REMEDIAL OVERSIGHT SUPPORT
ROCKY FLATS PLANT
GOLDEN, COLORADO

TECHNICAL REVIEW COMMENTS PRELIMINARY DRAFT PHASE II RFI/RI REPORT FOR OPERABLE UNIT 2

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 8, Federal Facilities Remedial Branch
Denver, Colorado

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1.0 INTRODUCTION

;equest of the U.S. Environmental Protection Agency (EPA), PRC Environmental gement, Inc. (PRC) has conducted a technical review of the preliminary draft Phase II Resource servation and Recovery Act (RCRA) facility investigation/ Comprehensive Environmental sponse, Compensation and Liability Act (CERCLA) remedial investigation (RFI/RI) for Operable nit 2 (OU2) at the U.S. Department of Energy (DOE) Rocky Flats Plant (RFP) in Golden, Colorado. OU2 consists of the 903 Pad Mound Area, and East Trenches areas. The preliminary draft report for OU2 was prepared by EG&G on behalf of DOE in December 1993.

PRC conducted a multiphase, multidisciplinary review of this RFI/RI report to aid EPA in its evaluation of the report. Pursuant to EPA request, PRC focused its review on issues that would alter its conclusions or require revisions to the report. The comments generated from this review are divided into general and specific comments. General comments pertain to the document as a whole or to multiple sections of the document. Specific comments are keyed to a particular page, paragraph, table, or figure. Where PRC found similar problems in several sections of the report, a general comment was written to avoid redundancy. However, PRC included specific examples within some of the general comments to further clarify the problem. These specific examples refer to an individual page, paragraph, table, or figure of the report. General and specific comments appear in Sections 2.0 and 3.0 of this review. A summary of PRC's review findings, based on the general and specific comments, appears in Section 4.0.

2.0 GENERAL COMMENTS

The following comments describe and evaluate each section of the RFI/RI report. Technical inadequacies and inconsistencies are noted in many of the general comments. PRC's general comments have also been subdivided into comments on the various appendices of the report.

Section 1.0, Introduction

1. This section contains all the information requested by EPA guidance (EPA 1988) in a clear and concise manner. However, it includes discussion relating to Sections 6.0 (Baseline Health Risk Assessment [BRA]), 7.0 (Environmental Evaluation), and 8.0 (Summary and Conclusions) of the report that were not submitted for review in this preliminary draft. Presumably, the draft document will contain these sections.

Section 2.0, Field Investigations

1. Technical Memorandum No. 8 (DOE 1993a) proposed specific installation and sampling criteria to meet the objectives of the bedrock drilling program. These objectives were to verify the assumption that contamination in the Lower Hydrostratigraphic Unit (LHSU) is limited and therefore the LHSU human health exposure pathway is incomplete. Data was obtained to (1) characterize contamination in the LHSU, (2) determine whether hydraulic communication exists between the Upper Hydrostratigraphic Unit (UHSU) and the LHSU, and (3) establish that the LHSU produces insufficient amounts of water to be considered a migration pathway. Some borehole and well installation procedures did not completely follow Technical Memorandum No. 8 criteria (See Appendix A General Comment 1 and Specific Comment 1). Therefore, conclusions drawn from the bedrock drilling program may not be completely valid.

2. One of the primary focuses of the bedrock investigation was to evaluate the interaction between the UHSU and the LHSU. The bedrock work plan was developed with very specific criteria to prove or disprove certain scenarios. One such scenario was that contamination detected in LHSU sandstone units which subcrop beneath the colluvium was very localized and did not extend a great distance from the subcrop area. Three bedrock wells (22093, 22193, and 22293) were installed to investigate the source of contamination in the subcrop wells and evaluate the permeability of the LHSU sandstones or siltstones. The geochemistry of the UHSU and LHSU groundwater was also compared using Stiff diagrams.

   Certain assumptions or conclusions stated in various sections of the RFI/RI report concerning the UHSU and LHSU interaction are contradictory. For example, Section 3.6.2.3 (Page 3-67, Paragraph 2) discusses the UHSU/LHSU system interaction. The text states that subcropping sandstones and siltstones are in direct communication with the UHSU in the immediate vicinity of the subcrop locations. The text also states that, away from the subcrops (wells 22093, 22193, and 22293), the sandstones and siltstones do not appear to be in communication with the UHSU. However, it is stated in Section 4.5.1 (Page 4-147, Paragraph 1) that geochemical results from well 22193, Stiff diagrams, indicate that the groundwater is the calcium-bicarbonate type typical of UHSU waters. It is not clear how the geochemical results of well 22193 can indicate the groundwater is typical of the UHSU when previous text states the groundwater in well 22193 is not in communication with the UHSU.

Additional contradictions were also noted. In one section of the report it states that well 22193 is screened in a LHSU interval that is not in hydraulic communication with the UHSU. Section 4.4.1.1 (Page 4-113, Paragraph 2) then states that the LHSU water-bearing zone is influenced by USHU groundwater. Discrepancies related to this UHSU and LHSU system interaction should be corrected.

3. Criteria for isolation casing installation, stratigraphic interpretation, and well screen interval placement were reviewed to evaluate the bedrock drilling program. It was necessary to review the text, three separate tables (Tables 2.2-3, 2.2-3, and A-3), and the borelogs (Appendix A4). Correct placement of isolation casing and well screen intervals are critical to the bedrock drilling program. A table which combines several of these criteria in a more usable format and presents the decision-making process for each borehole or well installed as part of the bedrock drilling program would be appropriate.

4. Previous LHSU investigations detected low levels of carbon tetrachloride and trichloroethene (TCE) in wells 3487 and 2887. No current data exist on the hydraulic gradient in these units, and it is possible these wells are crossgradient from the southeast trenches. It is also possible that these low levels of contaminants are migrating from the southeast trenches. No LHSU monitoring wells were placed east of this area during the 1993 bedrock drilling program. The data gap that exists in this area should be addressed.

