# LBNL Responses to DTSC Comments

October 18, 2004

BERKELEY LAB
Environment, Health and Safety Division
*Environmental Restoration Program*

Dr. Waqar Ahmad
Facility Permitting Branch
Cal EPA-DTSC
700 Heinz Avenue, Suite 200
Berkeley, CA 94710-2737

October 18, 2004
ERP-3028

Subject: Responses to Comments on the *Draft* RCRA Corrective Measures Study Report for the Lawrence Berkeley National Laboratory Environmental Restoration Program, CA-EPA ID No: CA4890008986, dated July 2004

Dear Dr. Ahmad:

Berkeley Lab appreciates the thorough review and constructive comments by DTSC and RWQCB on the *Draft* RCRA Corrective Measures Study Report dated July 2004. Enclosed are LBNL's responses to comments, as requested in the DTSC letter dated September 17, 2004.

Please contact me at (510) 486-6106 if you have any questions.

Sincerely,

Iraj Javandel
Environmental Restoration Program

Encls.

Ernest Orlando Lawrence Berkeley National Laboratory
One Cyclotron Road | Berkeley, California 94720-8126 | Mail Stop 90R1116 | Tel: 510.486.6106 | Fax: 510.486.8694

**LBNL Responses to Comments from *Calvin Willhite* of DTSC Human and Ecological Risk Division (HERD) dated September 10, 2004 to Waqar Ahmad of DTSC Standardized Permits and Corrective Action Branch.**
**Subject: Lawrence Berkeley National Laboratory, University of California, Berkeley, California; PCA: 22120 Site-WP: 200178-00 MPC: 39-PER (Review of the "Corrective Measures Study Report, July 2004, for the Lawrence Berkeley National Laboratory Environmental Restoration Program, Berkeley, California, EPA ID No. CA 4890008986)**

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***General Comments*** | | The report is well-organized and clearly presents nearly all options with estimated financial costs for each level of theoretical health risk. Each of the various options is presented with each risk level identified in the U.S. EPA acceptable risk range. While it is beyond the expertise of risk assessment to evaluate the accuracy of the range of cost estimates, it appears that the authors have identified correctly the applicable or relevant and appropriate requirements (ARARs) specified under the Solid Waste Disposal Act, the Toxic Substances Control Act, and the Clean Water Act. Identification of ARARs is important in establishing performance goals for remedial alternatives; ARARs are reiterated throughout the CMS and the ARARs proposed at LBNL have specific bearing on the Ground Water Project Tasks described in the CMS. It appears the LBNL authors have considered carefully all three ARAR types [ambient or chemical-specific ARARS that establish health- or risk-based specific chemical concentration limits in various LBNL environmental media; performance, design or action-specific ARARs that establish requirements on specific remedial activities related to management of hazardous materials released at LBNL; location-specific ARARs that establish administrative restrictions on and control of remedial activities based on the specific character of the LBNL). ARARs are so important to the CMS that, in fact, at LBNL the baseline public health risk assessment could have been satisfied by simply documenting the chemical-specific ARARs since all materials considered in the CMS have promulgated ARARs. | |

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***General Comments (cont'd.)*** | | At page xiii, it is not clear why a well-head treatment option of site groundwater prior to its use as either industrial process water and/or landscape irrigation was not included in the present analysis? Given the clear need to conserve EBMUD drinking water and the opportunity to reduce the long-term financial costs associated with site mitigation, an explanation for rejection of those options should be included at some point in the document. | The following paragraph will be added to Section 3.5.4, Subsection: Comply with Applicable Standards for Management of Waste.:<br>On-site reuse options were evaluated for treated groundwater when treatment systems were initially installed. Effluent from two treatment systems was used as makeup for cooling tower water at Building 88 and Building 37. The Building 88 reuse was halted when it was determined that the water was potentially damaging to cooling tower operations (total dissolved solids concentrations were too high). Reuse at the Building 37 cooling tower has continued. Currently, and according to the proposed remedies, most of the treated groundwater will be recirculated as part of implemented corrective measures to flush contaminants from the subsurface. Reuse options for extracted groundwater will be reevaluated in the future, if the water is no longer needed for recirculation. |

