



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII

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DENVER COLORADO 80202 2466

OPERABLE UNIT 1 FINAL PHASE III RFI/RI REPORT, NOV 1993

General Comments

1 General Errors Overall EPA expected to find fewer inaccuracies inconsistencies and mistakes in this document than it did especially since it is a final report that had undergone review by EG&G prior to submittal. Notable errors were found in the reported depths of hot spot samples inconsistencies between interrelated tables and text and other miscellaneous areas. This is troubling and such errors can have significant impacts in subsequent actions taken at the site. Flaws such as these erode the veracity of a report and it is strongly recommended that DOE and its contractors work harder to improve the quality of its reports. Specific errors will be detailed below.

2 OU 1 IM/IRA At several places in the text of the report the influence and effectiveness of the OU 1 IM/IRA (the French Drain and extraction well components) is discussed. It is most often characterized as being effective in intercepting all identified groundwater flow paths upgradient of the French Drain. Unfortunately the report does not include enough data to justify such conclusions. The two Quarterly Monitoring reports that EPA has received previously indicate that the French Drain appears to be generally effective but that there are certain areas for which this may not be true. In addition very little information has ever been presented regarding the extraction well but all indications are that it has pumped virtually no groundwater since being installed in March 1992.

Appendix B4 French Drain Hydrogeologic Assessment is inadequate since it was dated September 1992 and therefore did not include any data gathered from the French Drain monitoring wells that were installed at approximately the same time. The contents of this appendix must be replaced with the available OU 1 IM/IRA Quarterly Monitoring Reports which provide information gathered specifically for the purpose of determining the effectiveness of the French Drain and other components of the system. Conclusions regarding the effectiveness of the French Drain must be deleted from this report most notably in sections 3.7.1, 3.7.3.8 and 3.7.4. A thorough analysis of the IM/IRA will be an important part of the Corrective Measures Study/ Feasibility Study (CMS/FS).

In summary data collected from the construction and monitoring of the French Drain is useful and appropriate for this report, but conclusions regarding its effectiveness are premature and not necessary for the purposes of the RFI/RI Report.

3. Determination of Contaminants This report needs to demonstrate clearly and thoroughly how all of the analytes that were investigated at OU 1 were determined to be either present as contaminants or eliminated as contaminants. Subsequent to the complete lists of analytes found in Tables 2.6 through 2.10 supplemental tables are needed that correspond



to the determination of site contaminants flowcharts presented as figures D 2 for inorganics and D-4 for organics. At each step in the respective flowcharts where analytes are either retained or eliminated a corresponding table must specifically list these analytes. Such tracking is needed to clearly show why and at what point in the process each analyte was either eliminated or retained as a contaminant. For organics in particular there seem to be a number of analytes that did not appear in either the final contaminant list or the list of those eliminated as site contaminants (tables D 16 and D 17). In summary this report needs to clearly indicate all analytes for each specific media that were eliminated as contaminants and the reasons for such elimination.

The procedure used in Appendix D of this report for determination of contaminants deviates somewhat from standard EPA practice. Therefore it is necessary that a disclaimer be provided at the beginning of Appendix D in Section 4.2, and Section F3 that informs the reader of this special situation. The disclaimer should also indicate that EPA and CDH only intended for this procedure to be used for OU 1 and that it should not be cited as a precedent for other Operable Units at Rocky Flats or other CERCLA sites.

4 OU 1 Source Criteria Making a determination that an analyte is not a contaminant at OU 1 on the basis that the particular analyte has no known source at OU 1 is not acceptable. Such a criteria was never agreed to by EPA, but statements to this effect appear at various places in the report. Such statements must be deleted from the report because a complete and definitive list of chemicals disposed of at OU 1 does not exist. In summarizing the reasons for elimination of some inorganic analytes found in Tables D-7 through D-11 this argument is often inappropriately used and must be removed. (See specific comments for more detail regarding these tables and other areas where this statement needs to be deleted or revised). Nevertheless use of historical waste disposal knowledge is valid when used as the basis for including analytes known to have been disposed at OU 1 as contaminants of concern.

