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January 23, 2003

Jay Tomlin
U.S. Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, CA 94612

RE: Updated Designated-Level Analysis of the
Southwest Trenches Overburden Soil
DOE LEHR Site, Davis, California
WA Job # 128-4107-610

Dear Jay:

This letter provides an update of the designed-level (DL) screening initially presented in our Southwest Trenches (SWT) overburden letter report to Richard Fallejo dated September 24, 2001. The objective of the September report was to evaluate whether the SWT overburden is acceptable for reuse as backfill in the former Western Dog Pens (WDPs) area at the Laboratory for Energy-Related Health Research (LEHR) in Davis, California. This update addresses comments provided by the Central Valley Regional Water Quality Control Board on October 30, 2001 (attached) on the September report. If deemed appropriate by the United States Department of Energy (DOE), on-site reuse of this material is consistent with DOE's waste minimization goals and eliminates the need for costly off-site disposal.

The overburden soil is currently stored in the WDPs, and consists of approximately 435 cubic yards (cu yd) of material removed from 0 to 3.5 feet below ground surface (ft bgs) in portions of the SWT area. The overburden soil formed the cover over the low-level waste contained in the SWT disposal trenches which were removed in 1998.

DESIGNATED-LEVEL SCREENING

The overburden data were evaluated following the preliminary DL screening process presented in Section 6 of the *Final Southwest Trenches Area 1998 Removal Action Confirmation Report*[1]. A flowchart of the preliminary DL screening process is presented in Figure 1.

[1] Weiss Associates, *Final Southwest Trenches Area 1998 Removal Action Confirmation Report for the Laboratory for Energy-Related Health Research,* University of California, Davis, June 13, 2001, Rev. 0.

Designated-Level Screening Procedures

- The preliminary DL screening process consisted of four steps. Any analyte remaining after Step 4 would be considered a potential DL constituent of concern (COC) for overburden soil. The four screening steps were:

- Step 1: Each analyte was evaluated to determine whether it was detected in any of the samples. If the analyte was not detected, then it was not considered a potential DL COC.

- Step 2: The remaining analytes were compared to 1.5 times the background value and the percent of detected concentrations was considered. The decision to use a factor of 1.5 times the background value when screening maximum concentrations is based on contributions from two forms of error. The first form of error is the acceptable margin of quantitative error allowed in laboratory sample preparation and analysis based on US EPA Contract Laboratory Program, Inorganic Laboratory Method 4.0 (US EPA CLP ILM 4.0). The acceptable quantitative error in preparation and analysis of soil samples is approximately +/- 30% based on laboratory control sample (LCS) recovery limits in Form 7 of US EPA CLP ILM 4.0. LCS limits track the combined sample preparation and analysis errors. Analytical errors typically exceed these limits especially for results reported near the method detection limits, and many of the LEHR-specific background levels are near the method detection limits. The analytical error is taken into account in the screening process because the maximum concentration is a single laboratory analysis result rather than a value with a high level of statistical confidence.

  The second form of error is based on the probability of falsely concluding that a maximum value is representative of contamination. The background value is the 80% lower confidence limit (LCL) on the 95th percentile. Because 5% of uncontaminated soil has concentrations above the background value, the maximum concentration will likely be above the background value whether or not the soil is contaminated. The 1.5 factor provides reasonable assurance that carrying naturally occurring maximum values (background concentrations that are above the background value) forward in the screening process occurs with a frequency of less than 20%.

  If the maximum concentration of the analyte was greater than 1.5 times the background value and detected with a frequency of more than 5%, it was carried forward to Step 3. Otherwise, the analyte was no longer considered a potential DL COC.

- Step 3: Each analyte's soil/water partitioning coefficient (K_d) was evaluated along with its radiological half-life. An analyte was carried forward to Step 4 if it was organic (pesticides/semivolatile organic compounds [SVOCs]/volatile organic compounds [VOCs]) and its K_d was less than 10 milliliters per gram (ml/g), or it was inorganic (metals, minerals, and radionuclides) and its K_d was less than 1,000 ml/g, or if it was a radionuclide and its half-life was greater than one year. Otherwise, the analyte was dropped from the list of potential COCs.

- Step 4: The remaining analytes were evaluated based on whether biological degradation would prevent them from migrating to ground water. Analytes that are known to undergo rapid biological decay in vadose zone soil were eliminated from the list of potential COCs.

Designated-Level Screening Results

The results of the DL screening process are shown in Tables 1 and 2. Table 1 is a summary of the results for Steps 1 through 3, and Table 2 is a summary of Step 4 results.

Over 200 analytes were evaluated; only seven analytes remained after Step 4 of the screening process. All SVOCs were eliminated in Step 1 due to no detections. Nitrate, and the majority of the metals, pesticides, radionuclides, and VOCs were eliminated in Step 2 since they are within the background range. The remainder of the pesticides were eliminated in Step 3.

The only remaining analytes after Step 3 were hexavalent chromium (Cr), cadmium (Cd), selenium, carbon-14 (C-14), lead-210 (Pb-210), strontium-90 (Sr-90), tritium, 2-butanone, chloroform, methylene chloride, toluene, and xylene. The organic compounds were eliminated in Step 4 because they were not identified as COCs in the SWT waste matrix (Table 1). Hexavalent Cr, Cd, selenium, C-14, Pb-210, Sr-90, and tritium were retained as COCs. DL modeling was conducted to evaluate potential ground water impact by the COCs as described below.

DESIGNATED-LEVEL MODELING

This section summarizes the methodologies, assumptions, and rationale used to conduct the refined DL analysis. The refined DL analysis consisted of performing vadose zone modeling to determine the potential adverse impacts to ground water at the site. The modeling code, Non-Isothermal, Unsaturated Flow and Transport (NUFT) Model[2], was used as the modeling tool. The details of the model, including the selection of input parameter values and model setup, are the same as those presented in previous reports[3, 4]. Parameters are only discussed below if changes were made for this modeling effort. The iterative calculation approach, as it applies to this tool, is described in the *Addendum to Former Dog Pens Technical Memoranda*[5]. Modeling input and results are included as Appendix A.

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[2] Nitao, J.J., 1998, *Reference Manual for the NUFT Flow and Transport Code*, version 2.0, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-MA-130651).

[3] Weiss Associates (WA), 1997, *Draft Final One-Dimensional Vadose Zone Modeling for the U.S. Department of Energy Areas at the Laboratory for Energy-Related Health Research*, University of California at Davis, California, April.

[4] WA, 2000, *Addendum to Former Dog Pens Technical Memoranda for the Laboratory for Energy-Related Health Research*, University of California, Davis, February, Rev. C.

[5] *Ibid.*

The previously determined Western Dog Pens (WDPs) soil profile and input parameters[6] were used to model the migration of constituents of concern (COCs) in overburden soil through the vadose zone to ground water after the overburden soil is placed in the WDPs area. All of the COCs were initially modeled assuming placement of the overburden between zero and two ft bgs. The maximum overburden soil concentrations for all of the COCs with the exception of C-14, tritium and Cd were below the NUFT model soil results using the site's ground water background concentrations as the cleanup goal (Table 3). The NUFT model was then rerun for C-14, Cd and tritium assuming placemtent between one and two ft bgs with the drinking water maximum contaminant level (MCL) and ground water background as the impact target concentrations.