5. Tables 1 and 2 attached to the end of this report graphically illustrate the similarities and differences noted between field activities proposed in Technical Memorandum No. 8 and actual field activities documented in the RFI/RI report. Table 1 illustrates the alluvial investigation and Table 2 illustrates the bedrock investigation. In general, field activities were completed as proposed in Technical Memorandum No. 8 and followed prescribed standard operating procedures (SOPs). Specific deviations from Technical Memorandum No. 8 were described in Section 2.2.5 of this RFI/RI report. Also, field activities observed by PRC were portrayed accurately in the RFI/RI report. In some instances, however, well installation procedures may not have completely followed Technical Memorandum No. 8 criteria. (See Appendix A General Comments 1 and 2).

3.0, Physical Characteristics of OU2

1. The first four parts of this section present basic background information that has been provided in earlier documents. These sections are adequate as presented. Subsections 3.5 and 3.6 present background geology and hydrology information and interpretation. The discussion contains results from all OU2 investigations. The interpretation of the hydrogeologic setting is consistent and appears to be supported by the information gathered during the remedial investigations. However, one important subsection (3.6.3) has not been included in this RFI/RI report. This section is referenced as discussing the potential for hydrologic communication between the No. 1 Sandstone (No. 1 Sand) and subcroping Laramie sandstones. This section should be added to the draft RFI/RI report.

4.0, Nature and Extent of Contamination

1. The quality assurance/quality control (QA/QC) section (4.1.3) is incomplete. A comprehensive QA/QC evaluation consists of QC sampling and analysis activities, a summary of data validation results (for example holding times, initial and continuing calibration results), an assessment of precision, accuracy, representativeness, completeness, and comparability (the PARCC parameters), and a conclusion of whether the data quality objectives (DQOs) were met. Section 4.1.3 only refers the reader to Appendix J for an assessment of PARCC parameters and does not review any QA/QC parameters. Without reviewing any QA/QC parameters, the data quality cannot be determined. A comprehensive summary of QA/QC, including QC sampling and analysis activities, data validation results, DQOs, and PARCC parameters, should be included in the Section 4.1.3, or Section 4.1.3 should be eliminated and Appendix J should provide a comprehensive QA/QC presentation.

2. The current nature and extent of contamination discussion in Section 4.0 is incomplete. Detected organic compounds are treated differently for the three media-evaluated; surface soil, subsurface soil, and groundwater. In surface soil, all detected organic compounds are discussed and the concentrations illustrated on figures. For subsurface soil, only the potential waste-related volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) are illustrated on figures although the text described all organic compounds detected. In addition, only selected VOCs are illustrated on cross-section maps. For groundwater, isoconcentration maps for VOC chemicals of concern (COCs) were prepared. Detection maps are subdivided into VOC COCs, non-COC VOCs, and SVOCs.

For inorganic compounds (metals and radionuclides) in all media, only the compounds detected above the background 95 percent upper tolerance limit (UTL) concentration were included in summary tables and discussed in the report. In addition, only chemicals of interest (COIs) were included on maps illustrating the spatial distribution of contamination.

As described above, this nature and extent of contamination section does not illustrate all contaminants at OU2. Instead, different screening criteria (waste-related, VOC COC, and COI) were used so that only a portion of the compounds detected in OU2 media is illustrated. This section should be rewritten to describe and illustrate all organic chemicals detected and all inorganics above an approved background concentration.

3. The nature and extent of contamination discussion repeatedly makes statements that a detected chemical is not a waste-related contaminant at OU2. These unsubstantiated statements are inappropriate in a nature and extent of contamination discussion and should be removed. However, these statements are probably made because the COCs for OU2 are defined as "site-related organic chemicals, metals, or radionuclides that are (i.e., potentially related to releases of wastes or waste sources at OU2 that exceed background range and could be a significant threat to human health and the environment under the exposure conditions evaluated" [DOE 1993b]). By eliminating non-waste-related contaminants, DOE believes that the BRA can be focused on actual site contaminants that could threaten public health or the environment rather than naturally occurring elements or trace contaminants that may be detected infrequently at elevated concentrations but are not characteristic of site contamination (DOE 1993b).

Lastly, the criteria used to determine whether a chemical is a non-waste-related contaminant are not specified. The most common elimination criteria appear to be low frequency of detection and concentrations only slightly above background. However, the criteria have been applied inconsistently. In subsurface soil, radionuclide frequencies of detections as high as 48 percent and metal concentrations as high as twice background have been listed as non-waste related. Similar variances were noted in discussions of surface soil and groundwater contaminants.

4. The nature and extent of contamination discussion used the term COI. COI's are defined as "inorganic compounds that could not be eliminated from further consideration based on statistical comparison." An eight-step process for COI determination is described on pages 4-

24 and 4-25. This process determines whether inorganics exceeded background. The text then refers to Technical Memorandum No. 9 (DOE 1993b) for the complete results of the statistical comparison.

PRC attempted to compare the COI lists in the RFI/RI report with the Technical Memorandum No. 9 discussion. However, it should be noted that Technical Memorandum No. 9 never uses the term COI. Instead, the technical memorandum outlines the COC selection process, which includes a three-phase background comparison analysis. The first two phases, listed as a and b, appear to correlate to the eight-step COI determination process listed in the RFI/RI report. Tables in the technical memorandum illustrate whether chemicals were retained for further consideration after each phase of the background comparison.

The following table illustrates the differences between Technical Memorandum No. 9 and the COI list in the RFI/RI report. PRC assumed that chemicals retained for further consideration after completion of phase a and b of the background comparison, were equivalent to COIs identified in the RFI/RI report.