5 Further Assessment Mn, Sb, and Anthracene After review by EPA it was determined that at least three analytes need to be assessed in further detail. Two inorganic elements manganese and antimony were found to be present at concentrations in groundwater which exceed health based drinking water levels as calculated by the equations in EPA's Risk Assessment Guidance Part B (EPA 1991a). These two metals, which did exceed background levels must be added to the list of contaminants in groundwater in Table D-16 and then further evaluated in the risk assessment process along with the other contaminants. The third analyte is anthracene, which as one of the PAHs was not completely evaluated in the risk assessment. Table F3-27 indicates that it was eliminated because it contributed <1% of the risk, yet Table F3-21 (toxicity screen), did not include anthracene in the % risk calculation. This must be done and if anthracene does contribute >1% of the risk, it must be included as a contaminant of concern for surface soils.

Specific Comments

Executive Summary

- 1 Page ES 5, Paragraph 1 In this discussion it is stated that contaminants were detected in the LHSU at greater than predicted depths when typical permeability values were used in calculating the extent of vertical migration. One very likely explanation for this situation may be that drilling activities have inadvertently resulted in providing vertical conduits to groundwater contaminants that did not previously exist. This must be mentioned here as a possible explanation.

Section 1, Introduction

- 2 Page 1 31, First Complete Paragraph According to the text the MILDOS AREA model was selected for atmospheric modeling of emissions from a source transport in air and deposition at receptor locations. Although the use of the MILDOS AREA model is acceptable the Industrial Source Complex Short Term (ISCST) or Industrial Source Complex Long Term (ISCLT) models are generally more accepted by EPA Region 8. The text should justify use of the MILDOS-AREA model over more accepted models such as the ISCST or ISCLT model.

Also this report does not but should, include a hard copy of the MILDOS-AREA modeling input and output data. A presentation of these data would allow for a thorough review of the modeled results.

Section 2 0, OUI Field Investigation

- 3 Page 2 2, First Paragraph The first sentence states that all analytical data collected at OUI from January 1990 through June 1992 are presented with the exception of rejected data. No explanation of the term rejected data is provided. This explanation must be incorporated in the text so the reader knows the type of data that was eliminated.
- 4 Page 2 7, First Complete Paragraph The volumetric flow rate for the ambient air samplers is stated to be either approximately 0.71 actual feet³ per minute or 1.42 actual feet³ per minute. These figures are likely in error. According to page 4-50 first complete paragraph, the flow values should be 25 and 50 actual feet³ per minute. The flow rate should probably read as 0.71 actual meters³ per minute or 1.42 actual meters³ per minute. This discrepancy must be corrected.
- 5 Page 2-22, Last Paragraph It is stated here that hot spot sampling was conducted using a shovel and trowel to a depth of 9 to 10 feet below ground surface. The actual

depth was only 9 to 10 inches below ground surface as was stated by DOE and EG&G in a meeting between the agencies on January 28 1993 This is also verified by other hot spot investigation information included in Appendix A5 of this report Unfortunately this mistake has been carried through the text of this report and as a result several other pages tables figures and conclusions must be revised accordingly Rather than question the validity of the sample depth an attempt was made in Sections 4 9 1 4 and 5 1 2 to explain the seemingly unusual 10-foot depth of plutonium/americium penetration As a result corrections are needed here and to pages 4-48 4-76 4-77 5 10 and 7-4

