TETRA TECH, INC.

February 1, 2013

Lynn Nakashima
Project Manager
Department of Toxic Substances Control
700 Heinz Avenue
Berkeley, CA 94710

Subject: Final Technical Approach for Human Health Risk Assessment, Site Characterization Report, Proposed Richmond Bay Campus
University of California, Berkeley, Richmond Field Station

Dear Ms. Nakashima:

On behalf of the University of California, Berkeley, please find the Final Technical Approach for Human Health Risk Assessment for the Site Characterization Report (SCR) prepared for the Proposed Richmond Bay Campus. This document reflects the changes discussed both during the in-person meeting on November 15, 2012, as well as in the responses to comments submitted by Kimi Klein on November 20, 2012, and accepted by DTSC on November 29, 2012. The responses to comments are attached to the final technical memorandum.

The draft SCR, submitted to DTSC on January 9, 2013, reflects all changes documented within this technical memorandum. If you have any questions or comments regarding this submittal, please call me at (510) 302-6283.

Sincerely,

Jason Brodersen, P.G.
Project Manager

Enclosures

cc: Greg Haet, Office of EH&S, University of California, Berkeley
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Final Technical Approach for Human Health Risk Assessment
Site Characterization Report, Proposed Richmond Bay Campus

The University of California (UC) is proposing to establish a Richmond Bay Campus on properties it owns in Richmond, California, including the Richmond Field Station (RFS). The University of California, Berkeley (UC Berkeley), will prepare the site characterization report (SCR) in support of a Removal Action Workplan (RAW) under Health and Safety Code Section 25356.1(h). The proposed RAW would establish the remedy for certain portions of the RFS site defined as developable and identified as the "Research, Education, and Support" (RES) Area by the proposed Richmond Bay Campus Long Range Development Plan (LRDP), as well as prescriptive requirements for other portions of the RFS site defined as developable and identified as RES Area under the proposed Richmond Bay Campus LRDP. For the purposes of the SCR, the portions of RFS defined under the DTSC Order are referred to as the "Site." The DTSC Order does not address, and therefore Site does not include, the outboard marsh.

Tetra Tech, Inc. (Tetra Tech) will conduct a human health risk assessment (HHRA) as part of the SCR. The HHRA will provide a basis to support risk management decisions about health effects associated with potential human exposures to contaminants in soil in the RES Area and groundwater at the Site. The HHRA will be conducted consistent with California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) risk assessment guidance (DTSC 1992, DTSC 2011a). This approach identifies the proposed methodology to identify contaminants, assess exposure, assess toxicity, and characterize the risk. The results of the HHRA will be used to help identify appropriate final remedial actions for soil in the RES Area and groundwater Site-wide. The HHRA will be included as an appendix to the SCR for the proposed Richmond Bay Campus.

Because not all portions of the RES Area have been investigated to the same level of sampling, the HHRA for the RES Area will be conducted in two steps:

- Step 1 of the HHRA will evaluate chemical concentrations in RES Area soil and Site-wide groundwater against screening criteria.
- Step 2 of the HHRA will be a quantitative, focused HHRA for only those areas in the RES Area for which adequate soil data were available to conduct an assessment: Mercury Fulminate Area (MFA) and Associated Production Areas (APA), and Corporation Yard.

1.0 HUMAN HEALTH EVALUATION

The HHRA conservatively characterizes risks to human receptors potentially exposed to constituents detected in environmental media in the soils and groundwater.

The objectives of the HHRA are:

- To evaluate whether site-related constituents detected in environmental media pose unacceptable risks to potential human receptors under conditions documented at the time of the Field Sampling Workplan (FSW) Phases I through III.

- To provide information to support decisions concerning the need for further evaluation or action based upon current and reasonably anticipated future remedial actions and anticipated future land use.

Consistent with standard risk assessment practice and DTSC guidance, the HHRA will include the following components:

- **Conceptual Site Model (CSM)**—This step involves identifying potential exposure pathways to the chemicals of potential concern (COPC), and identifying human populations that might be exposed to these under future site conditions.

- **Data Evaluation and Selection of COPCs**— This step consists of evaluating the analytical data for usability in the HHRA, grouping analytical data by medium, and selecting COPCs in media. A summary of the detected analytes and media to be used in the HHRA is provided as Table 1 in this technical approach.

- **Exposure Assessment**—Anticipated future land use scenarios under which exposure to site-related constituents could occur are qualitatively discussed. For each potential land use scenario, a set of exposure assumptions was developed to quantitatively evaluate the scenarios by calculating future risks. These assumptions will be used to calculate site-specific risk-based concentrations (RBCs), consistent with methodologies outlined by DTSC (Cal/EPA 2005).

- **Toxicity Assessment**—The dose-response characteristics of carcinogens (including mutagens) and non-carcinogens will be described and toxicity values for each COPC will be presented.

- **Risk Characterization**—For each receptor and exposure scenario, the information provided by the exposure and toxicity assessments is combined to yield quantitative risk estimates that characterize the relationship between hypothetical exposures and potential toxicity. Estimates for potential theoretical excess cancer risks and non-cancer hazards are provided and discussed, both qualitatively and quantitatively. Risk will be calculated using a sum of ratios approach (DTSC 2011a). Uncertainties associated with the risk assessment will be also discussed in the report.

2.0 CONCEPTUAL SITE MODEL

This section presents the CSM for human receptors at the site. The CSM identifies potentially complete exposure pathways by which receptors could come in contact with site-related constituents. The CSM is used throughout the site investigation and remediation processes to: (1) provide a framework for addressing potential risks; (2) evaluate the need for additional data collection activities; and (3) evaluate health risks and the need for remedial measures.

The following four elements are necessary to form a complete exposure pathway:

1) A source or release from a source;
2) A mechanism of release and transport;
3) A point of contact for potential receptors (contaminated media); and
4) An exposure route (incidental ingestion, dermal contact, and inhalation).

If any one of the four elements is missing, the exposure pathway is considered incomplete. Only potentially complete exposure pathways will be evaluated in the HHRA.

As noted in Phase I and II reports (Tetra Tech 2011; 2012a, b, c), historical uses of the Site have resulted in chemical releases to soil, and subsequent impacts on groundwater have been identified at the Site. Potential mechanisms for release include surface spills, erosion, stormwater runoff, and groundwater transport. The point of contact is assumed to be in areas that are either being redeveloped or are anticipated to be developed in the future. While surface water is present in the Western Stege Marsh portion of RFS, the marsh is not included within the scope of this investigation. As well, portions of the Transition Area where development is not anticipated, soil in coastal terrace prairie areas where development is not anticipated, and the existing surface drainage ditch located along the western boundary outside of the current RFS property are excluded from the scope of this investigation.

POTENTIAL RECEPTORS. Discrete areas of soil have been impacted by historic site uses or industrial activities (incidental releases). The future use for the site assumes that significant portions will be developed or redeveloped for commercial activities. It is anticipated that future potential receptors are limited and these are summarized below.