Ground Water Goals

The California and/or United States Environmental Protection Agency (US EPA) MCLs, and site background were used as the ground water goals in the DL modeling. The targeted background concentrations were based on COC concentrations detected in ground water from well UCD1-18, located approximately 500 ft upgradient of the LEHR site. For tritium, C-14 and Pb-210, one-half of the lowest detection limit was used, because these COCs were not detected in well UCD1-18. For hexavalent Cr and selenium, the 80% lower confidence limit (LCL) on the 95th quantile of concentrations detected in well UCD1-18 was used. The background hexavalent Cr and selenium concentrations were 0.0394 milligram per liter (mg/l) and 0.00446 mg/l, respectively. Cd and Sr-90 were detected only once with concentrations of 0.001 mg/l and 1.7 picoCuries per liter (pCi/l), respectively, which were used as the background goals.

Parameter Value Estimation

The assumptions and data used to develop the input parameters for modeling calculations are described in detail in the *Draft Final One-Dimensional Vadose Zone Modeling*[7] and *Addendum to Former Dog Pens Technical Memoranda*[8]. The same soil physical and hydraulic properties that were used previously to model the WDPs area were also used for this modeling effort. The physical and hydraulic input parameter values are summarized in Table A-3, Appendix A. Conservative assumptions regarding the selected parameters are described below:

- Depth to ground water: The shallowest depth to the water table (20 ft bgs) observed at the site was used in the model;
- Infiltration: An infiltration rate of 10.8 centimeters per year, corresponding to 25% of the mean annual precipitation rate, was selected. The infiltration was assigned to the model at constant rates resulting in continuous vertical flux towards the water table. This is a very conservative assumption since there are

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[6] *Ibid.*

[7] WA, 1997.

[8] WA, 2000.

long periods during the year when the flux is either zero or directed upward due to evapotranspiration;

- Permeability and porosity: The highest measured values for each soil type are used in the model;
- Volatility: No volatilization was used for any of the COCs;
- Dispersion: No dispersion was used for any of the COCs;
- Partitioning coefficients: The smallest measured or reported partitioning coefficients were used for each soil type;
- Initial concentration (IC) distribution: ICs were assumed uniformly distributed throughout the entire interval of soil column that would be occupied by the SWT overburden soil, thereby significantly overestimating the total mass for that interval; and,
- Dilution: A thin aquifer thickness at the bottom of the model was used to represent the top of the water table as a receptor. Dilution is therefore negligible and this assumption overestimates the concentrations of ICs that may reach the water table.

Model Setup, Initialization, and Parameter Sensitivity Analysis

The details of the conceptual model, boundary conditions and the initial flow conditions are described in *One-Dimensional Vadose Zone Modeling*[9]. The iterative modeling approach used to determine soil concentrations is described in *Addendum to Former Dog Pens Technical Memoranda*[10].

The sensitivity of the model to infiltration rate, lithology, dispersion, grid-cell spacing, initial contaminant mass inventory and distribution, and ground water goal was discussed in detail in *One-Dimensional Vadose Zone Modeling*[11] and *Addendum to Former Dog Pens Technical Memoranda*[12]. Although no formal sensitivity analysis was performed on retardation factor and vadose zone thickness, increasing these parameters would be expected to increase peak time and decrease peak concentration.

In summary, these sensitivity analyses suggest that the DL modeling performed for the WDPs area produces conservatively low allowable soil concentrations for a given ground water goal because: 1) no vadose zone dispersion was included; 2) contaminant mass was biased high; 3) retardation factors, especially for tritium and C-14 which were assumed to be in water and methanol forms, respectively, were biased low; and, 4) the vadose zone thickness used was the

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[9] WA, 1997.

[10] WA, 2000.

[11] WA, 1997.

[12] WA, 2000.

minimum recorded. The infiltration rate and lithologies used to represent the WDPs area are considered representative, and using the most conservative reasonable representation of these parameters would not significantly change the modeling results. Therefore, the DL modeling results are expected to overestimate actual impacts to ground water.

Refined Designated-Level Analysis Results and Conclusions

The results of the modeling performed during the refined DL analysis are presented in Appendix A, summarized in Table 3, and discussed by COC below. As noted above, all of the COCs were first modeled assuming placement of the overburden soil between zero to two ft bgs. The NUFT model was rerun for C-14, Cd and tritium assuming a placement depth between one and two ft bgs to evaluate the effects decreased mass loading.

Hexavalent Chromium

The DL modeling results for the hexavalent Cr indicate that a soil concentration of 5.48 milligrams per kilogram (mg/kg) distributed between zero and two ft bgs will result in ground water impact at the 50 micrograms per liter (µg/l) MCL. Based on the DL modeling, a soil concentration of 4.34 mg/kg distributed from zero to two ft bgs will result in ground water impact at the estimated 39 µg/l background level. The hexavalent Cr background concentration for soil is 0.054 mg/kg.

The maximum hexavalent Cr concentration detected in SWT overburden soil samples was 0.343 mg/kg. Based on the DL modeling and these results, hexavalent Cr will present no threat to ground water if the SWT overburden is placed in the WDPs area.

A comparison of recent hexavalent Cr deionized water waste extraction test (DI WET) results to the soluble designated levels determined from modeled attenuation is presented in Appendix B. The DI WET comparison confirms that hexavalent Cr will not impact ground water above the MCL or background if SWT overburden is placed in the WDPs area.

Cadmium

Using the 5.0 µg/l MCL as the ground water goal and assuming SWT overburden soil is placed between a depth of 1 and 2 ft bgs, the DL modeling result for Cd is 4.12 mg/kg in soil. The peak ground water activity equivalent to the MCL occurs after 8,292 years. Using the 1.0 µg/l estimated background ground water concentration as a goal, the resulting DL soil limit is 0.895 mg/kg.

The maximum Cd concentration detected in SWT overburden soil samples was 0.809 mg/kg. Based on the DL modeling, Cd will present no threat to ground water if the SWT overburden soil is placed between a depth of one and two ft bgs in the WDPs area.

Selenium

The DL modeling results for selenium indicate that its presence in SWT overburden soil will present no significant risk to ground water after placement in the WDPs area. Using the estimated background concentration of 4.46 µg/l as a ground water goal results in an allowable soil concentration of 9.32 mg/kg. The maximum selenium concentration detected in SWT overburden sampling was 2.9 mg/kg. Therefore, based on these results, selenium will present no threat to ground water if the SWT overburden is placed in the WDPs area.

Carbon-14

Using the 2,000 pCi/l MCL as the ground water goal and assuming SWT overburden soil is placed between a depth of 1 and 2 ft bgs, the DL modeling result for C-14 is 3.44 picoCuries per gram (pCi/g) in soil. The peak ground water activity equivalent to the MCL occurs after 15 years. Using the 3.5 pCi/l estimated background ground water concentration as a goal, the resulting DL soil limit is 0.00733 pCi/g. The LEHR C-14 background soil activity is 0.13 pCi/g.

C-14 was reported above site background in three of the nine samples collected from the overburden (Table 1). The maximum C-14 activity detected in SWT overburden samples is 0.809 pCi/g. Based on the DL modeling, C-14 in SWT overburden soil may locally impact ground water above background concentrations in the WDPs area.