	Technical Memorandum No. 9	RFI/RI Report
Surface Soil Metal	cadmium selenium thallium tin	chromium lithium lead selenium
Subsurface Soil Radionuclides	americium-241 cesium-137 plutonium-239, 240 radium-228 tritium uranium isotopes	americium-241 cesium-137 plutonium-239, 240 tritium uranium isotopes
Groundwater- No. 1 Sandstone Metals	cyanide aluminum arsenic barium lead manganese strontium	cyanide aluminum arsenic barium lead manganese strontium mercury
Radionuclides	americium-241 plutonium-239, 240	americium-241 plutonium-239, 140 cesium-137

The differences between the technical memorandum and the RFI/RI report should be resolved. In addition, the technical memorandum should be rewritten to incorporate the term COI if the revised nature and extent discussion will still only illustrate inorganic COIs. Tables should also be reformatted to clearly demonstrate at which step a COI is determined. These modifications will allow for better comparison of the OU2 documents.

5. Section 4.0 of the RFI/RI report refers several times to Technical Memorandum No. 9, which described the COC selection process. PRC submitted its technical review comments on this document on January 18, 1994. The following items briefly describe some of problems noted in the technical memorandum.

- Eliminating chemicals from the COC list based on professional judgment
- Eliminating chemicals from the COC list based on the UTL comparison
- Eliminating non-source-related chemicals from the COC list
- Utilizing only the data collected from wells completed in the No. 1 Sand to select COCs for the on-site residential groundwater ingestion scenario

Resolution of these issues will impact the revisions of this RFI/RI report. It is recommended that revision to both the RFI/RI report and the technical memorandum should be coordinated so that the documents are consistent.

6. The text is not consistent in its discussion of COIs. Page 4-25 defines a COI as an analyte that could not be eliminated from further consideration based on the statistical comparison. On page 4-48, reference is made to special-case COIs for radionuclides in subsurface soils. The definition of special-case COIs should be added to Section 4.1.4.

7. The discussion of the nature and extent of contamination in Section 4.0 fails to adequately characterize the nature and extent of groundwater contamination at OU2 because it limits the characterization to data collected from the second quarter of 1991 to the present. The reason for providing such a restricted "data window" is that the second quarter 1991 was the first quarterly sampling event for which SOPs and validation criteria were in place. However, this data window also excludes all of the highest detections of TCE and tetrachloroethene (PCE) in the groundwater at OU2. Fox example between 1987 and 1989, PCE was detected at concentrations that were consistently in the range of 30 to 50 milligrams per liter (mg/L)

(with a maximum of 528 mg/L in well 0174). Well 0174 is screened in weathered claystone adjacent to the source in the Mound Area. During the same period, TCE was detected at concentrations of 100 and 220 mg/L in well 3687, which is screened in weathered sandstone below the East Trenches area. Even if the majority of these data are unqualified, they should be discussed in some context because of the implications these contaminant levels have on the presence and movement of contaminants as dense nonaqueous phase liquids (DNAPLs).

8. The tables and figures in Section 4.3, Subsurface Soils, were compared for consistency. For the Mound Area and Northeast Trenches, two SVOCs listed in the tables were not illustrated on the accompanying figure. These compounds are diethylphthalate and cis-1,3-dichloropropene. The distribution of these chemicals should be illustrated on the appropriate figure.

9. No data tables summarizing detections of field parameters, indicators and anions in subsurface soil samples were provided. For completeness, data summary tables illustrating the trends of these analytical parameters should also be included in the RFI/RI report.

10. The discussion in Section 4.3.3.7 of subsurface soil contamination in non-source areas of the Northeast Trenches is difficult to follow. Many of the non-source-area boreholes are located just outside a known source area, such as one of the individual trenches. To better understand whether the actual boundaries of the trenches are known, it may be more important to evaluate non-source-area results with each individual trench. This is especially important because one of the conclusions drawn from the non-source data is that VOC contamination in subsurface soils is probably associated with the groundwater contaminant plume. Comparing non-source- and source-area results may modify this conclusion.

11. The discussion of polynuclear aromatic hydrocarbon (PAH) detections in subsurface soil is inconsistent. Page 4-58 states that the presence of PAHs is most likely due to fuel combustion from vehicles, drum leakage, or the asphalt pad itself. PAH detections are considered waste-related on page 4-77. Lastly, page 4-91 attributes the PAH detections to field or laboratory detections. Although these detections are in different areas of OU2, it may be inappropriate to rationalize the subsurface soil detections of PAHs differently. These statements should be revised.

12. Section 4.0 text, figures, tables, and Appendix C (analytical results) were spot-checked to evaluate internal consistency. With minor exceptions, the data were found to be internally consistent.

13. The supporting data necessary to verify the conclusions drawn in the air quality investigation section were not provided. Therefore, general comments concerning the overall air quality at OU2 could not be corroborated.

5.0, Contaminant Fate and Transport

1. Subsections 5.1, 5.2, and 5.3 present a qualitative discussion of the physical and chemical factors that determine contaminant mobility at OU2. In addition, conceptual models presenting contaminant migration pathways are present for each subarea of OU2. These subsections provide the information requested in EPA guidance (EPA 1988). However, only information on the COCs determined in Section 4.0 of the RFI/RI report is discussed. Therefore, this section may have to be rewritten to some extent to include other chemicals if the COC list is changed.

2. The MODFLOW numerical groundwater flow model was applied to the UHSU saturated groundwater system at OU2 in support of the OU2 human health risk assessment. The text states "The groundwater modeling approach was limited by design to support the data needs of the OU-wide surface water model and the needs of the OU-wide human health risk assessment." Therefore, the complex hydrogeological situation at OU2 was simplified by combining the Rocky Flats Alluvium (RFA) and No. 1 Sand into a single composite groundwater flow system. This simplified model is not satisfactory for other types of data needs that may arise in the future, such as a model study to determine the impacts of remedial alternatives. This type of modeling objective would require a two- or three-layer model that distinguishes bedrock and alluvial hydrogeologic characteristics and a more detailed understanding of the spatial distribution of key parameters such as hydraulic conductivity. The model design that will be used to evaluate remedial alternatives should be carefully reviewed.

