2005 for a detailed listing of Interim Corrective Measures implemented at LBNL.

7. CORRECTIVE MEASURES STUDY

7.1 CMS WORKPLAN (2002)

LBNL submitted a CMS Workplan in May 2002. [10] The primary purpose of the workplan was to appropriate remedial alternatives were considered and evaluated in order to eliminate, reduce, or control risks to human health and the environment from the contaminants identified during the RFI. The CMS Workplan determined that in addition to the 30 units that were designated for further evaluation in the RFI Report, four other SWMUs and two areas of soil contamination that had not been designated as SWMUs or AOCs required further evaluation. This determination to include these six additional areas was based partly on new findings for some of the areas, and partly on a comparison of chemical concentrations in the soil to the most recent updated PRG values. The CMS Workplan also specified that all locations where chemicals were detected in groundwater and surface water were to be included in the CMS regardless of whether they had been designated as an AOC. DTSC approved the CMS Workplan in June 2002.

7.2 CMS REPORT (2005) and Summary of Proposed Remedies for Soil and Groundwater Contamination

The CMS Report evaluated four areas of soil contamination and 11 areas of groundwater contamination which were determined to pose a potential threat to human health and/or to potential beneficial uses of groundwater.[11] The locations of these 15 areas (referred to as units) are shown on Figure 1. The CMS Report identified and evaluated corrective measures and provided recommendations for the specific cleanup remedies that are proposed in this Statement of Basis. Remedies were recommended based on a detailed evaluation of the data generated during the RCRA Facility Investigation (RFI) together with information pertaining to potential corrective measures

[10] . See reference no. 9 in Section 10.0
[11] . See reference no. 13 in Section 10.0

technologies. The 15 units are listed in Table 7-1, along with the corrective measures that are proposed and the chemicals of concern (COC) at each of the units. Details of the evaluation and remedy selection process are summarized in sub-section 7.2 of this Statement of Basis.

Table 7-1 Summary of Proposed Remedies			
Unit	**Solid Waste Management Unit (SWMU) or Area of Concern (AOC)**	**Chemicals of Concern (COC)[(a)]**	**Proposed Remedies**
Soil Units			
Building 7 Sump	AOC 2-5	PCE TCE cis-1,2-DCE 1,1,1-TCA 1,1-DCA 1,1-DCE benzene carbon tetrachloride chloroform vinyl chloride	Excavation and offsite disposal.
Building 51L Groundwater Plume Source Area	Not Designated	PCE TCE chloroform vinyl chloride	Excavation and offsite disposal.
Building 88 Hydraulic Gate Unit	AOC 6-3	none	No further action is proposed. Contaminated soils were excavated and disposed at approved offsite disposal facility under an Interim Remdial Measure approved by DTSC. Excavation was completed and confirmatory samples taken of residual soils to confirm cleanup to the Toxic Substances Control Act (TSCA) self implementing cleanup level for soil of less than 1 ppm. 1 ppm is a no further action level set by U.S. EPA under TSCA.
Building 75 Former Hazardous Waste Handling and Storage Facility	SWMU 3-6	none	

Table 7-1 Summary of Proposed Remedies			
Groundwater Units	**Solid Waste Management Unit (SWMU) or Area of Concern (AOC)**	**Chemicals of Concern (COC)[a]**	**Proposed Remedies**
Building 51/64 Groundwater Solvent Plume	AOC 9-13	TCE PCE carbon tetrachloride cis-1,2-DCE trans-1,2-DCE 1,1-DCE methylene chloride 1,1-DCA 1,2-DCA vinyl chloride 1,1-TCA 1,1,2-TCA	Continue in situ soil flushing combined with groundwater capture in source area. Monitored Natural Attenuation (MNA) for downgradient portion of plume. Continue surface water (subdrain effluent) capture and treatment until groundwater discharge to surface water is shown to be below detectable levels.
Building 51L Groundwater Solvent Plume	Not Designated	vinyl chloride	Soil excavation (as described under Building 51L Groundwater Plume Source Area) for the source area. Monitored Natural Attenuation (MNA) for remaining plume area. Reconstruct storm drain to prevent migration of groundwater contaminants to surface water.

Table 7-1 Summary of Proposed Remedies			
Building 71 Groundwater Solvent Plume Building 71B lobe	AOC 1-9	TCE PCE cis-1,2-DCE vinyl chloride	The following combination for the plume source area: 1) excavation and offsite disposal of accessible shallow unsaturated zone soil; 2) limited in situ chemical oxidation of unsaturated zone soils adjacent to the building foundation; and 3) continue in situ soil flushing. For contaminated groundwater adjacent to the source area, enhanced bioremediation using Hydrogen Release Compounds (HRC). In addition, surface water (hydrauger effluent) capture and treatment will continue until groundwater discharge to surface water is shown to be below detectable levels.
Groundwater Units	**Solid Waste Management Unit (SWMU) or Area of Concern (AOC)**	**Chemicals of Concern (COC)[(a)]**	**Proposed Remedies**
Building 7 Lobe of the Old Town Groundwater Solvent Plume	AOC 2-4	TCE PCE carbon tetrachloride cis-1,2-DCE trans-1,2-DCE 1,1-DCE chloroform methylene chloride 1,1-DCA 1,2-DCA 1,2-dichloropropane vinyl chloride 1,1,2-TCA benzene	Soil excavation (as described under AOC 2-5) for the plume source area. Continue in situ soil flushing combined with groundwater capture for the plume core area. Monitored Natural Attenuation (MNA) in the downgradient area. Continue groundwater capture and treatment within and at downgradient edge of plume until groundwater concentrations are reduced to levels where downgradient migration of Chemicals above applicable Media Cleanup Standards (MCSs) or beyond the plume boundary would not occur without controls.