- **Future Commercial Workers:** Use of the site is anticipated for commercial purposes in the future. Future commercial workers may be exposed to soils while on site.

- **Future Construction Workers:** The future construction workers could be exposed to site-related constituents in soils and groundwater while performing construction activities related to redevelopment and construction.

- **Future Maintenance Workers:** Future maintenance workers could be exposed to site-related constituents in soils and groundwater while performing routine maintenance activities, including minor landscaping, utility repair, and other general maintenance. Landscape workers are also covered under this scenario.

- **Unrestricted Use:** Unrestricted use exposures are evaluated using conservative exposure assumptions typically based on residential receptors as a surrogate (DTSC 2011a). A hypothetical resident could be exposed to site-related constituents in soil and groundwater. Unrestricted use is not considered a future use; however it is included in the evaluation per DTSC guidance.

POTENTIALLY COMPLETE EXPOSURE ROUTES. The exposure routes that will be quantitatively evaluated are described below.

- **Future Commercial Workers:** Assumed to be exposed via incidental ingestion of and dermal contact with surface soils (0 to 2 feet below ground surface bgs) and subsurface soils (0 to 10 feet bgs) at the site and inhalation of particulates and volatile chemicals in outdoor air. In addition, future commercial receptors are assumed to be exposed via inhalation of volatile chemicals that may have migrated from groundwater into indoor air.

- **Future Construction Workers:** Assumed to be exposed via incidental ingestion of and dermal contact with subsurface soils (0 to 10 feet bgs) at the site and inhalation of particulates and volatile chemicals in outdoor air. In addition, future construction workers are assumed to be exposed via dermal contact with and inhalation of volatile chemicals in groundwater within a construction trench.

- **Future Maintenance Workers:** Assumed to be exposed via ingestion of and dermal contact with surface (0 to 2 feet bgs) and subsurface (0 to 10 feet bgs) soils and inhalation of particulates and volatile chemicals in outdoor air.

- **Unrestricted Use:** Assumed to be exposed via incidental ingestion of and dermal contact with surface (0 to 2 feet bgs) and subsurface (0 to 10 feet bgs) soils and inhalation of particulates and volatile chemicals in outdoor air. In addition, unrestricted use receptors are assumed to be exposed via inhalation of volatile chemicals that may have migrated from groundwater into indoor air.

3.0 DATA EVALUATION AND SELECTION OF COPCS

The section presents the HHRA soil and groundwater data sets, describes the approaches for data evaluation, and presents the COPCs in soil and groundwater. Soil gas data was not collected as part of the FSW and thus will not be evaluated for the Site.

As noted in section 1, the HHRA will be conducted in two steps. Step 1 of the HHRA will evaluate chemical concentrations in RES Area soil and groundwater at the Site against screening criteria. Step 2 of the HHRA will be a quantitative, focused HHRA for only those areas in the RES Area for which adequate soil data are available to conduct an assessment: MFA and APA, and the Corporation Yard.

Soil

Soil analytical data obtained during the FSW investigation and that were validated by Tetra Tech were evaluated in the HHRA. In cases where previous investigations had occurred within the same geographical footprint, the historical soil results, as published in the SCR (Tetra Tech 2008), will also be included in the data set for that area if those results had been obtained under either the San Francisco Bay Regional Water Quality Control Board or DTSC Orders (interpreted to be data obtained after June 2001). These available data are considered the most

up-to-date and provide reasonable coverage for soil in the portions of the site investigated during the FSW investigation.

Soil samples were analyzed for various analytes: metals, semivolatile organic compounds (SVOC) (including polycyclic aromatic hydrocarbons [PAH]), pesticides, polychlorinated biphenyl (PCB), and a limited number of samples were analyzed for dioxins, explosives, cyanide, total petroleum hydrocarbons (TPH), and volatile organic compounds (VOCs). All chemicals detected in at least one sample, except essential human nutrients and TPH, will be identified as COPCs. Chemicals considered essential human nutrients are calcium, magnesium, potassium, and sodium. TPH data will not be evaluated in the HHRA because these data are not chemical-specific and are considered inadequate and insufficient for risk evaluation (DTSC 1993). Rather, the data for specific TPH indicator chemicals (for example, benzene, toluene, ethylbenzene, xylenes, and PAHs) will be used to assess health risks from TPH contamination. A summary of the soil data from Phase II has been presented in the Phase II report (Tetra Tech 2012b); the soil data from Phase III will be presented as part of the SCR. Figure 1 shows the soil data included in Steps 1 and 2 of the evaluation for soil.

Areas evaluated in the FSW but that only have PCB data will not be evaluated in Step 2 of the HHRA. Rather, these PCB areas will be evaluated separately against the Toxic Substances Control Act criteria in the SCR. It will be conservatively assumed that conditions at the time of the investigation (i.e., unremediated conditions) are representative of future conditions.

Groundwater

The groundwater evaluation will be conducted using all groundwater samples collected from piezometers during the FSW Investigation (September 2010 and later). The piezometers that will be evaluated in Step 1 of the HHRA are presented in Figure 2.

Groundwater samples were analyzed for various analytes: metals, SVOCs, VOCs, and TPH. Like soil, all chemicals detected in at least one sample, except essential human nutrients and TPH, will be identified as COPCs for groundwater. A summary of the groundwater data from Rounds 1 through 4 sampling events (Phase I) was presented in the Phase I report (Tetra Tech 2012a).

A list of the COPCs detected in soil and groundwater is presented in Table 1.

4.0 EXPOSURE ASSESSMENT

An exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to a chemical in the environment. This section describes future land use assumptions, characterizes exposure factors for potential receptors, discusses the mechanisms by which these receptors might potentially come in contact with COPCs in environmental media, and estimates the degree of contact between potential human receptors and COPCs. This information is used to calculate RBCs, consistent with DTSC guidance (OEHHA 2005).

An exposure assessment consists of three basic steps:

1) Characterization of the exposure setting (physical environment and potential receptors).
2) Identification of exposure pathways (constituent sources, exposure points, and exposure routes).
3) Quantification of pathway-specific exposures (exposure point concentration (EPC), calculation of receptor intakes, and exposure assumptions).

The first two components are described in detail above in Section 2.0. The third component is described in the following subsections. For the HHRA, risks will be estimated under a reasonable maximum exposure (RME) scenario. The RME is estimated by selecting values for exposure variables such that the combination of all variables results in the maximum exposure that can reasonably be expected to occur.

4.1 EXPOSURE POINT CONCENTRATIONS

To evaluate exposures to COPCs in soil in the Step 1 HHRA, the result for each detected chemical in every soil sample will be used as the EPC.

To evaluate exposures to COPCs in soil in the Step 2 HHRA, two sets of site-wide EPCs will be calculated using the available soil data at the MFA and APA, and the Corporation Yard – one set for surface soils (0 to 2 feet bgs) and one set for subsurface soils (0 to 10 feet bgs). Surface soil data from the upper layer of soils – 0 to 2 feet bgs will be assumed to represent the most likely soils to be contacted under conditions of minimal surface disturbance during redevelopment. The subsurface soil EPC will be calculated using the entire soil profile – 0 to 10 feet bgs. This EPC would account for the possibility of future regrading or excavation activities, which would redistribute subsurface soils to the surface, and likely during trenching activities or as a result of significant excavations.