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***General Comments (cont'd.)*** | | In general, risk analyses rely upon the upper 95% confidence limit on the arithmetic mean of the chemical concentration data for each material considering all site groundwater. The authors present the risk analyses and the proposed risk reductions based on well-by-well concentrations. While this approach takes into account possible "hot-spots" (see Risk Assessment Guidance for Superfund. Volume 1. Human Health Evaluation Manual (Part A; EPA/540/1-89/002 Section 4.3.2), this is not the customary approach to a site as a whole (U.S. EPA Pub. 92857-081, May 1992). Because the heterogeneous, fractured and complicated geology at LBNL provides physical limitations to handling site groundwater as a homogeneous "aquifer" data set, a brief explanation of the geologic and groundwater characteristics included either in Section 1.2 (Introduction) or as a brief clarification in the Executive Summary would facilitate the readers' understanding of the CMS approach used here. | The following paragraph will be added to Section 2.2.2, Hydrogeologic Characteristics and Groundwater Yield.<br><br>The hydrogeological characteristics of the bedrock units and surficial materials, along with the physiography of the site, are the primary factors controlling groundwater flow and contaminant transport. There are several bedrock geologic units in the areas of LBNL where groundwater contamination is present including Orinda Formation sedimentary rocks that dip moderately toward the northeast. Overlying this unit in most areas of the site are colluvium, artificial fill, and/or isolated masses of Moraga formation volcanic rock that are interpreted to be paleolandslide (ancient landslide) deposits. Each of these geologic units consists of a distinct assemblage of soil and rock types with its own characteristic hydrogeologic properties. Due to the complex structural geometry of these units, the hydrogeology at LBNL is characterized by a number of discrete, relatively permeable zones, where groundwater flow is relatively rapid, separated and underlain by broad areas where underlying relatively impermeable rocks inhibit flow. As a result of this geometry, most of the contaminated groundwater plumes at LBNL are also discrete, and do not interact hydrologically. |

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***General Comments (cont'd.)*** | | At page 24 (line 11 from bottom), the document should do a much better job of explaining the site-specific features that lead one to the conclusions about "technical impracticability". This is a key concept presented in the CMS and must be clearly delineated – specifically, which area are amenable to remediation to MCLs and which areas are unlikely to meet the MCS goals – and – what features of those areas which are unlikely candidates for complete remediation to ARARs account for that failure? While Section 2 describes water yield and site geology, the authors should more directly explain the critical physical features which lead to the proposed ultimate "technical impractability". It is very important that the document be very clear on the specific factors that preclude certain area site groundwater remediation to MCLs. | As requested, additional text encompassing the following discussions will be added to Section 3.4 (Technical Impracticability) to more adequately explain the site-specific characteristics that lead to the cited conclusions regarding the technical impracticability of remediating areas to meet cleanup goals.<br><br>Low permeability rock and soil containing dense non-aqueous-phase liquids (DNAPL) or very high levels of dissolved VOCs are present at several of the LBNL groundwater units. These features, compounded by geologic characteristics such as multiple layers, heterogeneities, and fractured rock which are present over most of the site, limit the effectiveness of remedial measures in attaining MCSs. The presence of low permeability rock and soil below the water table results in very low rates of advection (flow) of contaminated groundwater, so that contaminant migration mechanisms are in many cases dominated by diffusion. Diffusion of contaminants out of such contaminated materials is generally an extremely slow process, even where the process is enhanced by in situ remediation technologies, thus limiting the ability to achieve MCSs and impacting adjacent areas for many years. The length of time necessary to achieve MCSs in areas with these characteristics is generally difficult to estimate, both because diffusion rates are difficult to estimate in heterogeneous geologic media, and because cleanup rates are also dependent upon unknowns such as the mass of contaminant released and the length of time the contaminant has been present in the subsurface. For in situ remediation methods, the presence of low permeability materials and/or DNAPL can result in contaminant removal rates that tail off (reach asymptotic levels) at concentrations that may be significantly above MCSs. |