Appendix A, Geological Data

1. Appendix A4: Appendix A4 presents borehole lithology and monitoring well construction logs. In general, presentation of borehole lithology and well construction diagrams is adequate. However, for wells drilled as part of the bedrock drilling program, stratigraphic interpretation of the distinction between the UHSU and the LHSU is necessary. The borelogs should contain the UHSU/LHSU conceptual boundary, the stratigraphic data presented in Table A-3 (No. 1 Sand and Laramie sandstone/siltstone boundary), and isolation casing depth. This will show the correlation between observed lithology, interpretation of lithology, isolation casing depth, and LHSU well screen interval placement. An additional column next to the graphic presentation of borehole lithology illustrating the information described above would be appropriate.

2. Appendix A4: Borelogs for wells 22093, 22393, 22593, and 23293 show no recovery for critical intervals such as isolation casing installation depths and LHSU intervals directly beneath the isolation casing. On page 2-32, the text states that information from pilot boreholes in each well cluster was used to *guide isolation casing and well screen installation for monitoring wells.* Section 3.5.2 of the RFI/RI report (page 3-29) states that LHSU sandstone/siltstone intervals appear to be discontinuous in nature, and correlations from borehole to borehole are tenuous. Section 3.6.2.3 discusses the discontinuous nature of the Laramie sandstone/siltstone units and states that on cross sections and during drilling activities, the lithology of the LHSU can change substantially over a horizontal distance of 20 to 30 feet. Although using pilot boreholes for well installation guidance was the only option available in the field when no core was recovered at specific intervals, the text should note that the potential for inappropriate installation of isolation casing or well screen intervals may have occurred.

Appendix E, Groundwater Modeling

1. A typical problem with MODFLOW simulations is that they are applied to sites that do not have enough data to support a finite difference model. At OU2, however, an intensive data collection and reduction effort is diluted by an oversimplified application of the model. This model study has taken a hydrogeologic system composed of interconnected, yet distinct, layers and attempted to combine their physical properties into one "composite" layer. The

one-layer MODFLOW groundwater flow model used in this study does not allow any differentiation between groundwater flow and contaminant transport in the RFA and the No. 1 Sand even though the hydraulic conductivities, flow directions, and seep locations are different in the two formations.

Model dervied isoconcentration maps and the mass loadings of contaminants into the creeks are highly suspect given the degree to which the physical and hydrogeologic framework of the UHSU at OU2 has been compromised in order to create this composite, one-layer model. Therefore, the results of the OU2 MODFLOW simulation should only be used in a qualitative rather than quantitative sense.

2. The text on page E3-1 states that the simplified conceptual model, which combines the RFA and the No. 1 Sand into one model layer, should be representative of the equivalent effects from flow and transport through the units separately. However, the OU2 groundwater flow model is not representative based on the discussion in Section E3 of the composite water table and the composite aquifer bottom. These discussions are summarized separately below.

Composite Water Table

The text on page E3-3 outlines the following steps taken to create a composite water table map of the two geologic units of interest:

- Where saturated alluvium exists, the composite water table contours were constructed to approximate the observed alluvial contours in terms of the flow direction, magnitude of hydraulic gradient, and the elevation of the water table.
- In areas outside of saturated alluvium, the composite contours were constructed to be consistent with the general direction of the groundwater flow in the sandstone, but are 5 to 10 feet higher than the sandstone water levels to be consistent with the contours within the saturated alluvium.
- The composite water table contours diverge from the inferred sandstone water table contours near the seep boundaries south of Ponds B-1 through B-4. No alluvial seeps occur in this area because the alluvium is not saturated in this area. Inferred groundwater contours in the No. 1 Sand are oriented so the groundwater flow in the sandstone is primarily northward, toward the bedrock seeps. Because the composite water table map represents a composite flow system of both the alluvium and sandstone, it was necessary to artificially orient the composite water table contour gradient in a more easterly direction

so as not to overestimate the quantity of flow leaving the groundwater system in this area.

Therefore, the area adjacent to the northern seep boundaries is modeled using an assumed alluvial water table elevation and flow direction, even though the alluvium is unsaturated in this area and all flow and seepage comes from the bedrock sandstone. As a result, the model's water table elevation and flow direction are not representative of site conditions. Apparently the third step was necessary because the second step raised the water table to an artificially high level. The second step would not have been necessary if the RFA and No. 1 Sand had been treated as separate layers.

Composite Aquifer Bottom

The text on page E3-4 indicates that the general method used to create the composite aquifer bottom consisted of the following steps:

- The 1992 alluvial saturated thickness (where alluvium is saturated) and the thickness of bedrock from the top of bedrock elevation to the bottom elevation of the No. 1 Sand (where the sandstone is present) will be summed to get the aquifer thickness.
- The thickness of any intervening claystone is then subtracted from the aquifer thickness to get the net aquifer thickness.
- The net aquifer thickness is subtracted from the composite water table to get the composite aquifer bottom.

As a result any areas which have a considerable thickness of claystone separating the RFA from the No. 1 Sand will have a relatively shallow aquifer bottom, regardless of the actual depth of the No. 1 Sand at that location. This effect will deform the lower model boundary in the area just north of the northeast trenches, where Figure E.5-22 shows that 10 to 15 feet of claystone separate the No. 1 Sand from the RFA. Well 3687 has about 13.5 feet of claystone between the RFA and No. 1 Sand and another 8 to 10 feet of claystone and siltstone interbedded with the No. 1 Sand, according to the borelog for well 3687. The base of the No. 1 Sand is at 63 feet below land surface (BLS). If the process described above is used to calculate the aquifer bottom at this point, the aquifer bottom will be 20 feet higher than it actually is and probably high relative to other points nearby. This should affect flow properties, causing flow to diverge around this area. The result will be a distorted model in the vicinity of a potential DNAPL source area.