- 6 Page 3 11, First Paragraph This paragraph discusses the Rocky Flats alluvium and refers to French Drain Borehole locations P302390 P302490 and P302590 These borehole numbers are not shown on Figures 3 9 or 3 29 These borehole numbers also do not exist in Appendix A containing the geologic data The text should be corrected
- 7 Page 3 24, Second Paragraph The text states that Table 3-5 compares back pressure permeability and horizontal hydraulic conductivity values This statement is incorrect. Table 5 presents results of geotechnical analyses including back pressure permeability. No table in this section compares back-pressure permeability and hydraulic conductivity The text should be corrected
- 8 Page 3-28. The influence of the French Drain is discussed at various places on this page but as mentioned in the general comments above conclusions are based upon incomplete monitoring data Such conclusions and predictions are premature must be removed from this page
- 9 Page 3 32, First Paragraph The text discusses water levels in the bedrock of the lower hydrostatic unit (LHSU) at IHSSs 119 1 and 119 2 The text states that the UHSU is not in hydraulic communication with the LHSU In Section 3 7 3 5 LHSU Recharge and Discharge Characteristics (Page 3-37) the text states that groundwater in saturated UHSU units percolates downward into the LHSU These two statements are contradictory and should be corrected
- 10 Page 3-39, Second Paragraph. This text states well control is absent for the central part of the drain. This statement is incorrect. Monitoring well 10792 was installed directly south of the central portion of the french drain. This well is completed in shallow bedrock sandstone as shown by the borelog and well construction diagram provided in Volume 3 of this report. Table 2 2 of the Final FDPMP (EG&G 1992) indicates that monitoring well 10792 was intended to "monitor for the presence and quality of groundwater in a sandstone lens beneath the drain that was observed during construction" near station numbers 10 and 45 The panel drawing corresponding to the section of the drain between station numbers 10 and 11 which is contained in

Appendix A4 of this report indicates that groundwater was observed seeping out of this sandstone in the north wall of the french drain excavation Table B 3 which is contained in Appendix B3 of this report indicates that the sandstone screened by monitoring well 10792 is saturated most of the time

Furthermore water elevations in monitoring well 10792 indicate that a shallow sandstone constituting part of the french drain has been saturated for a majority of the time since the well was installed The text should be corrected and revised to incorporate this information

- 11 Page 3-39, Second Paragraph The text states that well 45391 shows sporadic changes in water level which are probably due to the proximity of the well to the sump Well 45391 is located in colluvium and south of the french drain If the colluvium is periodically saturated at this location the french drain is not capturing all colluvial groundwater Also groundwater elevation data from well 45391 has been omitted from Appendix B3 (groundwater elevation data) and Attachment B3 2 (well hydrographs) All water level data from well 45391 should be presented and a hydrograph created for this well
- 12 Section 3 7 3, Assessment of Hydrogeological Conditions It should be noted in this section that the volume of UHSU groundwater is highly dependent upon the amount of recharge it receives. Changes to the industrial area of the plant, usage of diversion canals and many other factors could potentially increase recharge to the UHSU and as a result also increase the volume of groundwater present in the UHSU at OU I This must be stated at some point in this section
- 13 Pages 3-39 through 3-41 More discussion and conclusions regarding the French Drain IM/IRA are presented here prematurely, especially in regards to the extraction well and statements pertaining to interception of groundwater flow paths These must be removed or revised to account for uncertainty
- 14 Figure 3-24 A few additions and corrections could improve this map Elimination of the surface topographic contours would make the map more readable The collection well (CW001) and well 11092 should be shown on the map along with the data provided for other wells Top of bedrock should be included for 10992 and 38191 should be represented as a piezometer not a well
- 15 Figure 3-48 This map should also show well CW001 and bedrock wells 10492 10792 and 10892 with any corresponding water levels since they were completed in the upper 25' of bedrock - This report defines the UHSU as including the upper 25' of bedrock and so this figure should be made consistent with that definition. The water level for several wells downgradient or near the French Drain should be an average of the five measurements taken during the month of April 1993. In many cases these wells are shown as being dry, but more often than not, they had