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***General Comments (cont'd.)*** | | | The areas subject to corrective measures can be divided into the following three categories:<br><br>1) Areas where MCSs are unlikely to be attained. These areas are characterized by low permeability rocks and soil where DNAPL and/or very high levels of dissolved VOCs are present and excavation is not feasible, such as areas at or adjacent to the source zone of the Building 7 lobe of the Old Town Groundwater Solvent Plume.<br><br>2) Areas where attaining MCSs is likely. These areas fall into two subcategories: a) areas such as the Building 52 lobe of the Old Town Groundwater Solvent Plume characterized by relatively high permeability rock and soil where plume constituents consist of low to moderate concentrations of dissolved phase VOCs which migrate primarily due to advection; and b) areas where permeabilities are relatively low, but where DNAPLs are not present, and where dissolved phase constituent concentrations do not significantly exceed MCSs and are amenable to reductions due to natural attenuation mechanisms (e.g., the Building 69A Area of Groundwater Contamination).<br><br>3) Areas where the ability to attain MCSs is uncertain. These areas are generally characterized by low permeability rocks, absence of DNAPL, and moderate to high groundwater contaminant concentrations. These areas have characteristics generally intermediate between categories 1 and 2. A large fraction of the Building 7 lobe of the Old Town Groundwater Solvent Plume falls into this category, since the achievable long term rates of diffusion and advection of contaminants have not yet been ascertained. Assessment of the achievability of MCSs cannot be completed until sufficient time has elapsed to allow measurement of contaminant reduction rates resulting from the implemented corrective measures. |

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***General Comments (cont'd.)*** | | | The specific areas that "are amenable to remediation to MCLs and which areas are unlikely to meet the CMS goals will not be delineated, however, since an estimate of those areas is premature at this time and the Category 3 areas (where attaining MCSs may or may not be possible) would likely be the major site subdivision.<br><br>In addition, text will be added to Section 3.4 providing an estimate of the area of LBNL where concentrations of contaminants in the underlying groundwater exceed MCLs. This area is estimated to be approximately 4% of the entire LBNL site. |
| ***Specific Comments*** | | | |
| **1** | **Page xv-xvii** | Please identify the common names of the chemicals of concern (e.g., PCBs and/or specific VOCs) for each soil and groundwater unit listed in the table. At the soil units AOC 6-3 and SWMU 3-6, please either delete or modify the entry "No action" with a footnote the explanation of the CMS document section describing the completed interim measures or revise the entry to state "No further action". As written, the text is confusing and suggests that nothing was proposed, planned or has been completed. | *Agree.* A column will be added to the table listing the chemicals of concern at each soil and groundwater unit. The entry "No Action" will be modified to "No further action" for AOC 6-3 and SWMU 3-6. The following note will be added for AOC 6-3 and SWMU 3-6 in the table column Recommended Corrective Measure Alternative for Cleanup "See text paragraph preceding this table for a description of the ICM." |

| | | | |
|---|---|---|---|
| **2** | **Page xvi** | At the column "Recommended Corrective Measure Alternative for Cleanup", the status of the various alternatives for AOC 1-9 and AOC 2-4 is confusing. The status of the various alternatives is not readily apparent and it is not clear which of the various alternatives are actually recommended? | *Agree*. At the column "Recommended Corrective Measure Alternative for Cleanup", the status of the various alternatives for AOC 1-9 and AOC 2-4 will be revised as follows:<br><br>*AOC 1-9*<br><br>The following combination of corrective measures alternatives is recommended for the plume source area:<br><br>1) excavation and offsite disposal of accessible shallow unsaturated zone soil,<br>2) limited in situ chemical oxidation of unsaturated zone soils adjacent to the building foundation, and<br>3) in situ soil flushing.<br><br>For contaminated groundwater adjacent to the plume source area, enhanced bioremediation using Hydrogen Release Compounds (HRC) is the recommended measure. In addition, surface water (hydrauger effluent) capture and treatment will continue until groundwater discharge to surface water is shown to be below detectable levels.<br><br>*AOC 2-4*<br><br>The following combination of corrective measures alternatives is recommended for the different areas of the plume.<br><br>1) soil excavation (as described under AOC 2-5) for the plume source area,<br>2) continued in situ soil flushing combined with groundwater capture for the plume core area,<br>3) Monitored Natural Attenuation (MNA) in the downgradient area, and<br>4) continued groundwater capture and treatment within and at the downgradient edge of plume until downgradient migration of COCs within the plume does not result in exceedences of applicable MCSs and migration of detectable levels of COCs beyond the plume boundary would not occur in the absence of controls. |