Table 7-1 Summary of Proposed Remedies			
Building 52 Lobe of the Old Town Groundwater Solvent Plume	AOC 10-5	TCE PCE carbon tetrachloride cis-1,2-DCE	Continue in situ soil flushing in source area. Continue capture and treatment at downgradient lobe boundary until groundwater discharge to surface water is shown to be below detectable levels.
Building 25A Lobe of the Old Town Groundwater Solvent Plume		TCE PCE carbon tetrachloride 1,1-DCE	Continue in situ soil flushing in contaminant source area, Monitored Natural Attenuation (MNA) for remainder of lobe area.
Building 69A Area of Groundwater Contamination	Not Designated	vinyl chloride	Monitored Natural Attenuation (MNA).
Groundwater Units	**Solid Waste Management Unit (SWMU) or Area of Concern (AOC)**	**Chemicals of Concern (COC)[(a)]**	**Proposed Remedies**
Solvents in Groundwater South of Building 76	AOC 4-5	none	Monitoring only (chemical concentrations are below risk-based MCSs and groundwater characteristics do not meet criteria of State Water Resources Control Board Resolution 88-63 – *Sources of Drinking Water Policy*).
Building 77 Area of Groundwater Contamination	Not Designated	none	
Building 75/75A Area of Groundwater Contamination	Not Designated	none	.
Benzene Detected in Wells East of Building 75A	Not Designated	none	

(a) Chemicals of Concern (COCs):

- COCs for groundwater units where groundwater meets the criteria of State Water Resources Control Board Resolution 88-63 – Sources of Drinking Water Policy are those organic chemicals that were detected at concentrations above Maximum Contaminant Levels (MCLs) for drinking water in fiscal year 2003 (FY03) (October 1 2002 through September 30 2003).
- COCs for groundwater units where groundwater does not meet the criteria of State Water Resources Control Board Resolution 88-63 are those organic chemicals that were detected at concentrations exceeding human health based levels for institutional use in fiscal year 2003 (FY03).
- COCs for soil units are those organic chemicals that were detected at concentrations exceeding human health based levels for institutional use; and for those soil units where the underlying groundwater meets the criteria of State Water Resources Control Board Resolution 88-63, the organic chemicals in the groundwater that were detected in soil at the unit.
- Boldface concentrations indicate concentrations that exceed the proposed risk-based Media Cleanup Standard (MCS).

7.3 Evaluation of Corrective Measure Alternatives

The first step in the selection of the proposed corrective measures was compilation of a list of potentially applicable alternatives. These alternatives were screened to eliminate those that were considered ineffective or not applicable under LBNL site-specific conditions (i.e. low permeability soils, developed areas, topography etc.). The corrective measures identified as potentially applicable and effective for VOCs are listed in Table 8-2 and Table 8-3 for soil and groundwater, respectively.

Table 7-2 Corrective Measures Evaluated for VOC-Contaminated Soil			
Corrective Measures Category	**Corrective Measures Potentially Applicable to Cleanup of VOC-Contaminated Soil**	**Potentially Applicable and Effective Corrective Measure**	**Corrective Measure Proposed for Unit Specific Implementation**
Monitored Natural Attenuation (MNA)	Monitored Natural Attenuation (MNA)	no	no
Risk and Hazard Management	Institutional Controls (physical barriers or markers)	**yes**	no
	Institutional Controls (legal or administrative)	**yes**	no
Containment	Capping, Solidification, Stabilization	**yes**	no
In situ treatment	Enhanced bioremediation	no	no
	Phytoremediation	no	no
	Bioventing	no	no
	Chemical oxidation	**yes**	no
	Electrokinetic separation	no	no
Extraction with ex situ treatment	Soil vapor extraction (SVE)	**yes**	no
	Thermally enhanced SVE/dual phase extraction	**yes**	no
	Fracturing, enhanced SVE	no	no
	Soil flushing (water/surfactant/co-solvent) with groundwater Extraction	**yes**	no
	Soil mixing	**yes**	no
Excavation	Excavation with on site *ex situ* treatment	no	no
	Excavation and off-site disposal	**yes**	**yes**

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Table 7-3 Corrective Measures Evaluated for VOC-Contaminated Groundwater			
Corrective Measures Category	**Corrective Measures potentially Applicable to Cleanup of VOC-Contaminated Groundwater**	**Potentially Applicable and Effective Corrective Measures**	**Corrective Measure Proposed for Unit-Specific Implementation**
Monitored Natural Attenuation (MNA)	Monitored Natural Attenuation (MNA)	**yes**	**yes**
Risk and Hazard Management	Institutional Controls (physical barriers or markers)	**yes**	no
	Institutional Controls (legal or administrative)	**yes**	**yes**
Containment and Capture	Containment/diversion (Slurry walls, Sheet pile walls, Grout curtains)	**yes**	no
	Groundwater Capture (Drains, Trenches, Extraction wells)	**yes**	**yes**
In situ treatment	Permeable Reactive Barrier (PRB) and Funnel and Gate	**yes**	no
	Chemical Oxidation	**yes**	**yes**
	Enhanced bioremediation	**yes**	**yes**
	Phytoremediation	no	no
Extraction with ex-situ treatment	Soil Flushing with Groundwater Extraction	**yes**	**yes**
	Dual-Phase Extraction (DPE)	**yes**	**yes**
	Air Sparging	no	no
	In-Well Air Stripping	no	no
	Steam/hot water Injection	no	no

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The retained alternatives were subjected to a formal evaluation process for each soil and groundwater unit where further action was required. The no action alternative was considered in accordance with evaluation procedures but was not deemed effective in protecting human health and the environment. The evaluation criteria used to analyze the proposed remedies and alternatives included four general standards and five selection decision factors that assisted in determining the overall effectiveness of the measures. The four standards were:

- Protect human health and the environment
- Attain the required clean-up levels
- Control sources of releases
- Meet all applicable waste management requirements

The five selection factors were:

- Long-term reliability and effectiveness
- Reduction in the toxicity, mobility, or volume of waste
- Short-term effectiveness
- Ease of implementation
- Cost

The measures that are proposed for unit-specific implementation at Berkeley Lab are listed in Table 7-2 and Table 7-3, for cleanup of VOCs in soil and groundwater, respectively. The specific cleanup technology/technologies proposed for each unit were selected from the potentially applicable and effective measures on a media-specific (groundwater or soil) and site-specific basis. The only corrective measure proposed for clean-up at the two soil units is excavation and off-site disposal of the contaminated soil.