measurable water levels during most of that month

Section 4. Nature and Extent of Contamination

- 16 Section 4-1 The data management and quality subsection 4.1 should demonstrate that the appropriate frequency of quality control (QC) samples were taken as required by the EPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review (EPA 1991)
- 17 Page 4-2, first paragraph The last phrase of the last sentence in this paragraph states that surface soils, surface water, and sediments are not associated with historical waste disposal and are not designated as IHSSs. This statement needs to be deleted since it is obvious that surface soils have been directly affected by historical waste disposal at OU 1 and surface water and sediments are directly associated with contaminants in surface soils.
- 18 Page 4-9, paragraph 2 It is stated here that 66% of the Phase III data had been validated at the time that this report was written. Is DOE in the process of validating the remaining 34% or is this all of the validation for this data set? The answer to this question does not necessarily need to be added to the text, but DOE must provide a response to EPA in some format.
- 19 Page 4-10, paragraph 2 Further explanation is needed here since as written the indication is that 71% of the Phase I and II data was validated and none of it was rejected. Is that the case or was some other amount of the data validated and rejected? This needs to be clarified in the text.
- 20 Page 4-11, Second Paragraph This paragraph discusses data precision and states that it is acceptable to assess precision of metals results near the quantitation limit using the contract required detection limit. Because this rationale is used extensively to evaluate the precision of the data, justification for the acceptability of this procedure should be included in this paragraph.
- 21 Pages 4-14 and 4-15 The use and comparison of blank samples is discussed on these pages, and in several instances the term field blank(s) appears to be used incorrectly. After initially defining the three types of blanks that were collected, usage of the terms in the following paragraphs appears to be inaccurate and is somewhat confusing. This should be revised to clarify the intended meanings and conclusions.
- 22 Page 4-14, last paragraph The reference to CLP protocol used by data validators in comparing the laboratory blank results with associated sample results needs clarification and additional detail. It is stated here that when the occurrence of a compound is determined to be a laboratory artifact, the datum is qualified with a U

According to CLP protocol this type of occurrence should be qualified with a B The report needs to clarify whether U qualifiers were in fact used in this manner or whether this was actually just improperly worded in the report In regards to the magnitude of the difference it should be stated whether the 10 times rule was applied for this purpose

- 23 Page 4 20, Fourth Paragraph The statement rejecting the null hypothesis (no difference between background and site conditions) is false Accepting the null hypothesis means no difference The statement should be corrected
- 24 Page 4 26, paragraph 2 The second to last sentence in this paragraph must also state that radionuclide contamination in hot spots at IHSS 119 1 and 119 2 is attributed to leaking barrels
- 25 Page 4 32, Section 4 3 4 4 The second sentence in this section emphasizes the low VOC concentrations found in subsurface soils at 119 1 It should be noted here that VOC samples were not successfully obtained at all intervals in some of the key boreholes that would have been most likely to contain higher concentrations of VOCs
- 26 Page 4 35, First Paragraph The total plutonium content of the material from Building 776 was estimated at 14 grams The total plutonium content of Building 776 material is listed as 14 milligrams on page 1 12 third paragraph The correct value should be determined and used consistently
- 27 Page 4 36, First Paragraph Radiochemistry results for borehole 37191 are not discussed in the text but are presented in Table C3 e as exceeding background levels for americium 241 Also the results do not appear on the contaminant distribution map (Figure 4-4) This information should be included in the text and figures Addressing this additional contamination may also result in changes to the summary on page 4 36 second paragraph
- 28 Page 4-40, Third Paragraph The text states that uranium 238 was detected at 14 1 pCi/g at the 6 0- to 12 0-foot interval for borehole 30791 Table C3-e reports that uranium 238 was detected at 26 63 pCi/g for this borehole and interval Table 4-16 does not use the concentration reported on Table C3-e in the range of uranium 238 detected This difference is substantial and must be corrected
- 29 Page 4-44, Second Paragraph This paragraph discusses the PAH data and states that total concentrations range from 3 118 micrograms per kilogram ($\mu\text{g}/\text{kg}$) to 11 212 $\mu\text{g}/\text{kg}$ However these totals include many of the PAHs that have a U qualifier in Table C4-b in Appendix C indicating that they were not detected in the sample A more realistic interpretation of the PAH distribution would be to use only the detected compounds The rationale for using the total PAH value should be discussed in this paragraph

The last three sentences in this paragraph attempt to downplay PAH contamination at OU 1 by attributing its origin to commonplace entities such as vehicles furnaces and asphalt roads Unfortunately there is no hard evidence from which this can be concluded In addition incineration activities at building 881 must be given an equal or greater likelihood of being the origin of the PAH contaminants