<table>
<tr><td>3</td><td>Page xvii</td><td>At the column "Recommended Corrective Measure Alternative for Cleanup", the entry can be clarified by deletion of the phrase "is not a potential drinking water source" and replacement with "and groundwater characteristics do not meet SWRCB Resolution 88-63 provisions".</td><td>Agree. "is not a potential drinking water source" will be deleted and replaced with the following text "and groundwater characteristics do not meet criteria of SWRCB Resolution 88-63 – Sources of Drinking Water Policy."</td></tr>
<tr><td>4</td><td>Page 8, Section 1.3.3</td><td>Please list the areas of concern and/or solid waste management units that have been the subjects of interim soil removals. As written, it appears that the all of the materials of concern may remain on-site where this in fact is not necessarily the case.</td><td>Agree. Text will be revised as follows "The ICMs primarily included excavation and offsite disposal of contaminated soil…" The following table will also be added to Section 1.3.3:<br>Table 1.3.3-1. Locations of Soil Excavation ICMs Implemented at LBNL
<table>
<tr><th>Unit Number</th><th>Unit Name</th></tr>
<tr><td colspan="2">Units Included in CMS Report</td></tr>
<tr><td>SWMU 3-6</td><td>Building 75 Former Hazardous Waste Handling and Storage Facility</td></tr>
<tr><td>AOC 1-9</td><td>Building 71 Groundwater Solvent Plume: B71B Lobe</td></tr>
<tr><td>AOC 2-5</td><td>Building 7 Sump</td></tr>
<tr><td>AOC 6-3</td><td>Building 88 Hydraulic Gate Unit</td></tr>
<tr><td>AOC 10-5</td><td>Building 52A Groundwater Plume Source Area</td></tr>
<tr><td colspan="2">Units Not Included in CMS Report</td></tr>
<tr><td>AOC 1-10</td><td>Building 71 Room 003 Mercury Release</td></tr>
<tr><td>AOC 5-5</td><td>Building 77 Diesel Generator Pad</td></tr>
<tr><td>AOC 9-2</td><td>Building 51 Former Diesel UST</td></tr>
<tr><td>AOC 9-9</td><td>Building 51 Sanitary Sewer and Drainage System</td></tr>
<tr><td>AOC 9-10</td><td>Building 51/64 Catch Basin</td></tr>
<tr><td>AOC 9-13</td><td>Building 51/64 Groundwater Solvent Plume</td></tr>
<tr><td>AOC 11-1</td><td>Building 74 Former Diesel UST</td></tr>
<tr><td>AOC 14-1</td><td>Building 2 Diesel UST</td></tr>
<tr><td>AOC 14-7</td><td>Building 37 Electrical Substation</td></tr>
<tr><td>SWMU 2-1</td><td>Former Building 7 Plating Shop</td></tr>
<tr><td>SWMU 2-2</td><td>Former Building 52B Abandoned Above-Ground Liquid Waste Storage Tank</td></tr>
<tr><td>SWMU 2-3</td><td>Former Building 17 Scrap Yard and Drum Storage Area</td></tr>
<tr><td>SWMU 9-4</td><td>Building 51 Vacuum Pump Room Sump and Collection Basins</td></tr>
<tr><td>SWMU 9-6</td><td>Building 51 Motor Generator Room Sump</td></tr>
<tr><td>SWMU 10-10</td><td>Building 25 Plating Shop Floordrains</td></tr>
<tr><td>not a unit</td><td>Building 51 Basement Oil Pumps</td></tr>
</table></td></tr>
</table>