Excavation and off-site disposal are proposed for the cleanup of VOC-contaminated soil near Buildings 7 and 51L. Contaminated soil in these areas would be excavated and placed in covered storage bins until the bins could be shipped off-site for disposal in accordance with applicable local, state, and federal laws and regulations.

The primary technologies proposed for cleanup at groundwater units are in-situ soil flushing and monitored natural attenuation (MNA). Soil flushing and/or MNA are proposed for the cleanup of contaminated groundwater near Buildings 51/64, 51L, 69, and 71B, and in the “Old Town Area” near Buildings 7, 25A, and 52. Soil flushing consists of the simultaneous injection of clean water into, and extraction of contaminated water from, the subsurface. The purpose of soil flushing is to promote flow of contaminated groundwater towards extraction point(s) and to increase the rate that residual soil contaminants desorb into the flowing groundwater. Drains, trenches, and/or extraction wells would be used to control the migration of contaminated groundwater. The extracted groundwater would be treated on-site to non-detectable levels of VOCs using granular activated carbon (GAC) canisters. The treated water would then either be reinjected to flush contaminants from the subsurface or, if the water is not needed for flushing, discharged to the sanitary sewer under a permit issued by the EBMUD.

The initial construction or installation phases for most of the proposed soil flushing systems have already been completed during implementation of pilot tests or Interim Corrective Measures (ICMs) conducted over the past few years. The corrective measures in most cases consist of adoption or expansion of these pilot tests and ICMs. MNA would be applied in areas where hydrochemical data indicate that natural processes (e.g., biodegradation) are reducing the mass of contaminants, and consists of continued monitoring of the effectiveness of these processes. In some areas, Hydrogen Release Compounds® (HRC®) would also be used to enhance natural degradation processes. Localized application of chemical oxidants may also be used in limited areas to directly oxidize contaminants.

7.4 Media Cleanup Standards (MCSs)

Media Cleanup Standards (MCSs) were developed to address both risk-based and regulatory-based objectives. Risk-based MCSs were developed using an institutional land-use scenario, consistent with the current and reasonably foreseeable future land use at LBNL. Risk-based MCSs are applicable to soil and groundwater throughout LBNL.

Two sets of risk-based MCSs were developed. The first set, the target risk-based MCSs, was based on theoretical Incremental Lifetime Cancer Risks [ILCRs] of 10^{-6} and non-cancer Hazard Index (HI) of 1. An ILCR of 10^{-6} means that one additional person out of a million in the exposed population is theoretically at risk of developing cancer. An HI below 1.0 will likely not result in adverse noncancer health effects, The second set are regulatory-based MCSs for groundwater which were set at Maximum Contaminant Levels (MCLs) for drinking water in order to be protective of potential future drinking water. Regulatory-based MCSs for soils were set at levels that were estimated to not result in groundwater concentrations exceeding MCLs. Regulatory-based MCSs for both soil and groundwater are applicable for units located in the areas where groundwater is considered potentially suitable for domestic or municipal supply**.** Seven groundwater units have some wells that yield greater than 200 gallons per day and some wells that yield less than 200 gallons per day. There are four groundwater units wherein all the wells yield less than 200 gallons per day. Groundwater conditions directly underlying specific areas may limit potential use as a municipal or domestic drinking water supply due to low well yields (i.e. less than 200 gallons per day). For the wells in these areas, regulatory-based MCSs are not applicable. However, since the State Water Resources Control Board (SWRCB), designates all groundwater potentially suitable for municipal or domestic supply unless it has been formally de-designated, the long-term goal at LBNL is to restore groundwater quality throughout the site to MCLs, if practicable. Therefore, where low well yields limit the potential use of LBNL groundwater as a drinking water supply, long-term monitoring of both the status of natural degradation processes and the degree of migration control for contaminated groundwater will continue as long as concentrations of VOCs in the groundwater remain above MCLs.

Compliance with MCSs at groundwater units will be demonstrated by collecting groundwater samples. Corrective measures will be considered complete for each unit when the concentrations of COCs in all wells at a groundwater unit are shown to be lower than MCSs averaged over four consecutive quarters of monitoring.

Compliance with MCSs at soil units will be demonstrated by collecting post-remediation samples representative of residual contamination. To demonstrate that remedial objectives have been attained, representative site chemical concentrations to which human receptors may be exposed will be compared to the MCSs. When MCSs are attained at the confirmation soil sampling locations, the corrective measure will be considered complete for that unit.

Remediation of contaminated media to the prescribed MCSs can in certain situations be technically impracticable from an engineering perspective. Technical impracticability (TI) for contaminated groundwater will be evaluated after five years of operation of final approved remedies, or when sufficient data have been collected to support a determination of TI.

8. DETAILS OF PROPOSED REMEDIES FOR SPECIFIC UNITS

Corrective measures are needed to reduce or eliminate potentially adverse effects to human health or the environment caused by historic releases of chemicals to soil and groundwater, and will be conducted under the Corrective Measures Implementation (CMI) phase of the RCRA corrective action process. The following sub-sections provide details regarding the selected remedies for the 11 groundwater units and 2 soil units.

8.1 Building 51/64 Groundwater Solvent Plume

Proposed Remedies: In-situ soil flushing with treated extracted groundwater. Groundw

ater treatment consists of removal of VOCs with activated carbon. Groundwater monitoring to evaluate natural attenuation.