The EPCs in Step 2 of the HHRA will be calculated as the 95UCL using EPA's ProUCL Version 4.1.00 statistical software package (EPA 2010). The EPC will be generally selected as the 95 percent UCL of the statistical method recommended by ProUCL. Following EPA (2002, 2010), this may be estimated by either a 95, 97.5, or 99 percent UCL depending on the sample size, skewness, and degree of censorship. A 95UCL will not be developed for constituents with less than six detected results. In this circumstance, the maximum detected concentration will be used as the EPC.

To evaluate exposures to groundwater in the Step 1 HHRA, the maximum detected concentration in groundwater will be used to evaluate vapor intrusion to indoor air for a future commercial worker and unrestricted use scenario, as well as exposure to groundwater in a trench by a construction worker. For exposure to indoor air, the Johnson and Ettinger screening-level groundwater vapor intrusion model will be used (DTSC 2011b). For groundwater in a construction trench, the Virginia Department of Environmental Quality (VDEQ 2012) trench model will be used to determine the outdoor air concentrations of volatile chemicals in a trench.

Former DTSC toxicologist Brian Davis had previously recommended using the VDEQ model at another Bay Area site to evaluate a construction trench.

DTSC has identified carcinogenic PAHs as potential mutagens. Concentrations of these PAHs can be converted to an equivalent concentration of benzo(a)pyrene (BaP [EQ]) using potency equivalency factors (PEF) presented in the Cal/EPA Office of Environmental Health Hazard Assessment guidance (OEHHA 2002, DTSC 2011a). This approach will be used to evaluate potential exposures to seven carcinogenic PAHs detected in the soil at the Site: benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. A BaP (EQ) concentration will be developed for each sample at each location evaluated in Step 1 of the HHRA. A site-wide EPC for BAP (EQ) will then be calculated for use in the Step 2 HHRA for the MFA and APA, and Corporation Yard areas. Zero will be used for non-detected PAHs in the sample-specific calculation of the BAP (EQ) concentration.

For the dioxins and furans, the analytical data was reported for the individual components. Similar to the method described above for carcinogenic PAHs, the individual dioxin and furan congeners will be converted to an equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) using 2,3,7,8-TCDD toxicity equivalency factors (TEF) following the World Health Organization protocols (van der Berg and others 2006, DTSC 2009). Similar to calculation of the site-wide BaP equivalent concentration, zero will be used for non-detected congeners.

4.2 EXPOSURE FACTORS

As presented above, the receptors best representing the future exposures include future commercial workers, future construction workers, future maintenance workers, and unrestricted use. The exposure factors for the commercial worker, construction worker, and unrestricted use will be consistent with DTSC's exposure factors used to develop the California Human Health Screening Levels (CHHSL) (OEHHA 2005, DTSC 2011c). The only site-specific receptor is the future maintenance worker. The exposure factors for the maintenance worker are the same as the construction worker with two exceptions. The exposure frequency for a maintenance worker is 10 days per year, based on discussions with RFS management facility regarding maximum exposure potential and assumes an adult maintenance worker will conduct outdoor activities 1 day (8 hours) per month for 10 months. The exposure duration for a future maintenance worker is assumed to be 25 years.

Table 2 presents the exposure factors that will be used to develop the RBCs in the SCR.

5.0 TOXICITY ASSESSMENT

The toxicity assessment provides a description of the relationship between a dose of a chemical and the potential likelihood of an adverse health effect. The purpose of the toxicity assessment is to provide a quantitative estimate of the inherent toxicity of COPCs for use in risk characterization. In the context of the regulatory risk assessment process, potential effects of

chemicals are separated into two categories: carcinogenic (cancer) and noncarcinogenic (noncancer) effects. Potential health risks for COPCs will be evaluated for both carcinogenic and noncarcinogenic risk.

Sources that will be used to obtain toxicity criteria are listed below, and follow the hierarchy outlined in EPA (2003), except that a State of California toxicity criterion, if available, will be used preferentially over the federal toxicity criterion if the State of California toxicity criterion is determined to be more conservative.

1) EPA's Integrated Risk Information System (EPA 2012a)

2) EPA's Provisional Peer-Reviewed Toxicity Values (PPRTV) database, obtained from EPA (2012b).

3) The Agency for Toxic Substances and Disease Registry minimal risk levels, obtained from EPA (2012b).

4) Cal/EPA's OEHHA on-line database, which contains approved toxicity criteria (OEHHA 2012). These include reference exposure levels from December 18, 2008, and the cancer potency values from October 25, 2012.

5) Other EPA toxicity values, including, but not limited to:

    a) Screening toxicity values in an appendix to certain PPRTV assessments (obtained from EPA 2012b).

    b) EPA's Health Effects Assessment Summary Tables (EPA 1997).

    c) Environmental Criteria and Assessment Office (obtained from EPA 2012b).

Toxicity criteria proposed to be used in the HHRA to develop the RBCs are presented in Table 3.

6.0 RISK CHARACTERIZATION

The risk characterization step estimates the potential excess lifetime cancer risk and calculates an HI to quantify the potential for adverse health effects other than cancer for human receptors that may be potentially exposed to COPCs at the site. Receptor-specific RBCs will be developed for all COPCs detected at the site by "back-calculating" from a target risk level or algebraically reversing risk equations to obtain a concentration term. The target risk level to be used in this HHRA is a cancer risk of 1×10^{-6} and a hazard index (HI) of 1. RBCs for soil and groundwater will be calculated using equations used by EPA in developing RSLs (EPA 2012b), which is consistent with OEHHA and DTSC guidance (OEHHA 2002, Cal/EPA 2005). The exposure factors used in the calculations are those outlined in Section 4.0 and Table 2 and the toxicity factors are those noted in Section 5.0 and Table 3.

For the Step 1 HHRA, soil and groundwater data will be screened against future commercial RBCs for discussion and presentation purposes and will be included as an appendix to the SCR.

Groundwater data will be evaluated only in Step 1 of the HHRA by comparing chemical concentrations in groundwater against RBCs for migration of volatile chemicals from groundwater to indoor air.

For the Step 2 HHRA, risk from exposure to soil will be calculated using a sum of ratios approach (DTSC 2011a). In this approach, cancer risk will be estimated by taking the ratio of the EPC of detected chemicals in each medium to the RBC. The following equations will be used in the calculations.

$$\text{Cancer Risk} = \sum \left[\frac{EPC_{COPC}}{Cancer\ RBC_{COPC}} \times 10^{-6} \right]_{pathway}$$

$$\text{Hazard Index} = \sum \left[\frac{EPC_{COPC}}{Noncancer\ RBC_{COPC}} \times 1 \right]_{pathway}$$

The resulting pathway-specific cancer risks for soil will be summed to estimate the cumulative cancer risk for each receptor. Likewise, pathway-specific noncancer hazard quotients will be summed to estimate the cumulative noncancer HI for each receptor. Risks from exposure to groundwater will not be added to the estimated risks from soil, as the RBCs developed for groundwater will be used for comparison only in the Step 1 HHRA.