| | | | |
|---|---|---|---|
| **5** | **Page 10** | It is worthwhile to point out that any hypothetical off-site exposure would be far less than that accounted for by the hypothetical on-site future residential exposure scenario. Therefore, the on-site risk assessments included in the HHRA account for off-site residential exposure scenarios. | *Agree with comment.* No revision to the text is proposed. |
| **6** | **Page 10** | Please clarify what is meant by the term "relatively stable"? | *Agree.* The phrase "relatively stable will be revised to "stable' and the following clarification will be added "The stability of the plumes is indicated by measured groundwater concentrations that are generally static or decreasing at monitoring points located throughout the plume areas and by the absence of detectable concentrations of contaminants in wells monitoring the areas downgradient from the plumes." |
| **7** | **Page 14; Tables 1.3.4-2 and 1.3.4-3** | Please identify the primary chemical(s) encountered at each entry and please footnote the current status of that AOC or SWMU. Where the area or unit was retained in the CMS based on excess health risk, indicate the primary chemical that accounts for that risk. | *Agree.* A column will be added to the tables listing the risk-based Chemicals of Concern. The primary chemicals that account for the risk will be shown in boldface type. Note that different chemicals may be the primary contributors to risk in different areas of the plumes (e.g. PCE in the source area and vinyl chloride in downgradient areas) or different chemicals may have similar risks. Therefore, more than one chemical may be shown as the primary contributor to risk at a unit. Text will be added to the footnote for AOC 6-3 and SWMU 3-6 to indicate that no further action is proposed for these two units and that a removal action has been completed. |
| **8** | **Page 16** | Please explain the ultimate fate of the treated water that has been collected for the past 12 years as "hydrauger effluent". Since this water is treated, to what total water volume over this dozen years does this correspond and have those treated waters been used for any beneficial purpose (e.g., LBNL industrial process or landscape irrigation)? | See response to general comments. The treated hydrauger effluent has been discharged to the sanitary sewer under conditions of Berkeley Lab's Wastewater Discharge Permit issued by the East Bay Municipal Utility District (EBMUD). Approximately 4.8 million gallons have been treated by this system. |
| **9** | **Page 23, line 11 from bottom** | As written, the conclusion is speculation. Either replace the word "would" with "could" or replace the phrase with "there could be a possible adverse impact on private property values in neighborhoods adjacent to the Berkeley lab." There is no direct evidence for the statement as written. | *Agree.* |

| | | | |
|---|---|---|---|
| **10** | **Page 191, Section-5.0** | Interim remedial measures for soil PCBs have already been completed at Area of Concern (AOC) 6 Building 88 and Solid Waste Management Unit (SWMU 3-6) Building 75 (Attachment 1). It is important that the reader recognize that the interim remedial measures for the laboratory were achieved and verification sampling found compliance with, the soil polychlorinated biphenyl ARARs for all congeners consistent with unrestricted future site land use (e.g., Toxic Substances Control Act 40 CFR 761; Federal Register 50: 62788 and OSWER Directive No. 93555.4-01 FS, August 1990). It may be worthwhile to expand the presentation of this fact in the Executive Summary. | *Agree.* The following paragraph from the Executive Summary has been modified as indicated to address the comment.<br><br>"The HHRA identified PCBs as the COC at two units, 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 conducted Interim Corrective Measures (ICMs) (soil excavation and offsite disposal) that resulted in reduction of residual PCB concentrations to less than the proposed MCS for PCBs of 1 mg/kg at both units. 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, which is both a risk-based and regulatory-based level. Verification sampling found compliance with this level, which is consistent with unrestricted future land use. No additional corrective action is therefore recommended for either of these units." |