Lead-210

The DL modeling results for Pb-210 indicate that its presence in SWT overburden soil will present no significant risk to ground water after placement in the WDPs area. Using the estimated background concentration of 80 pCi/l as a ground water goal results in an allowable soil concentration of >100,000 pCi/g in the soil column at one to two ft bgs. The maximum Pb-210 activity detected in SWT overburden sampling was 9.77 pCi/g. Therefore, based on these results, Pb-210 will present no threat to ground water if the SWT overburden is placed in the WDPs area.

Strontium-90

The estimated Sr-90 background concentration of 1.7 pCi/l results in an allowable soil concentration of >100,000 pCi/g in the soil column at zero to two ft bgs. The maximum Sr-90 activity in SWT overburden sampling was 0.423 pCi/g. Based on these results, Sr-90 will present no threat to ground water if the SWT overburden is placed in the WDPs area.

Tritium

Using the 20,000 pCi/l MCL as the ground water goal and assuming SWT overburden soil is placed between a depth of 1 and 2 ft bgs, the DL modeling result for tritium is 76.3 pCi/g in soil. The peak ground water activity equivalent to the MCL occurs after 14.3 years. Using the 110 pCi/l estimated background ground water concentration as a goal the resulting DL soil limit is 0.43 pCi/g.

Tritium was reported above site background in six of the nine samples collected from the overburden soil (Table 1). The maximum tritium activity detected in SWT overburden samples is 2.9 pCi/g. Based on the DL modeling, tritium may impact ground water between background and the MCL if the SWT overburden is placed in the WDPs area.

RECOMMENDATIONS

Available data and modeling results indicate that the reuse of overburden soil between one and two ft bgs will not result in any future ground water impacts from COCs except possibly C-14 and tritium. The modeling results suggest that these constituents may impact ground water at activities approaching 10% of their respective drinking water MCL. However, due to the conservative nature of the model's input parameters, we expect that the actual ground water impacts from these constituents will be negligible. Thus, we conclude that reuse of the overburden soil between one and two ft bgs should be acceptable from a ground water impact perspective.

Potential ecological and human health risk impacts associated with reuse of the SWT overburden should be evaluated after the site-wide risk assessment is complete.

Please let me know if you have any questions or comments on this evaluation.

Sincerely,
Weiss Associates

Robert O. Devany

Robert O. Devany
Sr. Project Manager

Enclosures: Table 1. Steps 1, 2, and 3—Designated-Level Data Evaluation for Southwest Trenches Overburden Stockpiles LEHR 0651, 0652, 0653

Table 2. Step 4—Designated-Level Data Evaluation for Southwest Trenches Overburden Stockpiles LEHR0651, 0652, and 0653

Table 3. Summary Evaluation of Potential Impact of Designated-Level Constituents of Concern

Figure 1. Preliminary Designated-Level Analysis Flowchart—Data Evaluation and Screening

Appendix A. Designated-Level Modeling Input Parameters and Results
Table A-1. Vadose Zone Modeling Results
Table A-2. Representative Soil Profile, Western Dog Pens
Table A-3. Summary of Physical and Hydraulic Properties for Vadose Zone Model Soil Types
Appendix B. Comparison of Deionized Water Waste Extraction Test Results to Modeled Hexavalent Chromium Attenuation
Attachment. Responses to Comments on the Evaluation of 2001 Southwest Trenches Overburden Soil Data

TRU/CGL:rod

cc: Salem Attiga (EMS)
Jeff Bold (Montgomery Watson)
Mike Dresen (WA)
G. Fred Lee (G. Fred Lee and Associates)
Catherine Luu (DOE-OAK)
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Steve Ross (DTSC)
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Kathy Setian (US EPA)
Susan Timm (CVRWQCB)
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TABLES

Table 1. Steps 1, 2, and 3—Designated-Level Data Evaluation for Southwest Trenches Overburden Stockpiles LEHR0651, 0652, and 0653

		STEP 1			STEP 2				STEP 3				
Constituent	Units	Number of Samples Analyzed	Number of Samples w/ Detections	Background or Detection Limit Concentration [1]	Number of Detections above Background/ Detection Limit	Max. Detected Concentration	% of Detections above Background or DL	Is Max Conc. > 1.5xBKG **AND** % Detected above BKG>5%?	Partitioning Coefficient (K_d) (mL/g) [2]	Is the K_d less than 10 mL/g (organics) OR less than 1,000 mL/g (inorganics)	Half-Life (Years) [3]	Is the Half-Life greater than 1 year?	Does the Analyte Fail the K_d **OR** Half-Life Test?
General Chemistry													
Chromium, Hexavalent	mg/kg	9	9	0.054	9	0.343	100.0%	YES	1.90E+01	YES	N/A		YES
Nitrate	mg/kg	9	9	36.000	1	36.200	11.1%	NO					
Metals [5]													
Antimony	mg/kg	10	5	1.400	2	1.600	20.0%	NO					
Arsenic	mg/kg	9	9	8.140	0	7.800	0.0%	NO					
Barium	mg/kg	9	9	211.000	0	166.000	0.0%	NO					
Beryllium	mg/kg	9	9	0.564	0	0.400	0.0%	NO					
Cadmium	mg/kg	17	15	0.510	8	0.809	47.1%	YES	7.50E+01	YES	N/A		YES
Chromium	mg/kg	12	12	199.000	0	162.000	0.0%	NO					
Cobalt	mg/kg	9	9	31.000	0	23.900	0.0%	NO					
Copper	mg/kg	9	9	48.800	0	37.100	0.0%	NO					
Iron	mg/kg	9	9	44,000.000	0	34,600.000	0.0%	NO					
Lead	mg/kg	9	9	9.500	1	10.800	11.1%	NO					
Manganese	mg/kg	9	9	750.000	0	614.000	0.0%	NO					
Mercury	mg/kg	9	9	3.940	0	1.600	0.0%	NO					
Molybdenum	mg/kg	9	0	0.260	0		0.0%	NO					
Nickel	mg/kg	12	12	334.000	0	277.000	0.0%	NO					
Selenium	mg/kg	9	9	1.200	4	2.900	44.4%	YES	3.00E+02	YES	N/A		YES
Silver	mg/kg	9	4	0.550	0	0.390	0.0%	NO					
Thallium	mg/kg	9	0	1.600	0		0.0%	NO					
Vanadium	mg/kg	9	9	66.800	0	58.500	0.0%	NO					
Zinc	mg/kg	9	9	72.400	2	78.500	22.2%	NO					
Pesticides/PCBs													
4,4'-DDD	ug/kg	9	0				0.0%	NO					
4,4'-DDE	ug/kg	9	0				0.0%	NO					
4,4'-DDT	ug/kg	9	0				0.0%	NO					
Aldrin	ug/kg	9	0				0.0%	NO					
Alpha-BHC	ug/kg	9	0				0.0%	NO					
Alpha-Chlordane	ug/kg	10	10	*1.400*	10	102.000	100.0%	YES	1.40E+02	NO	N/A		NO
Arochlor-1016	ug/kg	9	0				0.0%	NO					
Arochlor-1221	ug/kg	9	0				0.0%	NO					
Arochlor-1232	ug/kg	9	0				0.0%	NO					
Arochlor-1242	ug/kg	9	0				0.0%	NO					
Arochlor-1248	ug/kg	9	0				0.0%	NO					
Arochlor-1254	ug/kg	9	0				0.0%	NO					
Arochlor-1260	ug/kg	9	0				0.0%	NO					
Beta-BHC	ug/kg	9	0				0.0%	NO					
Delta-BHC	ug/kg	9	0				0.0%	NO					