The Step 1 and 2 HHRA will evaluate lead by comparing the detected soil concentration (Step 1) or site-wide EPC (Step 2) against the OEHHA CHHSL of 80 milligram per kilogram (mg/kg) for unrestricted use and 320 mg/kg for a commercial worker (OEHHA 2009).

The site-specific RBCs and the Step 1 and Step 2 HHRA will be presented in the SCR for the proposed Richmond Bay Campus.

7.0 REFERENCES

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FIGURES

MFA and Associated Production Areas

Corporation Yard

Concrete Pad

0 250 500
Feet

Soil Data for Step 1 and Step 2 HHRA Evaluation

- Soil Sample Locations Evaluated in HHRA Step 1 only (All historical and FSW investigations data)
- Soil Sample Locations Evaluated in HHRA Steps 1 and 2 (FSW investigations data)
- Soil Sample Locations Evaluated in HHRA Steps 1 and 2 (Data collected under RWQCB or DTSC Order prior to FSW investigations data)[1]

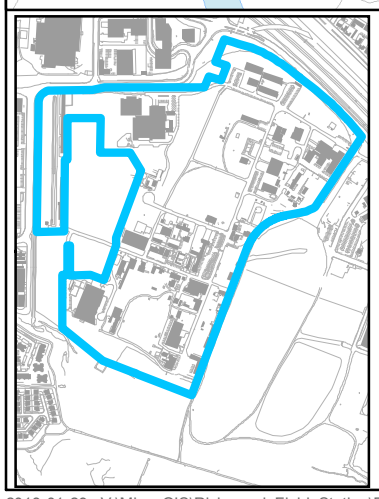
HHRA Step 2 Evaluation Data Boundary

- Corporation Yard
- MFA and Associated Production Areas

Notes:
1. Soil data collected after June 2001 and before FSW.

Soil sampling locations are identified in Appendix B, Figure B-1.

DTSC	Department of Toxic Substances Control
FSW	Field Sampling Workplan
HHRA	Human Health Risk Assessment
MFA	Mercury Fulminate Area
RWQCB	Regional Water Quality Control Board



- Research, Education & Support Area
- Marsh Boundary
- Surface Water
- Buildings
- Approximate Site Boundary
- Road Perimeter or other Landscape Feature
- Fenceline
- Asphalt/Concrete Pads
- Former Seawall (Approximate)
- Biologically Active Permeable Barrier Wall
- Slurry Wall
- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Lines:

- Open Swale
- Underground Culvert
- Underground Culvert, Abandoned (Grouted at Manholes)

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Richmond Field Station
University of California, Berkeley

FIGURE 1
SOIL SAMPLING LOCATIONS IN THE HHRA

Technical Approach For Human Health Risk Assessment
Site Characterization Report

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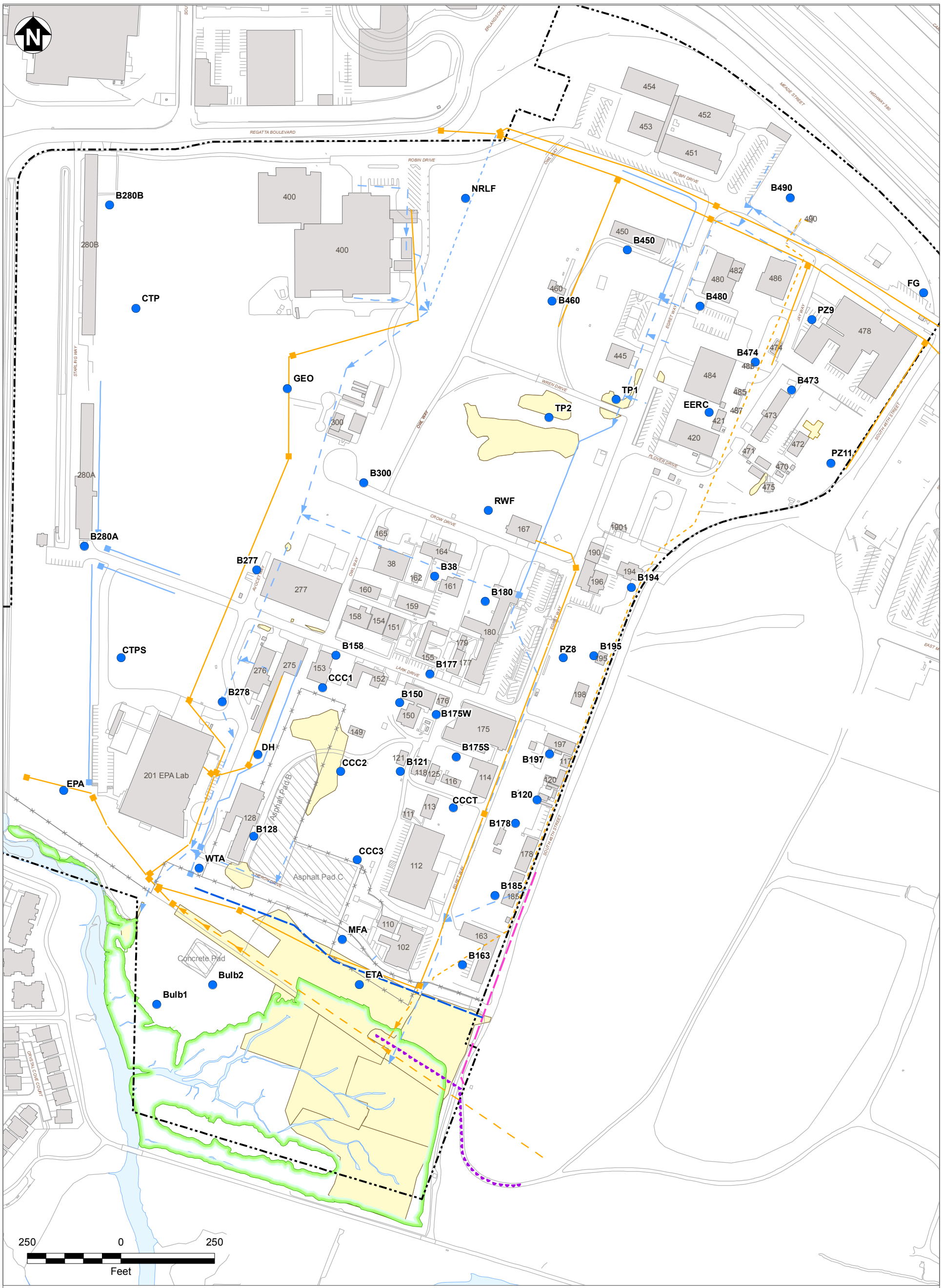