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***Conclusion*** | | The CMS represents a clear presentation of options available to regulatory risk managers. The authors and the facility should be given public credit for their achievements in removal of soil PCBs to less than ARARs intended for unrestricted future land use especially at Building 88. This is remarkable in light of the fact that the facility was able to accomplish removal actions in spite of the high voltage electrical and critical utility lines with concrete supports at this AOC (Figure 1). These utility lines are located in soils where PCBs were found and are located near the Berkeley cyclotron; clearly the immediate danger to workers engaged in soil excavations could have been brought forward as obstacles that could impede these remedial measures. The facility has made remarkable progress in site PCB risk reduction and this fact should be recognized by regulatory agencies.<br><br>The CMS appendices should include an update on the carcinogenic potency of trichloroethylene (TCE), a material which accounts in large measure for the risk estimates Presented for the various areas of concern and solid waste management units. Given the marked discrepancy between recent advancements in the science (Attachments 2-4) and the 20 year old risk assessments which formed the historical basis of the promulgated ARARs for TCE, to neglect considerations of these published advancements in TCE risk assessment would be to present an incomplete picture of the hazards (if any) associated with the TCE found in soil and groundwater at LBNL. | *Agree.* As shown in the revised Table 1.3.4-2, TCE does not "account in large measure for the risk estimates", as indicated in the DTSC comment. However, the text will be modified as described below to discuss recent advancements in the science concerning the toxicity of TCE.<br><br>The following text will be added at the end of Section 3.2.1:<br><br>Although no revisions have been made to cancer risk factors for TCE, recent research on TCE carcinogenicity strongly suggests that the cancer risk factors used to estimate the risk-based MCSs for TCE are overly conservative by approximately a factor of 10. A discussion of this research is given in Appendix A.<br><br>The following text will be added to Appendix A:<br><br>The TCE carcinogenic toxicity factor recommended by CalEPA (www.oehha.ca.gov/risk/ChemicalDB/index.asp) was used in the Human Health Risk Assessment (LBNL, 2003a) and was also used to develop proposed Media Cleanup Standards (MCSs) in the CMS Report. However, recent peer-reviewed articles by experts in the toxicity of TCE (Clewell and Andersen, 2004; Kester and Clewell, 2004) suggest that the carcinogenic potency of TCE may not be as great as suggested by either CalEPA, or USEPA [2002] which proposed a cancer potency value approximately 60-times more conservative than the CalEPA value in their TCE Health Risk Assessment. As discussed in Clewell and Andersen (2004), "a physiologically based pharmacokinetic (PBPK) model was applied to estimate target tissue doses for the three principal animal tumors associated with TCE exposure: liver, lung, and kidney" by USEPA (2002) in deriving cancer potency values. Clewell and Anderson (2004) state, "However, these risk estimates ignore the evidence that the human is likely to be |

| Item | Page/Para | DTSC Comment | LBNL Response |
|---|---|---|---|
| ***Conclusion (cont'd.)*** | | | much less responsive than the mouse to the carcinogenic effects of TCA [trichloroacetic acid] in the liver and that the carcinogenic effects of TCE are unlikely to occur at low environmental exposures ... environmental exposures below 66 µg TCE per cubic meter in air and 265 µg TCE per liter in drinking water are considered unlikely to present a carcinogenic hazard to human health." For comparison, the 10-6 theoretical ILCR used to develop the MCSs corresponds to a concentration of 6.1 µg TCE per cubic meter in air, and the Maximum Contaminant Level (MCL) for drinking water for TCE is 5 µg/L. Kester and Clewell (2004) provide a detailed discussion of the scientific deficiencies of the USEPA (2002) draft TCE health risk assessment and state that, "As a result, its major conclusions regarding the potential health risks associated with TCE exposure are scientifically indefensible." Therefore, based on this recent scientific evidence the risks associated with potential exposure to TCE detected in soil or groundwater and the potential risks from migration of TCE into indoor air would be significantly less than estimated in the Human Health Risk Assessment (LBNL, 2003a) and the MCS proposed for TCE in the CMS Report would be overly conservative by a factor of 10 or more.<br><br>Clewell, H.J. and M.E. Andersen. 2004. Applying mode-of-action and pharmacokinetic considerations in contemporary cancer risk assessments: An example with trichloroethylene. Crit. Rev. Toxicol. 34(5): 385-445.<br><br>Kester, J.E. and H.J. Clewell. 2004. The perils and promise of modern risk assessment: the example of trichloroethylene. Clin. Occup. Environ. Med. 4: 497-512.<br><br>USEPA, 2002. USEPA Science Advisory Board, Trichloroethylene Health Risk Assessment Synthesis and Characterization, An EPA Science Advisory Board Report, EPA-SAB-EHC-03-002, Washington, DC. |