Media Cleanup Standard: Drinking water standards for wells > 200 gallons per day (gpd). Short-term goal of risk-based levels for wells < 200 gpd and a long-term goal of drinking water standards.

Building 51/64 Groundwater Solvent Plume contains several halogenated VOCs in groundwater at concentrations exceeding both regulatory-based MCSs (MCLs). The exposure pathway of concern at this unit is inhalation by hypothetical future indoor workers of vapor that migrates from the groundwater to indoor air in buildings that may be built above the plume area. PCE, carbon tetrachloride, 1,1-DCA and vinyl chloride all exceeded MCSs in the upgradient (eastern) portion of the plume; only vinyl chloride exceeded MCSs in the downgradient portion of the plume. Concentrations of VOCs detected in the soil are less than MCSs.

Wells in the upgradient (eastern) portion of the plume generally have groundwater yields lower than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable in that area. The downgradient (western) portion of the plume is underlain by artificial fill, and well yields in this unit are greater than 200 gpd. Therefore, both risk- and regulatory-based MCSs (MCLs) are applicable in this area.

The remediation objectives for the Building 51/64 plume are to: 1) ensure that groundwater VOCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs; 2) reduce PCE, carbon tetrachloride, 1,1-DCA and vinyl chloride concentrations in the upgradient portion of the plume to concentrations less than target risk-based MCSs; 3) reduce groundwater VOC concentrations in the downgradient area underlain by artificial fill to below regulatory-based MCSs; and, 4) ensure that groundwater VOCs at detectable concentrations do not migrate to surface water through the storm drain system.

Soil flushing and excavation with offsite disposal are potentially effective corrective measures to meet remediation objectives (1) and (2). The Building 51/64 soil flushing pilot test results indicate that soil flushing should be effective in meeting remediation objective (2), reducing groundwater VOC concentrations in the source area to below target risk-based MCSs. The pilot test would be continued as the proposed corrective measure; however, it would be enhanced with an additional groundwater collection trench as a source control measure. Excavation of source area soils would also be effective in meeting remediation objectives (1) and (2), but since Building 64 overlies the source area, excavation is not currently possible, but should be considered if the building is removed.

Given that MNA has been documented to be a viable corrective measure for the plume, remediation objectives (1) and (3) are likely to be met by MNA, as long as containment and remediation of the source zone is conducted, as described above.

Objective (4) should be met by continued capture and treatment of groundwater in the Building 51 subdrain system until it can be shown that VOC concentrations at the point of compliance (the discharge point for the stormdrain) are below detectable levels.

8.2 Building 51L Groundwater Solvent Plume and Soil Removal Remedy

Proposed Remedies: Excavation of VOC contaminated soil and disposal at an authorized facility. Re-routing of a storm drain line to above the water table. Monitoring of groundwater to evaluate natural attenuation.

Media Cleanup Standard: Drinking water standards for wells > 200 gallons per day (gpd). Short-term goal of risk-based levels for wells < 200 gpd and a long-term goal of drinking water standards.

Building 51L Groundwater Solvent Plume contains halogenated VOCs in the groundwater at concentrations above regulatory-based MCSs (MCLs). In addition, vinyl chloride is present in the groundwater at a concentration exceeding MCS. Wells throughout the plume area have groundwater yields that are less than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable for both soil and groundwater.

Concentrations of PCE, TCE, chloroform, and vinyl chloride in the soil in the source area of the Building 51L Groundwater Solvent Plume exceed soil MCSs .

The exposure pathway of concern at this unit is the inhalation by hypothetical future indoor workers of vapor that migrates from the groundwater to indoor air in buildings that may be built above the plume area.

The remediation objectives for the Building 51L Groundwater Solvent Plume and source area are to: 1) ensure that groundwater VOCs at detectable concentrations do not migrate to surface water through the storm drain system; 2) ensure that groundwater VOCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs; 3) reduce vinyl chloride concentrations in groundwater below MCSs; and 4) reduce PCE, TCE, chloroform and vinyl chloride concentrations below MCSs.

Reconstructing the storm drain line so that it does not traverse through the area of contaminated groundwater is the proposed corrective measure to meet remediation objective (1). Lowering the water table below the storm drain will continue until the storm drain reconstruction is completed.

Given the small volume of the impacted area, soil excavation with offsite disposal is the proposed corrective measure to remove contaminated soil in both the saturated and unsaturated zones. This measure should meet objectives (2), (3), and (4). Contaminated soil in the source area for the groundwater contamination would be excavated to a depth of 10 to 20 feet. Excavated soil would be stored in covered bins on site, until shipped off site for disposal in accordance with applicable local, state, and federal laws and regulations. Any excavated soil that is determined to be RCRA hazardous waste will be disposed of in an offsite permitted disposal facility. After excavation has reduced VOC concentrations below risk-based levels in the central plume area it is likely that natural attenuation processes will further reduce VOC concentrations in the groundwater.

8.3 Building 71B Lobe of the Building 71 Groundwater Solvent Plume

Proposed Remedies: In-situ chemical oxidation of VOCs in groundwater with hydrogen peroxide. In-situ soil flushing with treated extracted groundwater. Enhanced bioremediation using hydrogen release compounds.

Media Cleanup Standard: Drinking water standards for wells > 200 gallons per day (gpd). Short-term goal of risk-based levels for wells < 200 gpd and a long-term goal of drinking water standards.

Building 71B lobe of the Building 71 Groundwater Solvent Plume contains several halogenated VOCs at concentrations above regulatory-based MCSs (MCLs).

Wells in the source area have groundwater yields that are greater than 200 gpd, so regulatory-based MCSs (MCLs) are applicable. Well yields in downgradient areas of the lobe are generally less than 200 gpd, so only risk-based MCSs are applicable.