Existing Buildings
Asphalt/Concrete Pads
Remediated Areas
Surface Water
Marsh Boundary
Approximate Site Boundary
Roads and Other Landscape Features
Fenceline
Biologically Active Permeable Barrier Wall
Former Seawall (Approximate)
Slurry Wall

Storm Drain Lines:
Open Swale
Underground Culvert
Underground Culvert, Abandoned (Grouted at Manholes)
Sanitary Sewer Lines:
Existing Sewer Line
Removed Sewer Line
Abandoned Sewer Line

Note:
HHRA Human Health Risk Assessment

Piezometers evaluated in Step 1 of the HHRA

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Richmond Field Station
University of California, Berkeley

FIGURE 2
GROUNDWATER PIEZOMETER LOCATIONS EVALUATED IN THE HHRA

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Site Characterization Report

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TABLES

TABLE 1: CHEMICALS OF POTENTIAL CONCERN

Technical Approach for the Human Health Risk Assessment, Site Characterization Report, Proposed Richmond Bay Campus
Richmond Field Station, UC Berkeley, Richmond, California

Medium	Chemicals of Potential Concern		
Soil	1,2-Dichloropropane	Benzo(g,h,i)perylene	gamma-BHC (Lindane)
	1-Methylnaphthalene	Benzo(k)fluoranthene	gamma-Chlordane
	2-Methylnaphthalene	Beryllium	Heptachlor
	4,4'-DDD	beta-BHC	Heptachlor epoxide
	4,4'-DDE	bis(2-Ethylhexyl)phthalate	HMX
	4,4'-DDT	Boron	Indeno(1,2,3-cd)pyrene
	4-Methylphenol	Butylbenzylphthalate	Iron
	Acenaphthene	Cadmium	Lead
	Acenaphthylene	Carbazole	m,p-Xylene
	Acetone	Chlordane	Manganese
	Aldrin	Chromium	Mercury
	alpha-BHC	Chrysene	Methyl Mercury
	alpha-Chlordane	Cobalt	Mirex
	Aluminum	Copper	Molybdenum
	Anthracene	delta-BHC	Naphthalene
	Antimony	Dibenz(a,h)anthracene	Nickel
	Aroclor-1242	Dieldrin	o-Xylene
	Aroclor-1248	di-n-Butylphthalate	Pentachlorophenol
	Aroclor-1254	Dioxin TEQ	Phenanthrene
	Aroclor-1260	Endosulfan I	Pyrene
	Arsenic	Endosulfan II	Selenium
	BAP (EQ)	Endosulfan sulfate	Silver
	Barium	Endrin	Thallium
	Benzene	Endrin aldehyde	Toluene
	Benzo(a)anthracene	Ethylbenzene	Trichloroethene
	Benzo(a)pyrene	Fluoranthene	Vanadium
	Benzo(b)fluoranthene	Fluorene	Zinc
Groundwater	1,1-Dichloroethene	bis(2-Ethylhexyl)phthalate	Methyl tert butyl ether
	1,2-Dichloroethane	Bromomethane	Methylene chloride
	1,2-Dichloropropane	Cadmium	Naphthalene
	1,4-Dichlorobenzene	Carbon disulfide	Nickel
	1,4-Dioxane	Carbon tetrachloride	Phenanthrene
	1-Methylnaphthalene	Chlorobenzene	p-Isopropyltoluene
	2-Butanone (MEK)	Chloroform	Pyrene
	4-Methyl-2-pentanone	Chloromethane	sec-Butylbenzene
	4-Methylphenol	Chromium	Selenium
	Acenaphthene	cis-1,2-Dichloroethene	tert-Butylbenzene
	Acenaphthylene	Copper	Tetrachloroethene
	Acetone	Ethylbenzene	Toluene
	Anthracene	Fluoranthene	trans-1,2-Dichloroethene
	Arsenic	Fluorene	Trichloroethene
	Benzene	Isopropylbenzene	Vinyl chloride
	Benzoic acid	m,p-Xylene	
	Benzyl alcohol	Mercury	

Notes:

BAP (EQ)	Benzo(a)pyrene equivalent	DDT	Dichlorodiphenyltrichloroethane
BHC	Hexachlorocyclohexane	MEK	Methyl ethyl ketone
DDD	Dichlorodiphenyldichloroethane	TEQ	Toxic equivalency factor
DDE	Dichlorodiphenyldichloroethylene		

TABLE 2: EXPOSURE PARAMETERS

Technical Approach for the Human Health Risk Assessment, Site Characterization Report, Proposed Richmond Bay Campus
Richmond Field Station, UC Berkeley, Richmond, California

Parameter	Units	Future Commercial Worker	Future Construction Worker	Future Maintenance Worker [a]	Unrestricted Use	
					Adult	Child
General Parameters						
Exposure time	hours/day	8	8	8	24	24
Exposure frequency	days/year	250	250	10 b	350	350
Exposure duration	years	25	1	25 b	24	6
Mass conversion factor	kg/mg	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}
Body weight	kg	70	70	70	70	15
Averaging time (carcinogens)	days	25,550	25,550	25,550	25,550	25,550
Averaging time (noncarcinogens)	days	9,125	365	9,125	8,760	2,190
Soil Ingestion						
Fraction ingested	unitless	1 c	1 c	1 c	1 c	1 c
Soil ingestion rate	mg/day	100	330	330	100	200
Dermal Contact with Soil						
Body surface area	cm^2/day	5,700	5,700	5,700	5,700	2,900
Soil adherence factor	mg/cm^2	0.2	0.8	0.8	0.07	0.2
Dermal absorption fraction	unitless	Chemical-specific d	Chemical-specific d	Chemical-specific d	Chemical-specific d	Chemical-specific d
Inhalation of Particulate and Volatile Chemicals in Soil						
Particulate emission factor	m^3/kg	1.316E+09	1.0E+06	1.0E+06	1.316E+09	1.316E+09
Soil volatilization factor	unitless	Chemical-specific e	Chemical-specific e	Chemical-specific e	Chemical-specific e	Chemical-specific e
Averaging time (carcinogens)	hours	613,200	613,200	613,200	613,200	613,200
Averaging time (noncarcinogens)	hours	219,000	8,760	219,000	210,240	52,560
Inhalation of Volatile Chemicals in Groundwater (as Vapor Intrusion or in a Construction Trench) [f]						
Exposure time	hours	8	2 g	2 g	24	24
Exposure frequency	days/year	250	250	10 b	350	350
Exposure duration	years	25	1	25 b	24	6
Trench volatilization factor	L/m^3	--	Chemical-specific h	Chemical-specific h	--	--
Averaging time (carcinogens)	hours	613,200	613,200	613,200	613,200	613,200
Averaging time (noncarcinogens)	hours	219,000	8,760	219,000	210,240	52,560
Dermal Contact with Groundwater (in a Construction Trench)						
Exposure time	hours	--	2 f	2 f	--	--
Exposure frequency	days/year	--	250	10 b	--	--
Exposure duration	years	--	1	25 b	--	--
Body surface area	cm^2/day	--	5,700	5,700	--	--
Volume conversion factor	L/cm^3	--	10^{-3}	10^{-3}	--	--
Permeability constant	unitless	--	Chemical-specific i	Chemical-specific i	--	--