Table 1. Steps 1, 2, and 3—Designated-Level Data Evaluation for Southwest Trenches Overburden Stockpiles LEHR0651, 0652, and 0653 (continued)

		STEP 1			STEP 2				STEP 3				
Constituent	Units	Number of Samples Analyzed	Number of Samples w/ Detections	Background or Detection Limit Concentration [1]	Number of Detections above Background/ Detection Limit	Max. Detected Concentration	% of Detections above Background or DL	Is Max Conc. > 1.5xBKG **AND** % Detected above BKG>5%?	Partitioning Coefficient (K_d) (mL/g) [2]	Is the K_d less than 10 mL/g (organics) OR less than 1,000 mL/g (inorganics)	Half-Life (Years) [3]	Is the Half-Life greater than 1 year?	Does the Analyte Fail the K_d **OR** Half-Life Test?
Dieldrin	ug/kg	9	0				0.0%	NO					
Endosulfan I	ug/kg	9	0				0.0%	NO					
Endosulfan II	ug/kg	9	0				0.0%	NO					
Endosulfan Sulfate	ug/kg	9	0				0.0%	NO					
Endrin	ug/kg	9	0				0.0%	NO					
Endrin Aldehyde	ug/kg	9	0				0.0%	NO					
Endrin Ketone	ug/kg	9	0				0.0%	NO					
gamma-BHC (Lindane)	ug/kg	9	0				0.0%	NO					
gamma-Chlordane	ug/kg	10	10	*1.400*	10	112.000	100.0%	YES	2.80E+02	NO	N/A		NO
Heptachlor	ug/kg	10	4	*1.400*	4	9.200	40.0%	YES	2.90E+03	NO	N/A		NO
Heptachlor Epoxide	ug/kg	9	3	*0.710*	3	0.470	33.3%	NO					
Methoxychlor	ug/kg	9	0				0.0%	NO					
Toxaphene	ug/kg	9	0				0.0%	NO					
Radionuclides [6]													
Actinium-228	pCi/g	12	12	0.633	0	0.582	0.0%	NO					
Americium-241	pCi/g	9	1	0.014	0	0.007	0.0%	NO					
Bismuth-212	pCi/g	12	12	0.388	2	0.439	16.7%	NO					
Bismuth-214	pCi/g	12	12	0.540	3	0.586	25.0%	NO					
Carbon-14	pCi/g	9	4	0.130	3	0.809	33.3%	YES	8.00E-01	YES	5.73E+03	YES	YES
Cesium-137	pCi/g	12	6	0.102	0	0.041	0.0%	NO					
Cobalt-60	pCi/g	12	0	0.006	0	0.019	0.0%	NO					
Lead-210	pCi/g	12	3	1.600	1	9.770	8.3%	YES	9.00E+02	YES	2.23E+01	YES	YES
Lead-212	pCi/g	12	12	0.691	0	0.582	0.0%	NO					
Lead-214	pCi/g	12	12	0.550	7	0.722	58.3%	NO					
Plutonium-241	pCi/g	9	1	0.500	1	0.547	11.1%	NO					
Potassium-40	pCi/g	12	12	14.000	0	13.500	0.0%	NO					
Radium-223	pCi/g	12	0	n/a	0	0.184	0.0%	NO					
Radium-226	pCi/g	9	9	0.752	0	0.599	0.0%	NO					
Radium-228	pCi/g	12	12	0.630	0	0.582	0.0%	NO					
Strontium-90	pCi/g	13	8	0.056	7	0.423	53.8%	YES	3.50E+01	YES	2.91E+01	YES	YES
Thallium-208	pCi/g	12	12	0.204	0	0.196	0.0%	NO					
Thorium-228	pCi/g	9	9	0.627	2	0.652	22.2%	NO					
Thorium-230	pCi/g	9	9	1.040	0	0.526	0.0%	NO					
Thorium-232	pCi/g	9	9	0.630	0	0.507	0.0%	NO					
Thorium-234	pCi/g	12	7	0.780	2	1.150	16.7%	NO					
Tritium	pCi/g	9	6	1.200	6	2.900	66.7%	YES	9.90E+00	YES	1.23E+01	YES	YES
Uranium-233/234	pCi/g	9	6	0.559	0	0.508	0.0%	NO					
Uranium-235	pCi/g	9	9	0.038	0	0.030	0.0%	NO					
Uranium-238	pCi/g	9	9	0.565	0	0.469	0.0%	NO					

Table 1. Steps 1, 2, and 3—Designated-Level Data Evaluation for Southwest Trenches Overburden Stockpiles LEHR0651, 0652, and 0653 (continued)

		STEP 1			STEP 2				STEP 3				
Constituent	Units	Number of Samples Analyzed	Number of Samples w/ Detections	Background or Detection Limit Concentration [1]	Number of Detections above Background/ Detection Limit	Max. Detected Concentration	% of Detections above Background or DL	Is Max Conc. > 1.5xBKG **AND** % Detected above BKG>5%?	Partitioning Coefficient (K_d) (mL/g) [2]	Is the K_d less than 10 mL/g (organics) OR less than 1,000 mL/g (inorganics)	Half-Life (Years) [3]	Is the Half-Life greater than 1 year?	Does the Analyte Fail the K_d **OR** Half-Life Test?
SVOCs													
None													
VOCs													
2-Butanone	ug/kg	9	4	*9.700*	4	43.400	44.4%	YES	3.80E-03	YES	N/A		YES
Chloroform	ug/kg	9	6	*1.100*	6	1.700	66.7%	YES	8.00E-02	YES	N/A		YES
Ethylbenzene	ug/kg	9	2	*1.100*	2	1.000	22.2%	NO					
Methylene Chloride	ug/kg	9	6	*1.100*	6	6.050	66.7%	YES	2.40E-02	YES	N/A		YES
Toluene	ug/kg	9	7	*1.100*	7	175.000	77.8%	YES	3.60E-01	YES	N/A		YES
Xylene	ug/kg	9	4	*1.100*	4	3.600	44.4%	YES	7.30E-01	YES	N/A		YES

Notes

[1] Background values for data from less than four feet below ground surface (ft bgs) were used because the majority of the confirmation samples were collected at this depth.
For SVOCs, VOCs, pesticides, and any other constituents without a background value, the lowest reportable detection limit was used for background concentration (*in italics*).

[2] K_d values are based on the lowest reasonable value observed in literature and site-specific vadose zone modeling data that relate K_d to the time-to-peak in ground water.
Examples of references used for K_d values: "Soil Screening Guidance for Radionuclides: Technical Background Document," USEPA, EPA/540-R-00-006, October 2000; and USEPA's Superfund Chemical Data Matrix (SCDM) database downloaded from the USEPA web page (http:\\www.epa.gov).

[3] Half-life values obtained from "Handbook of Environmental Degradation Rates" by Howard, Boethling, Jarvis, Meylan, and Michalenko 1991 and the USEPA SCDM database. Criteria is based on site-specific information regarding time of last waste burial and process knowledge regarding levels of radionuclide activity used at LEHR for research.

[4] A constituent is considered a designated-level (DL) constituent of concern (COC) if it is organic and its K_d is less than 10 mL/g (pesticides/SVOCs/VOCs), or it is inorganic and its K_d is less than 1,000 mL/g (metals, minerals, and radionuclides), or if it is a radionuclide and its half-life is greater than one year.