The concentrations of PCE in residual (post ICM) soil in the source area of the Building 71B lobe of the Building 71 Groundwater Solvent Plume exceed target risk-based MCSs (Table 5-5). Concentrations of PCE, TCE, cis-1,2-DCE, and trans 1,2-DCE exceed regulatory-based MCSs (for protection of potential drinking water sources).

The exposure pathway of concern at this unit is the inhalation by hypothetical future indoor workers of vapor that migrates from the groundwater to indoor air in buildings that may be built above the plume area.

The remediation objectives for the Building 71B lobe of the Building 71 Groundwater Solvent Plume are to: 1) ensure that groundwater VOCs do not migrate to surface water; 2) ensure that groundwater VOCs at concentrations exceeding regulatory-based MCSs (MCLs) do not migrate into areas where concentrations are less than MCLs; 3) reduce groundwater VOC concentrations in the source area to below regulatory-based

MCSs and target risk-based MCSs; and, 4) reduce soil VOC concentrations below target risk-based MCSs.

Effluent from several hydraugers used to dewater the slopes for slope stability purposes has been collected and treated. Continuation of the capture and treatment of effluent from these hydraugers is required to address objective (1) above, until it can be shown that VOC concentrations at the point of compliance (where the hydraugers discharge) are below levels of detection.

Soil flushing, application of Hydrogen Release Compound (HRC), chemical oxidation (for unsaturated zone soils only), and excavation with offsite disposal are potentially effective corrective measures to meet remediation objectives (3) and (4). A combination of these measures is proposed for the source zone of the Building 71B lobe. Chemical oxidation and/or HRC application are the proposed corrective measures for areas not accessible to excavation, such as the areas of contamination surrounding foundation members in the source area. Corrective measures proposed to meet objectives (3) and (4) will also help meet objective (2).

8.4 Building 7 Lobe of the Building 7 Groundwater Solvent Plume and the Former Building 7 Sump Soil Removal Remedy

Proposed Remedies: Excavation of soils contaminated with VOCs and disposal at an authorized off-site disposal facility. In-situ soil flushing with treated extracted groundwater. Groundwater monitoring to evaluate natural attenuation.

Media Cleanup Standard: Drinking water standards for wells > 200 gallons per day (gpd). Short-term goal of risk-based levels for wells < 200 gpd and a long-term goal of drinking water standards.

Building 7 Lobe of the Old Town Groundwater Solvent Plume contains several halogenated VOCs in the groundwater at concentrations above regulatory-based MCSs (MCLs).

Concentrations of halogenated VOCs in the soil in the source area (the Former Building 7 Sump location) exceed MCSs for protection of potential future drinking water sources.

Wells within the source and core areas of the Building 7 lobe generally have groundwater yields that are less than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable for both soil and groundwater. In the downgradient areas and lobe periphery, where well yields are greater, regulatory-based MCSs (MCLs) are applicable.

The exposure pathways of concern at this unit are: the inhalation by hypothetical future indoor workers of vapor that migrates from the groundwater to indoor air in buildings that may be built above the plume area; inhalation by landscape maintenance workers of vapor migrating to outdoor air from soil; and, dermal contact and ingestion of groundwater by intrusive construction workers.

The remediation objectives for the source area of the Building 7 lobe are to: 1) remove any residual or free-phase dense non-aqueous phase liquids (DNAPLs) that continue to result in dissolution of VOCs into groundwater; 2) decrease vadose zone soil VOC concentrations below target risk-based MCSs; and, 3) decrease groundwater VOC concentrations below target risk-based MCSs. The corrective measures likely to meet these objectives are excavation with offsite disposal and thermally enhanced dual phase extraction (DPE). The estimated cost of expansion and operation of the thermally enhanced DPE pilot test system would exceed the cost of excavation with offsite disposal within approximately 5 years, which is not a sufficient time for the DPE system to meet target risk-based MCSs. In addition, excavation and offsite disposal is potentially a more reliable and effective alternative, and is therefore the proposed corrective measure for the source area.

Contaminated soil would be excavated to a depth of approximately 50 feet over an area of approximately 100 square feet in the vicinity of the former Building 7 sump. Approximately 180 cubic yards of excavated soil would be stored in covered bins on site, until shipped off site for disposal in accordance with applicable local, state, and federal laws and regulations. Any excavated soil that is determined to be RCRA hazardous waste will be disposed of in an offsite permitted disposal facility. The excavation will be backfilled with clean material.

The remediation objectives for the core area of the Building 7 lobe are to: 1) decrease groundwater VOC concentrations below target risk-based MCSs; and, 2) prevent migration of VOCs in groundwater at concentrations above risk-based levels into the plume periphery area. The corrective measures that are likely to meet these objectives are chemical oxidation, excavation with offsite disposal, soil mixing, and groundwater extraction/flushing. Soil mixing and excavation with offsite disposal were rejected because of slope stability concerns and cost. Groundwater extraction and flushing was considered to be potentially a more reliable and effective alternative than chemical oxidation and is therefore the proposed corrective measure for the core area.

The remediation objectives for the periphery area of the Building 7 lobe are to: 1) ensure that groundwater VOCs do not migrate into uncontaminated areas; and, 2) decrease groundwater VOC concentrations below regulatory-based MCSs. The corrective measures that are likely to meet these objectives are MNA, groundwater capture, enhanced bioremediation, and soil flushing with groundwater extraction. The currently operating groundwater extraction and treatment system should continue at the downgradient edge of the Building 7 lobe to meet remediation objective (1). A combination of MNA and soil flushing and groundwater capture is proposed to meet objective (2). Since available data indicate that natural attenuation is resulting in concentration reductions at the downgradient edge of the Building 7 lobe, MNA is the proposed alternative for this area. Enhanced bioremediation is proposed only if MNA becomes ineffective. Soil flushing is the proposed corrective measure for the other areas of the periphery where evidence for MNA is currently absent.