TABLE 2: EXPOSURE PARAMETERS

Technical Approach for the Human Health Risk Assessment, Site Characterization Report, Proposed Richmond Bay Campus
Richmond Field Station, UC Berkeley, Richmond, California

Notes:	General parameters are based on DTSC (2011) and used in each exposure pathway, unless otherwise noted.
a	The exposure parameters for a future maintenance worker are based on a future construction worker unless otherwise noted.
b	Site-specific; maintenance workers are expected to be onsite 10 days per year for 8 hours per day to perform includes minor landscape activities, utility repair activities, and other general maintenance activities. Future maintenance workers are expected to be onsite for 25 years.
c	Professional judgment
d	DTSC (1994)
e	EPA (2012)
f	Evaluation of the exposure to volatile chemicals in groundwater as indoor air is not applicable to the construction and maintenance workers since they are expected to be outside at all times
g	Professional judgement; two hours was assumed for the amount of time a construction and maintenance worker would spend in a trench and they are not expected to spend a full 8 hours per work day in a trench.
h	VDEQ (2012)
i	EPA (2004)

--	Not applicable; exposure pathway not evaluated for this receptor	kg/mg	Kilogram per milligram
Cal/EPA	California Environmental Protection Agency	L/cm^3	Liters per cubic centimeter
cm/hour	Centimeters per hour	L/m^3	Liters per cubic meter
cm^2/day	Square centimeters per day	m^3/kg	Cubic meters per kilogram
DTSC	Department of Toxic Substances Control	mg/cm^2	Milligrams per square centimeter
EPA	U.S. Environmental Protection Agency	mg/day	Milligrams per day
kg	Kilogram		

Sources:

DTSC. 1994. "Preliminary Endangerment Assessment Guidance Manual." Second Printing, June 1999.

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EPA. 2004. "Risk Assessment Guidance for Superfund, Volume 1 – Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment." Final. Office of Superfund Remediation and Technology Innovation. EPA/540/R/99/005. July. Available on-line at: <http://www.epa.gov/oswer/riskassessment/ragse/index.htm>

EPA. 2012. Regional Screening Levels for Chemical Contaminants at Superfund Sites. November. Available on-line at: <http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm>

Virginia Department of Environmental Quality (VDEQ). 2012. "Voluntary Remediation Program Risk Assessment Guidance." Available on-line at: <http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RemediationProgram/VoluntaryRemediationProgram/VRPRiskAssessmentGuidance/Guidance.aspx>

TABLE 3: TOXICITY CRITERIA

Technical Approach for the Human Health Risk Assessment, Site Characterization Report, Proposed Richmond Bay Campus
Richmond Field Station, UC Berkeley, Richmond, California

		Carcinogenic				Noncarcinogenic			
		CSFo		IUR		RfDo		RfCi	
Chemical		(mg/kg-day)$^{-1}$		(ug/m3)$^{-1}$		(mg/kg-day)		(mg/m^3)	
1,1-Dichloroethene		--		--		5.0E-02	I	2.0E-01	I
1,2-Dichloroethane		9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P
1,2-Dichloropropane		3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I
1,4-Dichlorobenzene		5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I
1,4-Dioxane		1.0E-01	I	7.7E-06	C	3.0E-02	I	3.0E+00	C
1-Methylnaphthalene		2.9E-02	P	--		7.0E-02	A	--	
2-Butanone (MEK)		--		--		6.0E-01	I	5.0E+00	I
2-Methylnaphthalene		--		--		4.0E-03	I	--	
4,4'-DDD		2.4E-01	I	6.9E-05	C	--		--	
4,4'-DDE		3.4E-01	I	9.7E-05	C	--		--	
4,4'-DDT		3.4E-01	I	9.7E-05	I	5.0E-04	I	--	
4-Methyl-2-pentanone		--		--		8.0E-02	H	3.0E+00	I
4-Methylphenol		--		--		1.0E-01	A	6.0E-01	C
Acenaphthene		--		--		6.0E-02	I	--	
Acenaphthylene	a	--		--		6.0E-02	I	--	
Acetone		--		--		9.0E-01	I	3.1E+01	A
Aldrin		1.7E+01	I	4.9E-03	I	3.0E-05	I	--	
alpha-BHC		6.3E+00	I	1.8E-03	I	8.0E-03	A	--	
alpha-Chlordane	b	1.3E+00	C	3.4E-04	C	5.0E-04	I	7.0E-04	I
Aluminum		--		--		1.0E+00	P	5.0E-03	P
Anthracene		--		--		3.0E-01	I	--	
Antimony		--		--		4.0E-04	I	--	
Aroclor-1242		2.0E+00	C	5.7E-04	C	--		--	
Aroclor-1248		2.0E+00	C	5.7E-04	C	--		--	
Aroclor-1254		2.0E+00	C	5.7E-04	C	2.0E-05	I	--	
Aroclor-1260		2.0E+00	C	5.7E-04	C	--		--	
Arsenic		9.5E+00	C	4.3E-03	I	3.0E-04	I	1.5E-05	C
BAP (EQ)	c	7.3E+00	I	1.1E-03	C	--		--	
Barium		--		--		2.0E-01	I	5.0E-04	H
Benzene		1.0E-01	C	2.9E-05	C	4.0E-03	I	3.0E-02	I
Benzo(a)anthracene		1.2E+00	C	1.1E-04	C	--		--	
Benzo(a)pyrene		7.3E+00	I	1.1E-03	C	--		--	
Benzo(b)fluoranthene		1.2E+00	C	1.1E-04	C	--		--	
Benzo(g,h,i)perylene	d	--		--		3.0E-02	I	--	
Benzo(k)fluoranthene		1.2E+00	C	1.1E-04	C	--		--	
Benzoic acid		--		--		4.0E+00	I	--	
Benzyl alcohol		--		--		1.0E-01	P	--	
Beryllium		--		2.4E-03	I	2.0E-03	I	7.0E-06	C
beta-BHC		1.8E+00	I	5.3E-04	I	--		--	
bis(2-Ethylhexyl)phthalate		1.4E-02	I	2.4E-06	C	2.0E-02	I	--	
Boron	e	--		--		2.0E-01	I	2.0E-02	H
Bromomethane		--		--		1.4E-03	I	5.0E-03	I
Butylbenzylphthalate		1.9E-03	P	--		2.0E-01	I	--	
Cadmium		--		4.2E-03	C	1.0E-03	I	2.0E-05	C
Cadmium (Water)		--		4.2E-03	C	5.0E-04	I	2.0E-05	C
Carbazole	f	7.3E-03	E	1.1E-05	C	--		--	
Carbon disulfide		--		--		1.0E-01	I	7.0E-01	I
Carbon tetrachloride		1.5E-01	C	4.2E-05	C	4.0E-03	I	4.0E-02	C
Chlordane		1.3E+00	C	3.4E-04	C	5.0E-04	I	7.0E-04	I
Chlorobenzene		--		--		2.0E-02	I	5.0E-02	P
Chloroform		3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A
Chloromethane		--		--		--		9.0E-02	I
Chromium	g	--		--		1.5E+00	I	--	
Chrysene		1.2E-01	C	1.1E-05	C	--		--	