For the reasons specified above, this simplified model is not representative of the equivalent effects from flow and transport through the RFA and No. 1 Sand separately. Therefore, use of this model at OU2 may be inappropriate.

3. Section E6: This section, which describes the colluvium fate and transport model, should have a figure depicting the locations and length of the contaminant transport flow lines.

Appendix F, Surface Water Modeling

Appendix F was not included in this version of the RFI/RI report.

Appendix G, Air Modeling

Appendix G, was not included in this version of the RFI/RI report.

Appendix H, Baseline Health Risk Assessment

Appendix H was not included in this version of the RFI/RI report.

Appendix I, Environmental Evaluation

Appendix I was not included in this version of the RFI/RI report.

Appendix J, Quality Assurance

1. Appendix J concludes: "Based on the review of the data presented in this appendix, the data obtained during Phase II field investigations met the DQOs of the workplans and are appropriate for use in evaluating contamination at OU-2." Appendix J does not provide enough data to independently determine if DQOs were met. The use and validation of samples and duplicate samples with varying relative percent differences (RPDs) is not discussed; therefore, it is unclear if precision DQOs were met. No matrix spike/matrix spike

duplicate (MS/MSD) results used in determining accuracy were provided. Completeness cannot be assessed because the percentage of valid or acceptable data was not provided. Therefore, meeting DQOs cannot be assessed. Precision, accuracy, and completeness data should be summarized according to the specifications in Appendix J, Specific Comments 1, 2, and 3.

2. This appendix does not include a complete data set for rinsates and trip blanks. For example, no data for trip blanks accompanying groundwater or MS/MSD duplicate sample results were included. A complete data set should be provided.

3.0 SPECIFIC COMMENTS

Section 1.0, Introduction

1. Page 1-17, Third Paragraph: This paragraph begins a discussion of the individual hazardous substance sites (IHSSs) in the East Trenches area. For consistency with the previous sections, this discussion should be divided into the Northeast Trenches area and the Southeast Trenches area as shown on Figure 1.3-3.

2. Page 1-44, Third Paragraph: This paragraph discusses the focus of the bedrock field investigation. The text states that results from the LHSU evaluation are presented in Sections 3.5.2, 3.6.3, and 4.7 of the RFI/RI report. Section 3.6.3 does not exist and Section 4.7 discusses the nature and extent of contamination via the air exposure pathway. These discrepancies should be corrected.

Section 2.0, Field Investigations

1. Page 2-2, Fourth Paragraph and Page 2-17, Second Paragraph: These paragraphs discuss field operations that were conducted during the investigation. It states that changes to SOPs were presented in document change notices (DCNs). However, no table or text is included to describe these changes. This section should contain a summary of the DCNs used for the project. In addition, the DCNs should be added in a report appendix for completeness.

2. Page 2-3, First Paragraph: This paragraph discusses the drilling program for the subsurface soil investigation and refers to Tables 2.1-4 and 2.1-5. Both tables are not, but should be included in the report.

3. Page 2-6, First Paragraph: This paragraph discusses compositing methods for soil borings. Compositing soil samples for VOC analysis using the method described may result in a systematic lowering of composite VOC concentrations due to release of VOCs during compositing. The effects of this potential problem should be evaluated in this section of the report.

4. Table 2.2-2: This table presents the Revised Bedrock Work Plan Objectives and Completed Work. Well No. 23293 is shown as Well No. 23292 in this table. This should be corrected so all text, tables, and figures are consistent.

5. Page 2-24, Third Paragraph: The text states that in general, the base of the UHSU was identified by the presence of unweathered claystone. Isolation of the UHSU from the LHSU, and therefore proper placement of the isolation casing, is critical to the bedrock drilling program. A more detailed explanation of the criteria used to determine the USHU/LHSU boundary should be presented here. Also, the on-site field geologist stated that the distinction between the UHSU and the LHSU was obvious. He stated that the boundary was distinguished by color, silt content, and amount of oxidation (PRC 1993). This information should be included in the text.

4. Page 2-49, Second Paragraph: The text states the Smart Ditch Creek drainages were used as a reference area for ecological parameters, although not for tissue comparisons. It was probably contaminated by RFP operations and therefore inappropriate for use as a reference area. The rationale behind the qualified use of the area for ecological comparisons should be provided.

Section 3.0, Physical Characteristics of OU2

1. Page 3-57, Second Paragraph: A referenced section (Section 3.6.3), which apparently contains a discussion that is important to the nature and extent of contamination below a heavily contaminated part of the East Trenches area, is missing from the document. The text states that Laramie sandstones may subcrop directly below the No. 1 Sand in limited areas beneath the central part of OU2 and that in these areas the Laramie sandstones may be considered part of the UHSU. The text also states that "this condition is expected to be localized in the direct contact areas because of the low permeability and discontinuous nature of the Laramie sandstone units beneath the No. 1 Sandstone makes substantial and widespread hydraulic communication unlikely." The text states that this situation is discussed further in Section 3.6.3. This information should be supplied, because the No. 1 Sand is heavily contaminated with TCE (possibly as a DNAPL) in the potential subcrop area.

Section 4.0, Nature and Extent of Contamination

1. Page 4-15, Sixth Paragraph: The last sentence in this paragraph states common laboratory contaminants (CLCs) "are found in consistently low concentrations regardless of sampling location, it is probable that they are not related to waste sources in OU-2 but rather to laboratory or field contamination and can be eliminated from further consideration as COCs." This methodology was used to label acetone a: ! toluene as CLCs and eliminated from consideration as COCs. However, detections of acetone and toluene were not always "found in consistently low concentrations" and should not automatically be considered laboratory or field contamination. Acetone was detected at 26,000 micrograms per liter (μg/L) in one subsurface soil sample and was not qualified to indicate acetone in an associated blank. Toluene was detected in a subsurface soil sample at 3,100 μg/L and was not qualified to indicate any toluene in an associated blank. Toluene is not a CLC.