8.5 Building 52 Lobe of the Old Town Groundwater Solvent Plume

Proposed Remedies: In-situ soil flushing with treated extracted groundwater. Extracted groundwater is treated with activated carbon to remove VOCs.

Media Cleanup Standard: Drinking water standards for wells > 200 gallons per day (gpd). Short-term goal of risk-based levels for wells < 200 gpd and a long-term goal of drinking water standards.

Building 52 lobe of the Old Town Groundwater Solvent Plume contains halogenated VOCs in the groundwater at concentrations above regulatory-based MCSs (MCLs). Concentrations of VOCs in both the soil and groundwater are less than target risk-based MCSs. Concentrations of VOCs detected in the soil are less than both risk-based and regulatory-based MCSs (for protection of potential drinking water sources).

Wells within the Building 52 lobe are estimated to have sustainable yields greater than 200 gpd, so regulatory-based MCSs (MCLs) are applicable.

The remediation objectives for the Building 52 lobe are to: 1) ensure that groundwater VOCs at detectable concentrations do not migrate to surface water; 2) ensure that groundwater VOCs at concentrations exceeding regulatory-based MCSs do not migrate into areas where concentrations are less than MCSs; and, 3) decrease groundwater VOC concentrations below regulatory-based MCSs. The corrective measures that are likely to meet these objectives are groundwater capture, MNA, enhanced bioremediation, and soil flushing.

Groundwater capture using the Building 46 subdrain addresses remediation objectives (1) and (2) above. This technology should continue until it can be shown that termination of the technology does not result in detectable concentrations of VOCs in downgradient compliance wells and at the outfall to North Fork Strawberry Creek. The system (Building 46 subdrain and groundwater treatment system) is already in place and operation and maintenance costs are relatively low.

In situ soil flushing is a potentially effective corrective measure to address remediation objective (3) above. Based on the initial soil flushing pilot test results, this technology may permanently reduce VOC concentrations to regulatory-based MCSs, and therefore is proposed for full-scale implementation. Soil flushing may reduce VOC concentrations sufficiently so that MNA becomes an effective alternative. Enhanced bioremediation should be considered if MNA becomes ineffective.

8.6 Building 25A Lobe of the Old Town Groundwater Solvent Plume

Proposed Remedies: In-situ soil flushing with treated extracted groundwater. Groundwater monitoring to evaluate natural attenuation.

Media Cleanup Standard: Drinking water standards for wells > 200 gallons per day (gpd). Short-term goal of risk-based levels for wells < 200 gpd and a long-term goal of drinking water standards.

Building 25A lobe of the Old Town Groundwater Solvent Plume contains halogenated VOCs in the groundwater at concentrations above regulatory-based MCSs (MCLs) (Table 5-9). Concentrations of VOCs in both the soil and groundwater are less than target risk-based MCSs. Concentrations of VOCs detected in the soil are less than regulatory-based MCSs (for protection of potential drinking water sources).

Although most wells in the lobe area have yields that are less than 200 gpd, some wells near the source and downgradient and crossgradient areas have yields that are greater than 200 gpd. Regulatory-based MCSs (MCLs) are therefore applicable.

The remediation objectives for the Building 25A lobe of the Old town Groundwater Solvent Plume are to: 1) ensure that groundwater VOCs at concentrations exceeding regulatory-based MCSs do not migrate into areas where concentrations are less than MCSs; and, 2) decrease groundwater VOC concentrations below regulatory-based MCSs (MCLs). The corrective measures that are likely to meet these objectives are MNA, enhanced bioremediation, and soil flushing.

No remediation technologies, other than continued monitoring, are needed to address objective (1) above, since long-term groundwater monitoring data have established that the downgradient edges of the Building 25A lobe are not migrating, except possibly where it coalesces with the Building 7 lobe of the Old Town plume. Corrective measures proposed for the Building 7 lobe would address potential migration in that area.

In situ soil flushing is a potentially effective alternative to address remediation objective (2) above. Based on soil flushing pilot test results, this technology may permanently reduce VOC concentrations to regulatory-based MCSs, and therefore is proposed for full-scale implementation. If soil flushing does not reduce VOC concentrations sufficiently, MNA or enhanced bioremediation should be implemented to achieve the required MCSs.

8.7 Building 69A Area of Groundwater Contamination

Proposed Remedies: Groundwater monitoring to evaluate natural attenuation.

Media Cleanup Standard: Drinking water standards for wells > 200 gallons per day (gpd). Short-term goal of risk-based levels for wells < 200 gpd and a long-term goal of drinking water standards.

Building 69A Area of Groundwater Contamination contains cis-1,2-DCE, vinyl chloride and PCE at concentrations above regulatory-based MCSs (MCLs), and vinyl chloride at concentrations above target risk-based MCSs.

Wells throughout the Building 69/Building 75 area have groundwater yields that are less than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable.

The exposure pathway of concern at this unit is the inhalation by hypothetical future indoor workers of vapor that migrates from the groundwater to indoor air in buildings that may be built above the plume area.

The remediation objective for the Building 69A Area of Groundwater Contamination is to reduce vinyl chloride concentrations below target risk-based MCSs. The corrective measures that are likely to meet these objectives are MNA, enhanced bioremediation, chemical oxidation, and in situ soil flushing. Except for MNA, the effectiveness of these technologies would be limited by the low permeabilities of subsurface materials. The cost of MNA would be less than the other alternatives that can meet the remediation objective, therefore MNA is the proposed corrective measure.

8.8 Solvents in Groundwater South of Building 76 (AOC 4-5)

Proposed Remedies: No further action, except for continued monitoring to document the status of natural degradation and control of groundwater contaminant migration.

Media Cleanup Standard: Short-term goal of risk-based levels and a long-term goal of drinking water standards since all wells are less than 200 gpd.

Solvents in Groundwater South of Building 76 contain cis-1,2-DCE and TCE in groundwater at concentrations above regulatory-based MCSs (MCLs).