- 30 Page 4-47, Section 4.4.2.2 The last sentence in this paragraph states that PAHs are ubiquitous in surface soils which contradicts the statement from page 4-44 PAHs were rarely detected in background surface soil samples Therefore the last sentence in this section must be completely deleted
- 31 Figures 4-2 through 4-14 The radiochemistry data in Table C3 e and the information on the Contaminants Detected in Subsurface Soils figures differ Specifically this problem was noted on Figure 4-5 for the 0-foot to 6 foot interval for boreholes 33991 34091 34691 34891 and 34991 and on Figure 4-11 for the 0 foot to 6 foot interval for boreholes 33191 32891 and 33591 Also the figures and raw data tables do not correlate for Figures 4-12 4-13 and 4-14 This inconsistency potentially exists for all borehole radiochemistry data and may not be limited to the shallow depth interval The appropriate tables and figures should be reviewed and corrected
- 32 Figures 4-7 and 4-9 These figures are cross sections depicting wells and boreholes along with the contaminants detected in the soil boring samples The contaminants detected in well 4387/BH5787 are missing from both figures and must be added
- 33 Figure 4-15 The location for SS100393 depicted on this figure is approximately 100 further west than the location shown for the same sample on other figures The correct location must be depicted on all figures

Section 5, Contaminant Fate and Transport

- 34 Page 5-11, last paragraph It is stated here that LHSU groundwater flow is generally to the south-southwest This is not consistent with the fact that bedrock dips generally to the east under Rocky Flats The most accurate groundwater flow direction must be used here and this must be supported with a reference or explanation.
- 35 Page 5-33, Third Paragraph This paragraph discusses critical fraction of organic carbon (f_{oc}^{*}) values for TCA It states that the calculated f_{oc}^{*} value of 0.00029 is greater than the mean organic carbon content of 0.0022 Review of the calculations in Appendix B6 indicates that the actual value for f_{oc}^{*} is 0.0029. This error should be corrected

- 36 Page 5 37, Fourth Paragraph This paragraph discusses the specific activity of plutonium 239 and states that this value is 6.13×10^{10} pCi/g the correct value However Table 5 14 gives a conflicting value of 6.13×10^4 pCi/g Table 5 14 also incorrectly lists specific activity values for the other listed isotopes This table should be corrected to agree with the text and contain the correct values for all isotopes given
- 37 Page 5-48, Paragraph 4 This paragraph states the presence of the french drain just south of well 4787 prevents further downgradient migration of contaminated UHSU groundwater However the preceding paragraph indicates that the dissolved VOC plume emanating from IHSS 119 1 has reached monitoring well 4787 In fact the french drain is north of well 4787 and therefore cannot prevent migration of contaminated UHSU groundwater from well 4787 to Woman Creek These paragraphs should be corrected

Section 6 0, Baseline Risk Assessment

- 38 Page 6 9, Second Paragraph The text states that dermal and respiratory exposure to contaminants in subsurface soil was assessed because young of many species are reared in burrows and spend long periods in contact with subsurface soils It is not clear whether similar analyses were conducted for contact with surficial soils contaminated with PAHs and PCBs These analyses should be conducted and the results discussed
- 39 Page 6 9, Fifth Paragraph The text states that one indicator of small mammal habitat quality in the reclaimed area of OU1 is the presence of a Preble s meadow jumping mouse a Category 2 special status species The presence of a single individual does not indicate significant use of the area by the species and this should be stated in the text
- 40 Page 6 17, First Paragraph The text states that data suggest the disturbance or presence of weeds was not a result of contamination The data which demonstrate this case are not discussed It is not clear that impacts to the vegetation are a result of physical disturbance alone when samples from these areas contain significant contamination Supporting data and rationales should be provided
- 41 Page 6-23, first paragraph It is stated here that the radionuclide hot spot was essentially removed by sampling This conclusion is premature and can only be supported by additional sampling for verification Therefore the statement must be qualified or removed from this page page 6-27 and from several other pages in Appendix F

Section 6.0, Figures

42 Figure 6-7, Contaminants of Concern, Screening Flow Chart

The part of the flow chart describing the risk based concentration analysis is unclear. It indicates which direction to take after conducting the comparison however the box labeled Direct Contact* Risk Assessment is not explained. This should be defined in the text and the table.