If a sample result is less than 10 times (for CLCs) or 5 times (for non-CLCs) the detection in the associated blank, then the sample result is qualified with a U (nondetect). All detections of acetone and toluene should be reviewed, because the 10 times and 5 times rule for acetone and toluene were not strictly followed. Detections not determined to be field or laboratory contamination by the 10 and 5 times rules should be considered real contamination.

2. Page 4-21, First through Fourth Paragraphs: Only one of the PARCC parameters, comparability, is discussed in these paragraphs. The comparability of data does not need to be repeated because all the PARCC parameters are presented in Appendix J. The comparability of data should be removed from page 4-21.

3. Page 4-23, Second and Third Paragraphs: These paragraphs state that the OU2 groundwater results and background results for the UHSU were classified by lithologic unit in which the well screen was set. More specifically, only the results from wells screened in the No. 1 Sand were used in the BRA for hypothetical on-site groundwater ingestion. The No. 1 Sand was chosen because it is described as the only UHSU lithologic unit that has sufficient yield to support a well. These statements contradict earlier statements in the RFI/RI report. Page 3-42 states that the majority of flow in the UHSU occurs in the saturated RFA and No. 1 Sand, and that these two units appear to be in hydraulic communication throughout much of the OU2 area. It is unclear why the report states only the results from wells screened in the No. 1 Sand will be used in the exposure scenario since the RFA and No. 1 Sand will in hydraulic communication. This methodology should be reconsidered.

4. Page 4-24, First Paragraph: Step 3 states "if there were more than 50% nondetections in the grouped background and OU-2 data, the Kruskal-Wallis test or the Wilcoxon Rank Sum test is an appropriate analysis." Both of these tests can handle a moderate number of nondetects (Gilbert 1987). More than 50 percent nondetections may not be considered a moderate number of nondetects. Step 3 should be evaluated to determine if the Wilcoxon Rank Sum test and the Kruskal-Wallis test are appropriate for data sets with more than 50 percent nondetects.

5. Page 4-24, Second Paragraph: Step 4 refers to the Wilcoxon Rank Sum test as parametric. The Wilcoxon Rank Sum test is nonparametric (Gilbert 1987). A clarification should be made or an actual parametric test should be selected.

6. Page 4-24, Third Paragraph: In step 5, the data are evaluated for normality. Neither the Wilcoxon Rank Sum test nor the Kruskal-Wallis test requires the data sets to be from normal distributions, but both require the distributions to be from populations of equal variance (Gilbert 1987). The evaluation for normality should be reviewed, and if the test for normality is inappropriate it should be eliminated. The test for equal variance is addressed in step 6.

7. Page 4-48, Third Paragraph: This paragraph states that selected VOCs and radionuclides are illustrated on source borehole cross sections. VOCs were selected based on persistence in subsurface soil. No selection criteria for radionuclides were described. However, paragraph 3 on page 4-49 states that two radionuclides were selected because of high reported activities. In addition, this paragraph states that borehole cross sections for radionuclide sources were only constructed for the 903 Pad. Additional information should be added to the paragraphs to explain how a chemical was determined to be persistent and why only the radionuclide concentrations of the 903 Pad source boreholes are illustrated.

8. Page 4-52, Second Paragraph: This paragraph discusses three phthalates as suspected laboratory contaminants. However, Technical Memorandum No. 9 retained two of the phthalates, bis(2-ethylhexyl)phthalate (BEHP) and di-n-butylphthallate (DNBP), as possible OU2 subsurface soil contaminants. In addition, the third phthalate discussed in this paragraph, di-n-octylphthalate, is not mentioned as a possible laboratory contaminant in Technical Memorandum No. 9. Therefore, it appears that the general statement that phthalates are suspected laboratory contaminants is inaccurate. The text of the RFI/RI report should be revised to discuss phthalates as contaminants.

9. Page 4-55, Last Paragraph: This discussion of SVOCs in subsurface soil at IHSS 112 does not include N-nitrosodiphenylamine. This SVOC is illustrated on Figure 4.3-4 and should be in the discussion on page 4-55.

10. Page 4-57, Third Paragraph: In this paragraph tritium and uranium (U) U-238 are considered to be detected at low activities based on being detected at less than 2 times background UTL. The 2 times UTL criteria is not established in the background comparison process. An explanation of the significance and reasoning behind using 2 times the UTL criteria should be provided.

11. Page 4-59, First Paragraph: This paragraph summarizes VOC contamination in subsurface soil at IHSS 140. It states that the source of VOC contamination in BH2887 and 09691 appears to be seepage from the 903 Pad groundwater plume. This statement is not supported by data or figures. In addition, this paragraph does not discuss a source of the VOCs detected in boreholes 09791 and 07691. A complete discussion of VOC contamination should be added to this paragraph.

12. Page 4-60, Fourth Paragraph and Page 4-61, First Paragraph: These paragraphs present contradictory statements regarding Cesium (Cs) Cs-137 in subsurface soil. Page 4-60 states Cs-137 is not waste related, whereas Page 4-61 states Cs-137 is waste related.

13. Page 4-62, First Paragraph: This paragraph concludes that VOC contamination in subsurface soils at IHSS 155 is secondary and is only present in the groundwater. The rationale for this statement is that VOCs were found in locations downgradient from two primary sources at IHSS 112. The location of IHSS 155 boreholes and IHSS 112 boreholes and their respective VOC concentrations with depth should be illustrated to support this conclusion.