Groundwater well yields are less than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable. Since VOC concentrations are less than target risk-based MCSs, no action is required to attain MCSs. No migration of VOCs beyond the plume margins is occurring, so migration control is not a concern. Therefore, No Further Action is proposed for the Solvents in Groundwater South of Building 76, except for continued monitoring of the status of natural degradation and control of groundwater contaminant migration.

8.9 Building 77 Area of Groundwater Contamination

Proposed Remedies: No further action, except for continued monitoring to document the status of natural degradation and control of groundwater contaminant migration.

Media Cleanup Standard: Short-term goal of risk-based levels and a long-term goal of drinking water standards since all wells are less than 200 gpd.

Building 77 Area of Groundwater Contamination contained cis-1,2-DCE and PCE in groundwater at concentrations slightly above regulatory-based MCSs (MCLs). Well yields are less than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable. Since VOC concentrations are less than target risk-based MCSs, no action is required to attain MCSs. No migration of VOCs beyond the plume margins is occurring, so migration control is not a concern. Declining concentration trends and the presence of degradation products indicate that natural attenuation of VOCs is occurring. Therefore, No Further Action is proposed for the Building 77 Area of Groundwater Contamination, except for continued monitoring of the status of natural degradation and control of groundwater contaminant migration.

8.10 Building 75/75A Area of Groundwater Contamination

Proposed Remedies: No further action, except for continued monitoring to document the status of natural degradation and control of groundwater contaminant migration.

Media Cleanup Standard: Short-term goal of risk-based levels and a long-term goal of drinking water standards since all wells are less than 200 gpd.

Building 75/75A Area of Groundwater Contamination contained TCE, PCE and cis-1,2-DCE in groundwater at concentrations above regulatory-based MCSs (MCLs). Well yields are less than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable. Since VOC concentrations are less than target risk-based MCSs, no action is required to attain MCSs. No migration of VOCs beyond the plume margins is occurring, so migration control is not a concern. Therefore, No Further Action is proposed for the building 75/75A Area of Groundwater Contamination, except for continued monitoring to document the status of natural degradation and control of groundwater contaminant migration.

8.11 Benzene Detected in Groundwater in Wells East of Building 75A

Proposed Remedies: Groundwater monitoring to evaluate natural attenuation.

Media Cleanup Standard: Short-term goal of risk-based levels and a long-term goal of drinking water standards since all wells are less than 200 gpd.

Benzene has been detected in two deep wells (greater than 100 feet deep) located east of Building 75A at concentrations above the regulatory-based MCS (Table 5-14). Benzene is generally the only VOC detected in either well. Benzene has not been detected at a concentration above the target risk-based MCS. The benzene detected in these two deep wells screened in the Orinda Formation may be naturally occurring.

The yields of both wells are less than 200 gpd, so groundwater is not considered a potential drinking water source, therefore only risk-based MCSs are applicable. Since benzene concentrations are less than target risk-based MCSs, no action is required to attain MCSs. No Further Action is proposed for the Benzene Detected in Groundwater in Wells East of Building 75A, except for continued monitoring to document the status of natural degradation.

8.12 Building 88 Hydraulic Gate Unit and Building 75 Former Hazardous Waste Handling and Storage Facility

PCBs are the COCs at both the Building 88 Hydraulic Gate Unit and the Building 75 Former Hazardous Waste Handling and Storage Facility. Subsequent to completion of the HHRA, Berkeley Lab completed ICMs in which contaminated soil at both units was excavated and disposed of offsite. These ICMs resulted in reduction of residual PCB concentrations to below the MCS for PCBs of 1 mg/kg. The MCS was set at the Toxic Substances Control Act (TSCA) (40 Code of Federal Regulations [CFR] Parts 750 and 761) self-implementing cleanup level of 1 mg/kg, for soil in high occupancy areas. Therefore, no further action is required at these units.

9 REFERENCES

The following reference documents have been cited in this Statement of Basis:

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3. Berkeley Lab 1992 RCRA Facility Investigation Phase I Work Plan for the Lawrence Berkeley Laboratory, Environmental Restoration Program, October 30, 1992