[5] Metals list does not include: aluminum, calcium, magnesium, potassium, or sodium results. No background data were available for these elements.

[6] Gross alpha and non-volatile beta results are not included in this table. These parameters were analyzed as indicators for alpha and beta emitting radionuclides.

Abbreviations

BKG	background
Conc.	concentration
DDD	dichlordiphenyl dichlor
DDE	dichlordiphenyl ethylene
DDT	dichlordiphenyl trichlor
Max.	maximum
mg/kg	milligrams/kilogram
mL/g	milliliters per gram
PCBs	polychlorinated biphenyl
pCi/g	picoCuries per gram
SVOC	semi-volatile organic compound
ug/kg	micrograms per kilogram
VOC	volatile organic compound

Table 2. Step 4—Designated-Level Data Evaluation for Southwest Trenches Overburden Stockpiles LEHR0651, 0652, and 0653

Constituent	Units	Background/ Detection Limit Concentration [1]	Number of Detections above Background/DL	Max. Detected Concentration	% Detected above Background/DL	Partitioning Coefficient (K_d) (mL/g) [2]	Half-Life (Years)	Surrogate DL (mg/kg or pCi/g) [4]	Is Constituent a Designated Level COC? [3]	Explanation
General Chemistry										
Chromium, Hexavalent	mg/kg	0.0540	9	0.3430	100.0%	1.90E+01	N/A	2.56 mg/kg	YES	
Metals										
Cadmium	mg/kg	0.5100	8	0.8090	47.1%	7.50E+01	N/A	Not Avail.	YES	Designated-level modeling was conducted to evaluate potential ground water impact.
Selenium	mg/kg	1.2000	4	2.9000	44.4%	3.00E+02	N/A	Not Avail.	YES	Designated-level modeling was conducted to evaluate potential ground water impact.
Pesticides/PCBs										
None										
Radionuclides										
Carbon-14	pCi/g	0.1300	3	0.8090	33.3%	8.00E-01	5.73E+03	Not Avail.	YES	Designated-level modeling was conducted to evaluate potential ground water impact.
Lead-210	pCi/g	1.6000	1	9.7700	8.3%	9.00E+02	2.23E+01	Not Avail.	YES	Designated-level modeling was conducted to evaluate potential ground water impact.
Strontium-90	pCi/g	0.0560	7	0.4230	53.8%	3.50E+01	2.91E+01	1.72E+15	YES	Designated-level modeling was conducted to evaluate potential ground water impact.
Tritium	pCi/g	1.2000	6	2.9000	66.7%	9.90E+00	1.23E+01	Not Avail.	YES	Designated-level modeling was conducted to evaluate potential ground water impact.
SVOCs										
None										
VOCs										
2-Butanone	ug/kg	*9.7000*	4	43.4000	44.4%	3.80E-03	N/A	Not Avail.	NO	Low concentration and biodegradable
Chloroform	ug/kg	*1.1000*	6	1.7000	66.7%	8.00E-02	N/A	Not Avail.	NO	Low concentration
Methylene Chloride	ug/kg	*1.1000*	6	6.0500	66.7%	2.40E-02	N/A	Not Avail.	NO	Low concentration
Toluene	ug/kg	*1.1000*	7	175.0000	77.8%	3.60E-01	N/A	Not Avail.	NO	Low concentration and biodegradable
Xylene	ug/kg	*1.1000*	4	3.6000	44.4%	7.30E-01	N/A	Not Avail.	NO	Low concentration and biodegradable

Notes

(1) Background values for data from less than 4 feet below ground surface (ft bgs) were used because the overburden was excavated from this depth.
For SVOCs, VOCs, pesticides, and any other constituents without a background value, the lowest reportable detection limit was used for background concentration (*in italics*).

(2) K_d values are based on the lowest reasonable value observed in literature and site-specific vadose zone modeling data that relate K_d to the time-to-peak in ground water.
Examples of references used for K_d values: "Soil Screening Guidance for Radionuclides: Technical Background Document,", USEPA, EPA/540-R-00-006, October 2000; and USEPA's Superfund Chemical Data Matrix (SCDM) database downloaded from the USEPA web page (http:\\www.epa.gov).

(3) A constituent is considered a designated-level (DL) constituent of concern (COC) if it is organic and its K_d is less than 10 mL/g (pesticides/SVOCs/VOCs), or it is inorganic and its K_d is less than 1,000 mL/g (metals, minerals, and radionuclides), or if it is a radionuclide and its half-life is greater than one year.

(4) Derived from other site locations with similar lithology/contaminant distribution.

Abbreviations

COC	constituent of concern	pCi/L	picoCuries per liter
EDP	Eastern Dog Pens	PRG	preliminary remediation goal
Max.	maximum	SVOC	semi-volatile organic compound
MCL	maximum contaminant level	ug/kg	micrograms per kilogram
mg/kg	milligrams per kilogram	VOC	volatile organic compound
mL/g	milliliters per gram	WDP	Western Dog Pens
pCi/g	picoCuries per gram		

Table 3. Summary Evaluation of Potential Impact of Designated-Level Constituents of Concern

Constituent of Concern	Overburden Soil Maximum (mg/kg or pCi/g)	Soil Background Value[1] (mg/kg or pCi/g)	NUFT Soil Result (BG Goal) (mg/kg or pCi/g)	NUFT Soil Result (MCL Goal) (mg/kg or pCi/g)	Summary of Ground Water Impact Potential [2]
Hexavalent Chromium	0.343	0.054	4.34	5.48	No impact above background or MCL.
Cadmium	0.809	0.51	0.895	4.12	No impact[3] above background or MCL.
Selenium	2.9	1.2	9.32	85.8	No impact above background or MCL.
Carbon-14 (as methanol)	0.809	0.13	0.00733	3.44	No impact[3] above MCL. Localized impact above background possible.
Lead-210	9.77	1.6	> 100,000[4]	> 100,000[4]	No impact above background or PRG.
Strontium-90	0.423	0.056	> 100,000[5]	> 100,000[5]	No impact above background or MCL.
Tritium (as tritiated water)	2.9	1.2	0.43	40.4	No impact[3] above MCL. Localized impact above background possible.

Notes

[1] 0 to 4 ft bgs.
[2] Assumes overburden is placed between 0 and 2 ft bgs.
[3] Overburden soil must be placed between 1 and 2 ft bgs.
[4] Results indicate that pure lead-210 placed between 0 and 2 ft bgs will not impact ground water.
[5] Results indicates that pure strontium-90 placed between 0 and 2 ft bgs will not impact ground water.