TABLE 3: TOXICITY CRITERIA

Technical Approach for the Human Health Risk Assessment, Site Characterization Report, Proposed Richmond Bay Campus
Richmond Field Station, UC Berkeley, Richmond, California

		Carcinogenic				Noncarcinogenic			
		CSFo		IUR		RfDo		RfCi	
Chemical		(mg/kg-day)$^{-1}$		(ug/m3)$^{-1}$		(mg/kg-day)		(mg/m^3)	
cis-1,2-Dichloroethene		--		--		2.0E-03	I	--	
Cobalt		--		9.0E-03	P	3.0E-04	P	6.0E-06	P
Copper		--		--		4.0E-02	H	--	
delta-BHC	h	6.3E+00	I	1.8E-03	I	8.0E-03	A	--	
Dibenz(a,h)anthracene		7.3E+00	E	1.2E-03	C	--		--	
Dieldrin		1.6E+01	I	4.6E-03	I	5.0E-05	I	--	
di-n-Butylphthalate		--		--		1.0E-01	I	--	
Dioxin TEQ	i	1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C
Endosulfan I	j	--		--		6.0E-03	I	--	
Endosulfan II	j	--		--		6.0E-03	I	--	
Endosulfan sulfate	j	--		--		6.0E-03	I	--	
Endrin		--		--		3.0E-04	I	--	
Endrin aldehyde		--		--		3.0E-04	I	--	
Ethylbenzene		1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I
Fluoranthene		--		--		4.0E-02	I	--	
Fluorene		--		--		4.0E-02	I	--	
gamma-BHC (Lindane)		1.1E+00	C	3.1E-04	C	3.0E-04	I	--	
gamma-Chlordane	b	1.3E+00	C	3.4E-04	C	5.0E-04	I	7.0E-04	I
Heptachlor		4.5E+00	I	1.3E-03	I	5.0E-04	I	--	
Heptachlor epoxide		9.1E+00	I	2.6E-03	I	1.3E-05	I	--	
HMX		--		--		5.0E-02	I	--	
Indeno(1,2,3-cd)pyrene		1.2E+00	C	1.1E-04	C	--		--	
Iron		--		--		7.0E-01	P	--	
Isopropylbenzene		--		--		1.0E-01	I	4.0E-01	I
Lead		--		--		--		--	
m,p-Xylene	k	--		--		2.0E-01	I	1.0E-01	I
Manganese	l	--		--		2.4E-02	S	5.0E-05	I
Mercury	m	--		--		3.0E-04	I	3.0E-04	I
Methyl Mercury		--		--		1.0E-04	I	--	
Methyl tert butyl ether		1.8E-03	C	2.6E-07	C	--		3.0E+00	I
Methylene chloride		1.4E-02	C	1.0E-06	C	6.0E-03	I	4.0E-01	C
Mirex		1.8E+01	C	5.1E-03	C	2.0E-04	I	--	
Molybdenum		--		--		5.0E-03	I	--	
Naphthalene		--		3.4E-05	C	2.0E-02	I	3.0E-03	I
Nickel	n	--		2.6E-04	C	2.0E-02	I	1.4E-05	C
o-Xylene		--		--		2.0E-01	I	1.0E-01	I
Pentachlorophenol		4.0E-01	I	5.1E-06	C	5.0E-03	I	--	
Phenanthrene	o	--		--		4.0E-02	I	--	
p-Isopropyltoluene	p	--		--		8.0E-02	I	5.0E+00	I
Pyrene		--		--		3.0E-02	I	--	
sec-Butylbenzene	q	--		--		5.0E-02	P	--	
Selenium		--		--		5.0E-03	I	2.0E-02	C
Silver		--		--		5.0E-03	I	--	
tert-Butylbenzene	q	--		--		5.0E-02	P	--	
Tetrachloroethene		5.4E-01	C	5.9E-06	C	6.0E-03	I	3.5E-02	C
Thallium	r	--		--		1.0E-05	X	--	
Toluene		--		--		8.0E-02	I	3.0E-01	C
trans-1,2-Dichloroethene		--		--		2.0E-02	I	6.0E-02	P
Trichloroethene		4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I
Vanadium		--		--		5.0E-03	S	--	
Vinyl chloride		7.2E-01	I	7.8E-05	C	3.0E-03	I	1.0E-01	I
Zinc		--		--		3.0E-01	I	--	

TABLE 3: TOXICITY CRITERIA

Technical Approach for the Human Health Risk Assessment, Site Characterization Report, Proposed Richmond Bay Campus
Richmond Field Station, UC Berkeley, Richmond, California

	Carcinogenic		Noncarcinogenic	
Chemical	**CSFo $(mg/kg\text{-}day)^{-1}$**	**IUR $(ug/m3)^{-1}$**	**RfDo (mg/kg-day)**	**RfCi (mg/m^3)**

Notes:

a	The toxicity criteria for acenaphthene was used as a surrogate for acenaphthylene.
b	The toxicity criteria for chlordane was used as a surrogate for alpha- and gamma-chlordane.
c	The toxicity criteria for benzo(a)pyrene was used as a surrogate for BAP (EQ).
d	The toxicity criteria for pyrene was used as a surrogate for benzo(g,h,i)perylene.
e	The toxicity criteria for boron and borates only was used as a surrogate for boron.
f	The toxicity criteria for chrysene was used as a surrogate for carbazole.
g	The toxicity criteria for chromium(III), insoluble salts was used as a surrogate for chromium.
h	The toxicity criteria for alpha-BHC was used as a surrogate for delta-BHC.
i	The toxicity criteria for 2,3,7,8-TCDD was used as a surrogate for Dioxin TEQ.
j	The toxicity criteria for endosulfan was used as a surrogate for endosulfan I, endosulfan II, and endosulfan sulfate.
k	The toxicity criteria for m-xylene was used as a surrogate for m,p-xylene.
l	The toxicity criteria for manganese (non-diet) was used as a surrogate for manganese.
m	The toxicity criteria for mercuric chloride was used as a surrogate for mercury.
n	The toxicity criteria for nickel soluble salts was used as a surrogate for nickel.
o	The toxicity criteria for fluorene was used as a surrogate for phenanthrene.
p	The toxicity criteria for toluene was used as a surrogate for p-isopropyltoluene.
q	The toxicity criteria for n-butylbenzene was used as a surrogate for sec- and tert-butylbenzene.
r	The toxicity criteria for thallium soluble salts was used as a surrogate for thallium.