14. Page 4-65, Third Paragraph: This paragraph summarizes VOC detections in subsurface soil in the 903 Pad non-source areas. It states that the low concentrations of VOCs found above the initial water at time of drilling (ATD) indicate the VOCs volatilized from the contaminated groundwater and were adsorbed by clay materials. To substantiate this statement, comparison of VOC concentrations in source areas, both in subsurface soil and groundwater, should also be presented.

15. Page 4-72, Third Paragraph: This paragraph discusses radionuclides in subsurface soil at IHSS 153. Although Cs-137 was detected above background UTLs in all seven samples analyzed, the paragraph concludes that this activity is similar to the Cs-137 activity found throughout the OU2 area and is not a concern. It is not clear how radionuclide concentrations above background are not a concern.

16. Page 4-74, Fifth Paragraph: This paragraph summarizes results of the subsurface soil investigation at IHSS 154. It states that no VOC, SVOC, pesticide/polychlorinated biphenyl (PCB), or metals contamination is present. However, 1,2-dichloroethane (1,2-DCA) was detected in shallow depths. The summary should be modified to correctly reflect the results.

17. Page 4-78, Last Paragraph: This paragraph describes the 10 SVOCs detected in subsurface soil at IHSS 110. However, the introductory sentences only describe six of the SVOCs. The other four SVOCs should be listed.

Figures and Tables

18. Table 4.3-3 and Figure 4.3-2: Table 4.3-3 lists analytes detected above the background UTL in subsurface soil at the 903 Pad. Figure 4.3-2 illustrates VOCs detected in subsurface soil at the 903 Pad. The VOCs listed in the table and illustrated on the figure are not consistent. Specifically, more VOCs are illustrated on the figure than listed in the table. These VOCs are 1,2-DCE, cis-1,3-dichloropropene, carbon tetrachloride, and trans-1,2-dichloroethene. It is not clear why these 4 analytes not listed as detected are illustrated for the 903 Pad. The data presented in tables, text, and figures should be consistent.

Appendix A, OU2 Geological Data

1. Table A-3: Table A-3 presents stratigraphic data and shows that for well 22193 (WC-3a), the base of the No. 1 Sand interval is interpreted to be at 46.8 feet. A comparison with Table 2.2-3 shows the isolation casing was installed at 44 feet. If the depth shown on Table A-3 is correct, the isolation casing was not installed at the base of the UHSU and Technical Memorandum No. 8 criteria was not followed. An additional evaluation of the borehole lithology for well 22193 (Appendix A4) was completed. The data in Appendix A4 indicates that the isolation casing was set at the appropriate depth. Therefore, the stratigraphic interpretation of the base of the No. 1 Sand on Table A-3 may be incorrect. This discrepancy should be corrected.

Appendix E, Groundwater Modeling

1. Page E3-6, Third Paragraph: The text states that the flow boundaries of the model occur where alluvial and sandstone seeps are known or inferred to occur along the hillsides of the Walnut and Woman Creek drainages. The model boundaries depicted on Figure E4-1, however, do not coincide with the seeps depicted in Plate 3.6-1 (OU2 Seep Locations). The northern model boundary appears to be located 100 to 200 feet south of the bedrock seeps that are located above Ponds B-1, B-2 and B-4. This should increase the length of the simulated flow path, and therefore the travel time, of the contaminants through the colluvium.

2. Page E4-4, Second Paragraph: This paragraph lists five assumptions governing the spatial distribution of recharge in the model. Assumption 2 states, "the alluvium within the medial paleoscour receives more recharge due to the effect of the underground groundwater

collection basin." The "underground groundwater collection basin" apparently refers to the paleoscour in the bedrock surface. Bedrock topography below the water table should not affect recharge in any way. The recharge parameter should be controlled by (1) the strength and duration of precipitation events, (2) surface conditions (permeability and contour of the surface), (3) evapotranspiration potential, and (4) permeability of geologic materials in the unsaturated zone. It may not be practicable or necessary to represent all of these variables in the recharge array. However, the recharge parameter should not increased for the area above the medial paleoscour on the basis of bedrock topography.

3. Pages E4-5 through E4-7: The text in this section specifies initial parameter values for hydraulic conductivity. Figures E4-4 and E4-5 show the final parameter value arrays for hydraulic conductivity after calibrating the model to the high and low recharge scenarios. The text also indicates that the only prior information considered was the results of three pumping tests conducted in 1992, and that single value was used as the initial value for the entire array. The final parameter value arrays (after calibration) contain values that exceed both the upper and lower boundaries of the range of values (0.34 feet per day [ft/day] to 8.77 ft/day) derived from the aquifer tests (EG&G 1992). Values of hydraulic conductivity that exceed the upper boundary of this range, are clustered in blocks of cells at the southwest and northeast corners of the model at one place along the northern boundary of the model. The locations of these high hydraulic conductivity cells do not appear to be based on the distribution of alluvial soil types depicted in the alluvial lithofacies cross sections (Figures 3.5-13 through 3.5-16) included with the main body of the report, or the lateral extent of the No. 1 Sand, as depicted in Figure 3.5-21. Therefore, the hydraulic conductivity array appears to be an artificial byproduct of the calibration process and not necessarily representative of site conditions.

The hydraulic conductivity parameter should represent the spatial distribution of hydraulic conductivity only. It should not be treated as a lumped parameter or manipulated to mimic a hypothetical water table. Prior information on the magnitude and spatial distribution of hydraulic conductivity should not be limited to the results of three pump tests, particularly in a complex setting. Other information, such as previous pump or slug test results or lithologic data, should be considered to build a stronger understanding of the spatial distribution of hydraulic conductivity. An explanation or analysis should be provided for areas where calibrated parameters exceed calibration constraints.