Abbreviations

BG	background, based on concentrations in ground water from upgradient well UCD1-18
bgs	below ground surface
ft	feet
mg/kg	milligrams per kilogram
MCL	primary maximum contaminant level for ground water
NUFT	Non-Isothermal, Unsaturated Flow and Transport Model
pCi/g	picoCuries per gram
PRG	preliminary remediation goal
SWT	Southwest Trenches
WDP	Western Dog Pens

FIGURE

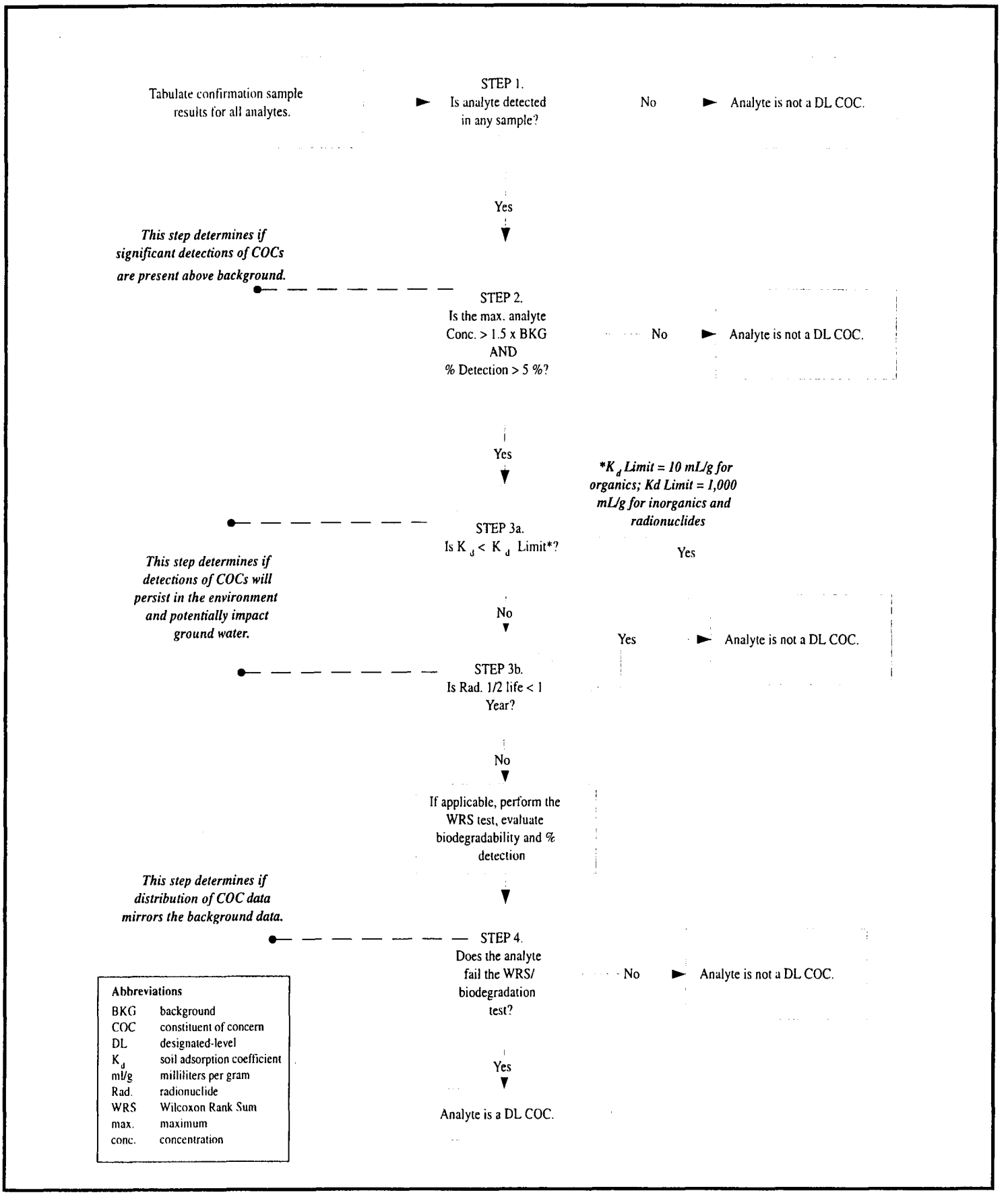

Figure 1. Preliminary Designated-Level Analysis Flowchart—Data Evaluation and Screening

APPENDIX A

DESIGNATED-LEVEL MODELING INPUT PARAMETERS AND RESULTS

Table A-1. Vadose Zone Modeling Results

Constituent of Concern	NUFT Soil Result (mg/kg or pCi/g)	Depth Interval	Time to peak at Ground Water Goal Level[1] (years)	Ground Water Goal Conc. (µg/l or pCi/l)	Goal Reference
Hexavalent Chromium	5.48	0 - 2 ft	2,165	50	MCL
Hexavalent Chromium	4.34	0 - 2 ft	2,172	39.4	BG
Cadmium	4.12	1 - 2 ft	8,292	5.0	MCL
Cadmium	0.895	1 - 2 ft	8,251	1.0	BG
Selenium	85.8	0 - 2 ft	33,993	50	MCL
Selenium	9.32	0 - 2 ft	34,532	4.46	BG
C-14 (as methanol)	3.44	1 - 2 ft	15.0	2,000	MCL
C-14 (as methanol)	0.00733	1 - 2 ft	15.0	3.5	½ L BG DL
Lead-210	> 100,000[2]	0 - 2 ft	N/A	0.0375	PRG
Lead-210	> 100,000[2]	0 - 2 ft	N/A	80	½ L BG DL
Strontium-90	> 100,000[3]	0 - 2 ft	N/A	8.0	MCL
Strontium-90	> 100,000[3]	0 - 2 ft	N/A	1.7	BG
Tritium (as tritiated water)	76.3	1 - 2 ft	14.3	20,000	MCL
Tritium (as tritiated water)	0.43	1 - 2 ft	14.5	110	½ LBG DL

Table A-1. Vadose Zone Modeling Results (continued)

Notes

[1] Calculated using a 10.8 centimeters per year infiltration rate.

[2] Results indicate that pure lead-210 placed between 0 and 2 ft bgs will not impact ground water.

[3] Results indicate that pure strontium-90 placed between 0 and 2 ft bgs will not impact ground water.

Abbreviations

½ L BG DL	One-half of the lowest reported background detection limit for well UCD1-18 samples. Applies to constituents of concern whose UCD1-18 results were all not detected.
BG	Background value based on concentrations detected in well UCD1-18 samples.
C-14	carbon-14
Conc.	concentration
ft	feet
MCL	maximum contaminant level
MCL	State of California Primary Maximum Contaminant Level for ground water
mg/kg	milligrams per kilogram
NUFT	Non-Isothermal, Unsaturated Flow and Transport model
pCi/g	pico curies per gram
pCi/l	pico curies per liter
PRG	Region 9 Environmental Protection Agency Preliminary Remediation Goal.
µg/l	micrograms per liter

Table A-2. Representative Soil Profile, Western Dog Pens

Element Number	dz(m)	Depth (m)	dz (ft)	Depth (ft)	Node Depth(ft)	Material Boundary Condition
33	1.00	0.00	3.28	0.00	0.00	atmospheric element
32	1.00	0.00	3.28	0.00	0.00	recharge element
31	0.15	0.15	0.50	0.50	0.25	unsaturated clayey
30	0.15	0.31	0.50	1.00	0.75	sandy silt elements
29	0.15	0.46	0.50	1.50	1.25	
28	0.15	0.61	0.50	2.00	1.75	unsaturated sand
27	0.15	0.76	0.50	2.50	2.25	elements
26	0.15	0.91	0.50	3.00	2.75	
25	0.31	1.22	1.00	4.00	3.50	
24	0.31	1.52	1.00	5.00	4.50	
23	0.31	1.83	1.00	6.00	5.50	
22	0.31	2.13	1.00	7.00	6.50	
21	0.31	2.44	1.00	8.00	7.50	unsaturated clayey
20	0.31	2.74	1.00	9.00	8.50	sandy silt elements
19	0.31	3.05	1.00	10.00	9.50	
18	0.31	3.35	1.00	11.00	10.50	
17	0.31	3.66	1.00	12.00	11.50	
16	0.15	3.81	0.50	12.50	12.25	
15	0.15	3.96	0.50	13.00	12.75	
14	0.31	4.27	1.00	14.00	13.50	
13	0.31	4.57	1.00	15.00	14.50	
12	0.31	4.88	1.00	16.00	15.50	
11	0.31	5.18	1.00	17.00	16.50	
10	0.31	5.49	1.00	18.00	17.50	
9	0.31	5.79	1.00	19.00	18.50	
8	0.31	6.10	1.00	20.00	19.50	water table 20 ft-bgs
7	0.31	6.40	1.00	21.00	20.50	saturated clayey
6	0.31	6.71	1.00	22.00	21.50	sandy silt elements
5	0.31	7.01	1.00	23.01	22.50	
4	0.31	7.32	1.00	24.01	23.51	
3	0.31	7.62	1.00	25.01	24.51	
2	0.31	7.93	1.00	26.01	25.51	
1	0.31	8.23	1.00	27.01	26.51	saturated silty clay element