--	Not available	MEK	Methyl ethyl ketone
$(\mu g/m^3)^{-1}$	Per microgram per cubic meter	mg/kg-day	Milligram per kilogram per day
BAP (EQ)	Benzo(a)pyrene equivalent	$(mg/kg\text{-}day)^{-1}$	Per milligram per kilogram per day
BHC	Hexachlorocyclohexane	mg/m^3	Milligram per cubic meter
CSFo	Cancer slope factor, oral	OEHHA	California Environmental Protection Agency Office of
DDD	Dichlorodiphenyldichloroethane		Environmental Health Hazard Assessment
DDE	Dichlorodiphenyldichloroethylene	RfCi	Reference concentration, inhalation
DDT	Dichlorodiphenyltrichloroethane	RfDo	Reference dose, oral
EPA	U.S. Environmental Protection Agency	TCDD	Tetrachlorodibenzo-p-dioxin
IUR	Inhalation unit risk	TEQ	Toxic equivalency factor

Sources:

A	Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Minimal Risk Levels. February. Available on-line at: <http://www.atsdr.cdc.gov/mrls/pdfs/atsdr_mrls_february_2012.pdf> (as cited in EPA 2012b [see Source "S"])
C	Criteria for CSFo and IUR are taken from the following: OEHHA. 2012. OEHHA Toxicity Criteria Database. Available on-line at: <http://www.oehha.ca.gov/risk/chemicalDB/index.asp> Accessed October 25. Criteria for RfCi are taken from the following: OEHHA. 2008. "OEHHA Acute, 8-hour and Chronic Reference Exposure Levels." December 18. Available on-line at: <http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html> Accessed October 25, 2012.
E	Environmental Criteria and Assessment Office (as cited in EPA 2012b [see Source "S"])
H	EPA. 1997. "Health Effects Assessment Summary Tables (HEAST): Annual Update, FY 1997." EPA-540-R-97-036. National Center for Environmental Assessment, Office of Research and Development and Office of Emergency and Remedial Response. July. (as cited in EPA 2012b [see Source "S"]
I	EPA. 2012a. Integrated Risk Information System (IRIS). Online Database. Office of Research and Development, National Center for Environmental Assessment. Available on-line at: <http://www.epa.gov/iris> (as cited in EPA 2012b [see Source "S"])
P	Provisional Peer Reviewed Toxicity Value (as cited in EPA 2012b [see Source "S"])
S	The basis for the toxicity criteria shown for manganese and vanadium are discussed in the User's Guide for the EPA RSL table: EPA. 2012b. Regional Screening Levels for Chemical Contaminants at Superfund Sites. November. Available on-line at: <http://www.epa.gov/region9/superfund/prg/index.html>
X	Provisional Peer Reviewed Toxicity Value Appendix (as cited in EPA 2012b [see Source "S"])

ATTACHMENT 1
RESPONSES TO DTSC COMMENTS

TECHNICAL APPROACH FOR HUMAN HEALTH RISK ASSESSMENT
SITE CHARACTERIZATION REPORT
PROPOSED RICHMOND BAY CAMPUS
RICHMOND FIELD STATION
UNIVERSITY OF CALIFORNIA, BERKELEY

Department of Toxic Substances Control (DTSC) Cursory Review
Comments Submitted By: Kimi Klein, 11/20/12

TEXT COMMENTS

Comment 1: **On page 6/11 in the third paragraph, it says that the 'calculated EPC for these constituents will be used to calculate a site-wide BaP equivalent concentration'. Do you mean for the 'site' or for an exposure area?**

Response: A benzo(a)pyrene equivalent (BaP EQ) concentration will be developed for each sample at each location that is included in the developable area dataset at the Richmond Field Station (RFS). However, a site-wide exposure point concentration (lesser of the 95th percentile upper confidence limit of the arithmetic mean [95UCL] and the maximum detected concentration) will only be developed for each of the two exposure areas: Mercury Fulminate Area and Associated Production Areas, and Corporation Yard.

Comment 2: **On page 7/11 in the second paragraph of Section 5.0, the hierarchy is not currently being recommended for use.**

Response: Comment noted. The hierarchy for the RFS site characterization report is thus proposed to be revised to follow the hierarchy provided in the U.S. Environmental Protection Agency's (EPA) Office of Solid Waste and Emergency Response (EPA 2003) memorandum, but use the state criterion when it is more stringent than the federal criterion.

For example, the May 2012 EPA regional screening level (RSL) table (which follows the EPA [2003] memorandum) indicates the federal cancer slope factor of 0.35 per milligrams per kilogram per day ([mg/kg-day]$^{-1}$) for chlordane. However, the state criterion (1.3 [mg/kg-day]$^{-1}$) is more stringent. Thus, we would default to the state criterion for chlordane.

TABLE 3 COMMENTS

Comment 1: **What is the 'R' designation opposite the RfC for 4-methylphenol?**

Response: The "R" is a typo. The correct source should be shown as "C" for California EPA (Cal/EPA).

Comment 2: **Somewhere you should provide justification(s)/rationale for the surrogates chosen for the non-carcinogenic PAHs (structure similarity?).**

Response: Rationale for the chosen surrogates will be provided in the human health risk assessment that will be included as part of the site characterization report. If DTSC prefers alternative surrogates be used for the surrogate chemicals currently shown in Table 3, please let us know your preference.

Comment 3: **You've listed the new BaP SF from OEHHA of 2.9 (mg/kg/d)$^{-1}$. This is less stringent than the current US EPA SF of 7.9 *[sic]* (mg/kg/d)$^{-1}$. Although I believe the OEHHA number is based on a good scientific analysis, CERCLA regulations say that state standards cannot be less stringent than federal standards. So maybe we should go with the EPA SF?**

Response: The oral slope factor for BaP will be changed to the value currently recommended by the EPA (7.3 [mg/kg-day]$^{-1}$).

Comment 4: **It's ok to use the OEHHA tox criteria for tetrachloroethylene. But HERO recommends using the new US EPA tox criteria for trichloroethylene as listed in IRIS.**

Response: The toxicity criteria for trichloroethylene will be changed to the values currently recommended by the EPA. No changes will be made to tetrachloroethylene as the state criteria are more stringent than EPA.

Comment 5: **Please explain 'source "S"' in the footnotes.**

Response: Footnote "S" will be revised to add the following text preceding the reference: "*The basis for the toxicity criteria shown for manganese and vanadium are discussed in the User's Guide for the EPA RSL table*."

Comment 6: **I presume that all the listed provisional peer reviewed toxicity values listed are current? They all have a definite shelf life I think.**

Response: The Provisional Peer Reviewed Toxicity Values (PPRTV) that are presented in Table 3 are taken from the May 2012 EPA RSL table and are presumed to be the most current. When EPA releases their Fall 2012 RSL table, the EPA's use of these PPRTVs will be confirmed.

REFERENCE

U.S. Environmental Protection Agency (EPA). 2003. "Human Health Toxicity Values in Superfund Risk Assessments." Memorandum from Michael B. Cook, Director, to Superfund National Policy Managers, Regions 1-10. Office of Solid Waste and Emergency Response Directive 9285.7-53. December 5. Available on-line at: <http://www.epa.gov/swerrims/riskassessment/pdf/hhmemo.pdf>