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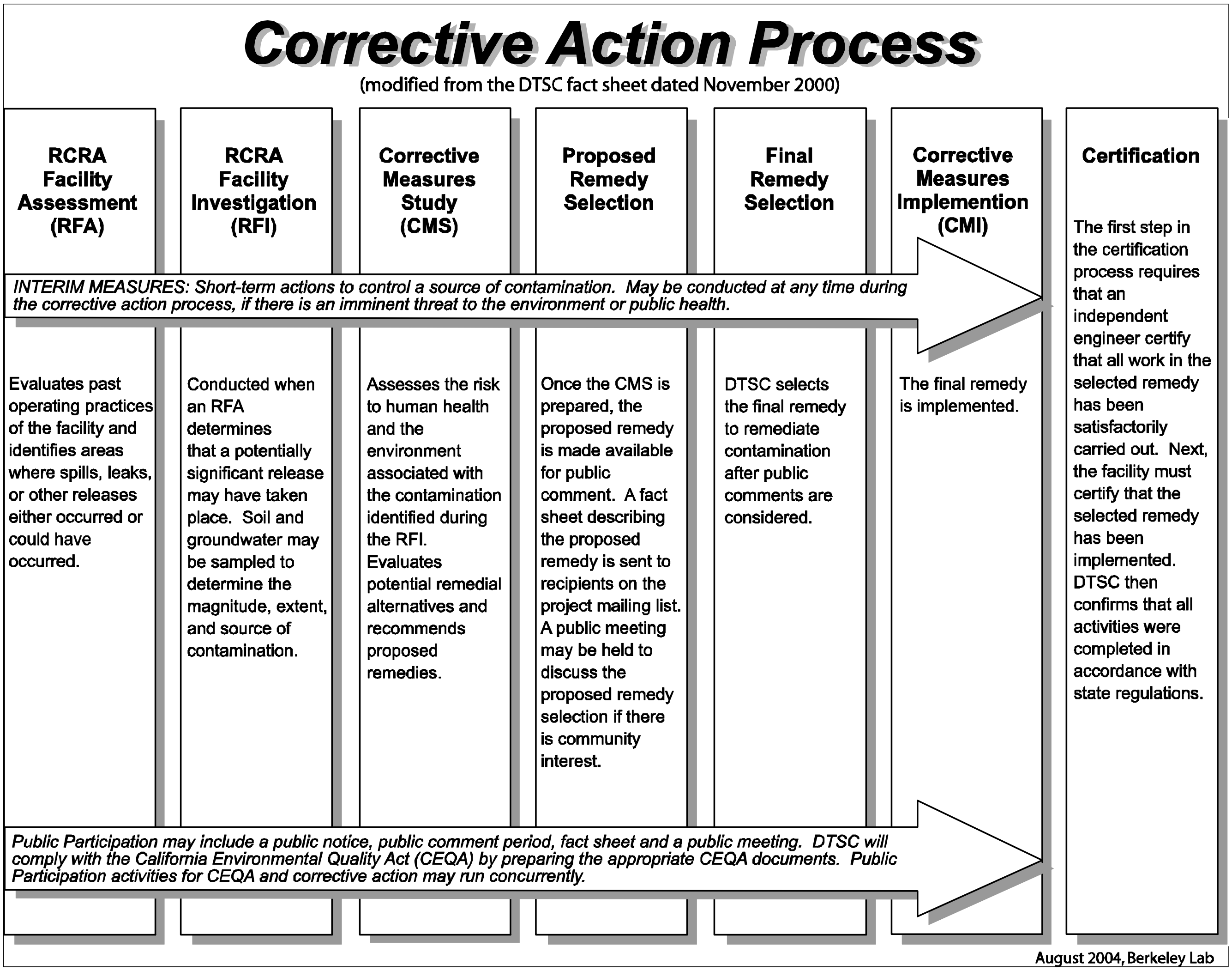
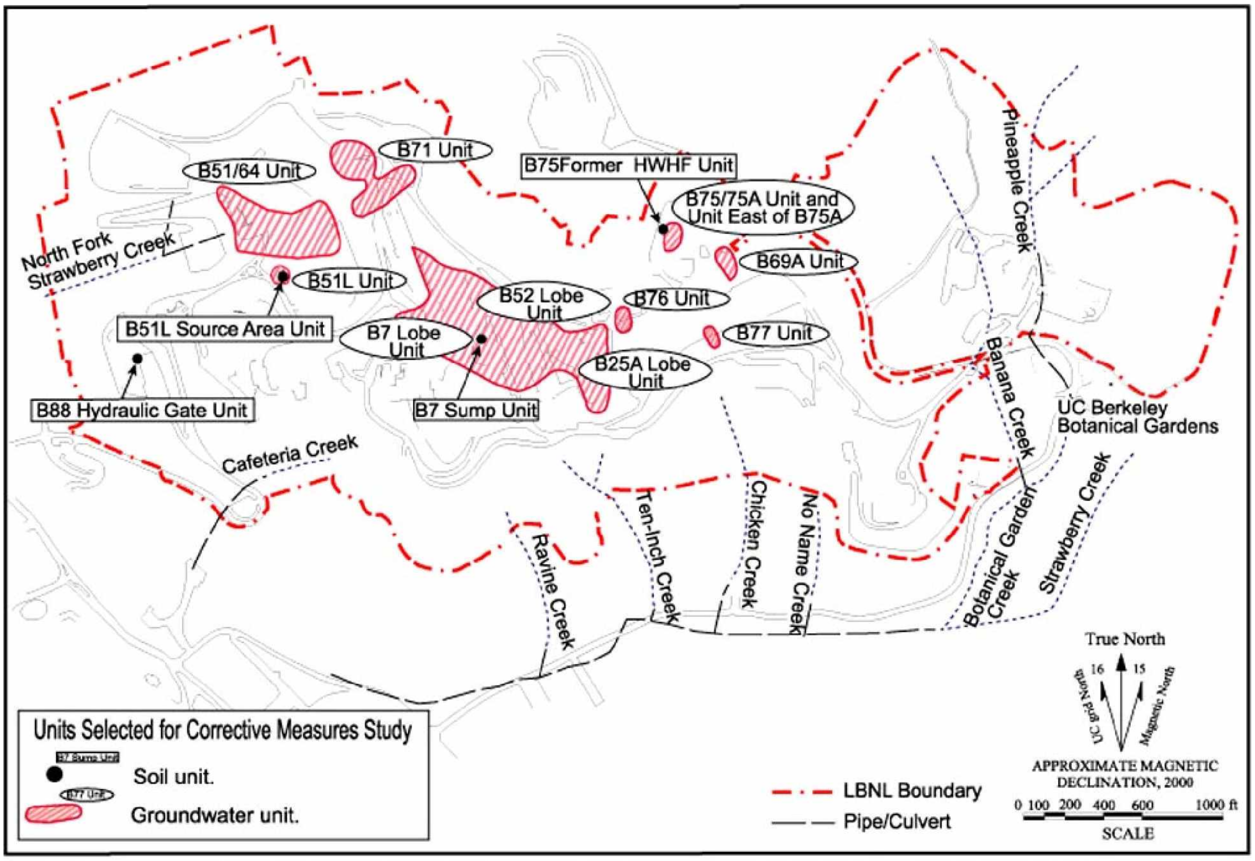
Figure 1. Overview of the RCRA Corrective Action Process





Units Recommended for Inclusion in Corrective Measures Study, Lawrence Berkeley National Laboratory (LBNL)

Figure 2. Locations of Soil and Groundwater Units Evaluated in the CMS Report, Lawrence Berkeley National Laboratory