Abbreviations

dz element thickness
ft feet
m meters

Table A-3. Summary of Physical and Hydraulic Properties for Vadose Zone Model Soil Types

Chemical Specific Parameters		
COC	**K_d (ml/g)**	**Molecular Weight**
Hexavalent Chromium	19	52.0
Cadmium	75	112.4
Selenium	300	78.96
C-14 Methanol	0	34.0
Lead-210	900	210.0
Strontium-90	35	89.91
Tritiated Water	0	20.016

Formulas
Normalized Kd = $\rho B.Kd / \phi$
Tortuosity Factor = $S^{(7/3)} \cdot \phi^{(1/3)}$

Unit	Porosity	Hydraulic Conductivity (cm/s)	Dry Bulk Density (g/cm^3)
clayey sandy silt	0.35	1.00E-06	1.7
sand	0.3	1.00E-04	1.9
silty clay	0.39	5.80E-08	1.7

Abbreviations

cm	centimeter
COC	constituent of concern
ϕ	porosity
g	grams
Kd	soil/water partition coefficient
ml	milliliter
ρB	bulk density
S	saturation
s	seconds

APPENDIX B

COMPARISON OF DEIONIZED WATER WASTE EXTRACTION TEST RESULTS TO MODELED HEXAVALENT CHROMIUM ATTENUATION

B. COMPARISON OF DEIONIZED WATER WASTE EXTRACTION TEST RESULTS TO MODELED HEXAVALENT CHROMIUM ATTENUATION

Four soil samples were collected from the Domestic Septic System 6 (DSS 6) area during removal action activities in May 2002 and analyzed for total hexavalent chromium by United States Environmental Protection Agency (US EPA) Method 7196A (US EPA, 2002) and extractable hexavalent chromium by the Deionized Water-Waste Extraction Test (DI WET) procedure. The samples contained total hexavalent chromium concentrations ranging from non-detectable to 0.467 milligram per kilogram (mg/kg) and extractable hexavalent chromium concentrations ranging from non-detectable to 0.055 milligram per liter (mg/l). The results indicated a positive correlation between total hexavalent chromium and extractable hexavalent chromium as shown in the correlation plot in Figure B-1. Only three samples are shown in Figure B-1 because total and DI WET results were non-detectable in the fourth sample.

A ten times (10x) correlation between total and DI WET results would be expected if all of the hexavalent chromium in a sample were extracted by the DI WET procedure because 10 milliliters of DI water is added for each gram of sample in the test. The actual test results (Figure B-1) indicate that approximately all of the hexavalent chromium was extracted from the highest concentration sample, but less than 100% was extracted from the lower concentration samples. Because a lower percentage was extracted from the low concentration samples, these data may indicate that Laboratory for Energy-Related Health Research (LEHR) soil retains a minimum concentration of hexavalent chromium that cannot be extracted by DI water. The results also suggest that LEHR soil containing hexavalent chromium concentrations below a certain minimum may have some capacity to adsorb hexavalent chromium and prevent it from migrating.

A predicted maximum DI WET concentration for Southwest Trenches (SWT) overburden soil was determined from the measured correlation between DI WET and total hexavalent chromium. The maximum hexavalent chromium concentration in SWT overburden soil was 0.343 mg/kg. From the plot in Figure B-1, a total concentration of 0.343 mg/kg correlates to a maximum DI WET concentration of 0.026 mg/l for SWT overburden soil.

The maximum DI WET concentration of 0.026 mg/l was used for comparison to the soluble designated level, which was determined using the attenuation factor from the Non-Isothermal, Unsaturated Flow and Transport Model (Nitao, 1996). The attenuation factor was determined by dividing the peak concentration in water at the initial leachate boundary by the peak concentration in water at the water table boundary. Assuming the SWT overburden soil is placed between one and two feet below ground surface, the resulting attenuation factor is 11.1.

A soluble designated level was then determined using Equation 4 of the Designated-Level Methodology (CRWQCB CVR, 1986), which is:

Soluble Designated Level (mg/l) = Water Quality Goal (mg/l) x Attenuation Factor ÷ 10

Using the California maximum contaminant level (MCL) for hexavalent chromium (0.050 mg/l) as the ground water goal and the modeled attenuation factor (11.1), the resulting soluble designated level was 0.0555 mg/l. Using background (0.0394 mg/L) as the ground water goal, the resulting soluble designated level was 0.0437 mg/l. Based on the soluble designated levels and the maximum DI WET concentration (0.026 mg/l) for SWT overburden soil, hexavalent chromium will present no threat to ground water if the SWT overburden is placed in the WDP area.

B.1 References

California Regional Water Quality Control Board, Central Valley Region (CRWQCB CVR), 1986, The Designated-Level Methodology for Waste Classification and Cleanup Level Determination, Staff Report, October 1986, Updated - June 1989.

Nitao, J.J., 1998, *Reference Manual for the NUFT Flow and Transport Code*, version 2.0, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-MA-130651).

United States Environmental Protection Agency (US EPA), 2002. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, US EPA, Office of Solid Wastes, Method 7196A.

ATTACHMENT

RESPONSES TO COMMENTS ON THE EVALUATION OF
2001 SOUTHWEST TRENCHES OVERBURDEN SOIL DATA

REGIONAL WATER QUALITY CONTROL BOARD
Comments from Susan Timm dated October 30, 2001

Reference	Comment	Response
General Comment 1	Since cleanup levels have not been established, all potential impacts to groundwater must be compared to background or the lowest detection limit for non-naturally occurring constituents.	The evaluation uses the background ground water concentration or lowest detection limit for non-naturally occurring constituents as the point of departure.
Specific Comment 2, Stockpile Sampling (pp. 2-3)	DOE performed several iterations of sampling and analyzing stockpiles in this section, DOE should give the rationale for additional sampling with respect to the particular analytes. It is not clear why DOE re-sampled. Nor is it clear if DOE used only the analytical results of the re-sampling in the screening process or included the earlier sampling results. Additional samples do not negate earlier results. All sampling results should be included in the screening process.	DOE identified potential inconsistencies with the first round of sampling results, but determined that there was no firm basis to reject the data based on review of the laboratory QA records. DOE reanalyzed these samples and used all data in the evaluation process. When duplicate samples were analyzed, the average of the results was used.
Specific Comment 3, Resource Conservation and Recovery Act Waste Screening (pp. 10)	DOE analyzed the stockpiled soil for nickel and chromium using the toxicity characteristic leaching potential (TCLP) and the California Waste Extraction Test (WET) to determine if these constituents were below the federal and state regulatory levels for characteristic hazardous waste. DOE needs to include the TCLP and the WET analysis results in the report.	The nickel and chromium TCLP and WET results were below the federal and state regulatory levels for characteristic hazardous waste. The data will be reported in the next iteration of the report.