4. Pages E5-2 through E5-4: This section discusses the specification of contaminant sources in the MT3D groundwater fate and transport model. The text states that concentration values for source cells were specified based on average historical observed concentrations for vicinity wells or estimated from the May 1992 plume maps. This does not appear to be entirely true because much higher concentrations of VOC COCs have been reported in previous reports (DOE 1990; DOE 1991) than are listed in Table E5-1. The text also states that source cell locations are based on the locations of the maximum concentrations of COCs in current groundwater plumes. These assumptions are inappropriate for modeling source areas because they lead to incorrect identification of sources and underestimation of source concentrations. Source cells should be located in known source areas and be given source concentrations equal to the highest concentrations that have been detected at the source areas.

Data from an earlier phase of the OU2 RFI/RI (DOE 1990) shows that PCE was detected in former monitoring well 0174 at a level of 528 mg/L, which is over 3 times the solubility of PCE (150 mg/L). This one-time peak detection probably resulted from the capture of free-phase PCE in the well. From 1987 to 1989, the average PCE concentration from this well was 80 mg/L; most detections were in the 30 mg/L and 50 mg/L range. These levels are an almost certain indication that PCE exists in the form of DNAPL in the vicinity. Therefore, the source concentration for the dissolved PCE plume should be equal to the solubility of PCE.

It should also be noted that a PCE source cell is located east of the Mound Area (near well 02091) in the model. However, the PCE detected in well 02091 probably represents the dissolved PCE plume emanating from the Mound Area (the screen in well 02091 is the closest in elevation to that of the now abandoned well 0174). Instead of being used as a source concentration, the 13,000 μg/L detected at well 02091 in second quarter 1992 should be used as a calibration point.

Similarly, the source strength for TCE should be increased for plume 3, near well 3687 in the northeast trench area. Table E5-1 shows a value of 60,000 μg/L as the TCE source strength. An earlier report (DOE 1990) shows that from November 1987 to May 1988, TCE levels increased from 118,000 μg/L to 222,000 μg/L before decreasing to levels below 100,000 μg/L. These levels are at least 10 percent of the reported solubility of TCE (1,100 mg/L), which indicates the presence of DNAPL nearby. Therefore, the source strength should probably equal the solubility of TCE, at least for a portion of the saturated thickness.

These analytical results indicate that DNAPL sources for VOC COCs almost certainly exist at the Mound Area and East Trenches areas. The source terms for VOC COCs in these areas should reflect this.

Appendix J, Quality Assurance

1. Page iii, Fourth Paragraph: This paragraph discusses analytical precision, but does not discuss how the data were used or qualified when precision was unacceptable to DQOs. Precision is determined by the RPD for a sample result and a duplicate sample result. For this RFI/RI, less than 40 percent for nonaqueous and less than 30 percent for aqueous samples are acceptable RPDs. A qualitative summary of RPD results for the different chemical analyses begins on Appendix J page vii, but does not address the use or qualification of data outside DQOs. A review of RPD results, where neither real sample nor duplicate sample is qualified with a "U" or a "B," and not considering CLCs, showed four of seven borehole VOC (carbon tetrachloride and toluene) subsurface soil samples' RPDs were greater than the acceptable RPD of 40 percent. The text should explain how sample results were used or qualified when the associated RPD did not agree with DQOs.

2. Page iv, Second Paragraph: This paragraph states "accuracy assessments are addressed during data validation." No data validation summary was provided in the document. Therefore, the accuracy of the analytical data cannot be determined. A summary of the data validation and an assessment of analytical accuracy should be included.

3. Appendix J, Page iv, Paragraph 4 through Page v, Paragraph 2: This paragraph states that 90 percent data completeness was used as a QA/QC objective. However, no data summary was provided to determine if this objective was met. The number of samples planned and the number of samples actually collected and considered valid should be included in Appendix J.

4.0 SUMMARY AND CONCLUSIONS

The preceding sections have detailed the technical inadequacies and inconsistencies in this preliminary draft RFI/RI report. The field investigations (Section 2.0) were explained and deviations from the work plan noted. Some statements regarding the interaction of the UHSU and LHSU were inconsistent and these need to be revised. The discussion of physical characteristics (Section 3.0) was accurate and represented information presented in earlier reports. Section 4.0, nature and extent of contamination contained numerous technical inconsistences and inadequacies. Section 5.0, fate and transport, presented a clear summary of the fate and transport of currently identified COCs. If the COC list is modified, Section 5.0 should also be revised.

The main problem with the nature and extent of contamination discussion in Section 4.0 is that it does not present a clear picture of the contaminants detected in all media investigated at OU2. Instead, different screening mechanisms were used to decide which analytes to depict on figures. Only waste-related VOCs were illustrated for subsurface soil, and groundwater isoconcentration maps only illustrated VOC COCs. For inorganic compounds in all media, only the COIs were illustrated. In addition, the discussion of groundwater contamination utilizes only the data collected from the second quarter of 1991 to the present. This data window excludes the highest concentrations of TCE and PCE. This section should be rewritten to describe and illustrate all organic compounds detected and all inorganics detected above an approved background concentration.

Another inadequacy of this RFI/RI report is its failure to include a BRA, or environmental evaluation. These two sections represent a substantial portion of an RI report. Review of these sections may also cause further revisions of the preceding sections of the report.

The appendices of the RFI/RI report were complete and well organized. However, Appendices E (groundwater modeling) and J (quality assurance) will require revisions. Both the MODFLOW groundwater flow model and MT3D groundwater fate and transport model have problems with assumptions and values. These issues should be resolved. Appendix J did not fully explain or provide the data necessary to evaluate the quality of the OU2 data.

Therefore, although this preliminary draft RFI/RI report represents a major effort, substantial revision of the report is necessary. Because two sections of the report are missing, additional substantial issues may be noted during subsequent review of the draft RFI/RI report.

5.0 REFERENCES

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