REGIONAL WATER QUALITY CONTROL BOARD
Comments from Susan Timm dated October 30, 2001

Reference	Comment	Response
Specific Comment 4, Table 3	In step 3, no explanation was given for the use of different K_d screening values for organic and inorganic constituents. Also, DOE needs to identify which K_d were taken from the literature and which are based on modeling. Literature values for K_d assume a particular organic carbon content in the soil. DOE needs to justify using the literature values based on the organic carbon content of the site soils.	The determination of site-specific organic carbon content would only be applicable for estimating K_d values for organic constituents. The rationale for this screening step is that organic compounds degrade while most inorganic compounds do not. Site vadose zone modeling indicates that a constituent with a K_d of 10 ml/g will reach the ground water after about 2,000 years. Hence, the screening step eliminates organic compounds with K_d greater than 10 under the assumption that they will have degraded during the 2,000-year travel time. The K_d screening level for inorganic compounds is set at 1,000 which corresponds to a vadose zone travel time of 100,000 years.
Specific Comment 5, Tables 3 and 4	DOE did not include an explanation of the basis for the screening criteria in steps 2 and 3. The use of 1.5 times background (already an upper confidence limit) in step 2, and the use of 2.0 or 2.5 times background in Step 4, is arbitrary and inconsistent. Also, DOE should explain why it used 5% detections above background as a cut-off for potential to impact groundwater. DOE needs to justify the screening criteria used in these two steps to eliminate a constituent as a potential threat to groundwater.	Weiss Associates presented the designated-level (DL) analysis approach to the RPMs during three previous Phase II Data Evaluation meetings (one for the Southwest Trenches, one for Ra/Sr Area I, and one for Ra/Sr Area II). During these meetings, the RPMs were presented with the rationale and explanation for the DL analysis approach, including the comparison of the analytical results with the 1.5 times background value and agreed to the approach during each of the three meetings. The following text was added to Section A.1.2.2 to justify comparing the maximum concentration to 1.5 times background: "The decision to use a factor of 1.5 times the background value when screening maximum concentrations is based on contributions from two forms of error. The first form of error is the acceptable margin of quantitative error allowed in laboratory sample preparation and analysis based on EPA Contract Laboratory Program,

REGIONAL WATER QUALITY CONTROL BOARD
Comments from Susan Timm dated October 30, 2001

Reference	Comment	Response
		Inorganic Laboratory Method 4.0 (EPA CLP ILM 4.0). The acceptable quantitative error in preparation and analysis of soil samples is approximately +/- 30% based on laboratory control sample (LCS) recovery limits in Form 7 of EPA CLP ILM 4.0. LCS limits track the combined sample preparation and analysis errors. Analytical errors typically exceed these limits especially for results reported near the method detection limits, and many of the LEHR-specific background levels are near the method detection limits. The analytical error is taken into account in the screening process because the maximum concentration is a single laboratory analysis result rather than a value with a high level of statistical confidence. The second form of error is based on the probability of falsely concluding that a maximum value is representative of contamination. The background value is the 80% lower confidence limit on the 95th percentile. Because 5% of uncontaminated soil has concentrations above the background value, the maximum concentration will likely be above the background value whether or not the soil is contaminated. The 1.5 factor provides reasonable assurance that carrying naturally occurring maximum values (background concentrations that are above the background value) forward in the screening process occurs with a frequency of less than 20%." The subsequent use of 2 and 2.5 times background have been eliminated (see response to Comment 6).

REGIONAL WATER QUALITY CONTROL BOARD
Comments from Susan Timm dated October 30, 2001

Reference	Comment	Response
		The use of 5% detection frequency of above background addresses the probability of falsely concluding that contamination is present when the data distribution is representative of background. For example, in a population of twenty samples, one sample concentration should exceed the 95th percentile concentration (i.e., site background).
Specific Comment 6, Table 4a	DOE concludes that hexavalent chromium concentrations less than 2.56 mg/kg would not result in groundwater impacts above 0.02 mg/L (20 ug/L) based on modeling conducted for the Eastern Dog Pens. This modeling uses a K_d for hexavalent chromium of 19ml/g, based on literature values. It appears that DOE is relying heavily on literature values for its analyses of predicted impacts to groundwater. We would prefer analytical data, including WET analyses, to substantiate those K_d values for constituents found in groundwater, including hexavalent chromium.	At the request of the RWQCB, DOE has recently collected DI-WET samples for hexavalent chromium. Preliminary review of these data shows that hexavalent chromium has a very low leaching potential. DOE will re-model hexavalent chromium using specific Western Dog Pens parameters and the newly generated results from the DI-WET.
Specific Comment 6, Table 4b	DOE screened out cadmium, selenium, and tritium based on their being less than 2.0 or 2.5 times background. In Step 2, DOE used 1.5 times background as screening criteria. DOE needs to justify using 2.0 and 2.5 times background as a reason to screen these constituents.	DOE will model the transport of these constituents to further evaluate their potential to impact ground water above background.
Specific Comment 6, Table 4c	For carbon-14 and lead-210, DOE listed the MCL and the PRG as an explanation for screening out this constituent. The soil concentrations are in pCi/g and the MCL and PRG are in concentrations for drinking water, with units of pCi/L. DOE needs to show a relationship between concentrations in soil and concentrations in groundwater.	To show the relationship between the concentration in soil and concentrations in ground water, DOE will model the transport of these constituents to further evaluate their potential to impact ground water above background.

REGIONAL WATER QUALITY CONTROL BOARD
Comments from Susan Timm dated October 30, 2001

Reference	Comment	Response
Specific Comment 6, Table 4d	DOE screened out chloroform based on its concentration being below the MCL for trihalomethanes of 100µg/L. as has been discussed many times, the MCL for trihalomethanes does not pertain to allowable levels of chloroform in groundwater. DOE needs to determine if chloroform will impact groundwater above the detection limit of 0.5µg/L. DOE should remove any reference to drinking water standards for chloroform.	DOE believes that the detection of chloroform in the overburden is anomalous since it is not a contaminant associated with the Southwest Trenches area. Reference to the primary MCL of the 100 µg/L in the explanation column of Table 4 has been removed.
Specific Comment 6, Table 4e	DOE screened out the other VOCs based on concentrations and susceptibility to biodegradation. Since VOCs are volatile, concentrations in grab samples are likely not representative of true concentrations. Since the stockpiles are sitting above ground, volatilization is likely ongoing; however, DOE needs to show that biodegradation is occurring and the concentrations in the soil are not a threat to human and ecological receptions of groundwater.	Based on site history, field screening, and characterization data of the Southwest Trenches excavated waste, VOCs were not considered to be COCs in the waste matrix. Therefore, it is unlikely that trace detections of several VOCs in the overburden material represents true contamination. Cross-contamination during sampling or at the analytical laboratory is the most likely cause for these trace detections. The source of toluene in soil samples was identified as tape that had been applied over the seam between the sample jar and lid. This practice has been discontinued.