43 Figure 6-8, Conceptual Site Model This figure classifies external exposure to radiation as negligible or incomplete. While this pathway for radionuclides may not pose significant risks, it is a complete pathway and should be quantitatively evaluated in the human health risk assessment.

Section 7, Summary and Conclusions

44 Page 7 7, third indented paragraph The statement is made here that the French Drain may reduce the groundwater level necessary to sustain wetlands. This is a hypothetical impact that has not been proven or evidenced from actual measured water levels. As such it is inappropriate and must be removed.

45 Page 7 9, first RAO In this list of remedial action objectives (RAOs) the first bullet discusses the continued operation and monitoring of the extraction well at IHSS 119 1 for effective groundwater extraction. Unfortunately, it is EPA's understanding that this well does not provide effective groundwater extraction due to the fact that it has only pumped for very limited periods since being installed. Therefore, the statement made here must be revised so that the effectiveness of the well is not misrepresented. As this is an integral piece of the OU 1 IM/IRA and may provide an important part of the final remedy, a thorough evaluation of this well is necessary.

Appendix A

46 Table A1 6 This table (Soil Samples Collected During the Phase III REI/RI Field Program for Chemical Analyses) reports borehole 32191 was to be sampled for radionuclides. However, radiochemistry results are not reported in Table C3-e (raw data) or Figure 4-3 (contaminant distribution figure for IHSS 103). This borehole is the only one within the boundaries of IHSS 103 therefore the results are important in determining nature and extent of contamination at this IHSS. Either the results of the radiochemistry analysis (if conducted) should be included and examined, or an explanation should be provided as to why no radiochemistry analysis was conducted.

Appendix B

- 47 Attachment B3 2 Well Hydrographs A number of well hydrographs show groundwater elevations above the ground surface. If the data are correct, the wells are flowing. This should be discussed in the hydrogeology section. If not, the hydrographs should be corrected.

Appendix C Analytical Data, Figures

- 48 Table C 8a There are also several questions regarding laboratory standard operating procedures dealing with detection limits, dilution factors, and sample prescreening procedures.
- There are several instances where detection limits for reported data are above contract required quantitation limits (CRQLs). It would be better to initially analyze the sample at full strength, even though EPA protocol allows for diluting laboratory samples if pre-screening is performed. Performing laboratory tests on diluted samples only allows for other potential contaminants with lower concentrations to go undetected.
 - The sample for well 0974 collected on October 16, 1990 should have been re-run at a lower dilution factor. The sample data showed no detectable concentrations of analytes at the dilution factor for which the laboratory analysis was performed.

Appendix D

- 49 Page D 32, paragraph 3 Acetone, 2-Butanone, and Methylene Chloride are all discussed together here in regards to reasons why they were determined to not be contaminants at OU 1. Since the occurrence of each analyte was found to be somewhat different, each of the three analytes must be separately discussed. For example, 2-butanone is not listed in Appendix G, Table G3 a, as being detected in any QC blanks, whereas acetone and methylene chloride are. Elimination of methylene chloride is of special concern due to the concentrations at which it was detected, the fact that it is a known carcinogen, and the fact that it is a degradation product of known site contaminants. Therefore, a separate discussion is needed for each analyte in order to clearly specify why each is determined to not be a contaminant at OU 1.
- 50 Table D-1, Page 1 The background concentrations for metals in surface soils listed here are not believable for most of the elements listed. Apparently this column was a typographical error since other figures in Appendix D used different and more

realistic values for background concentrations of metals in surface soils. The same table is also found as Table 4.5. These values must be corrected and a check needs to be run to determine whether any of these erroneous values were actually used for comparisons to surface soil background concentrations.

- 51 Table D 7, Page 1 Contrary to what is stated here, antimony is elevated in two colluvial wells, one of which has the highest concentration detected, see Figure D 15.
- 52 - Page 11 Comments in the table for cesium 134 and 137 state: "There has been a criticality at OU 1. If this is true, a complete discussion of the event must be provided. If the statement is false, it should be corrected."
- 53 Pages 13 and 14 Uranium (all isotopes) is listed as groundwater contaminant according to the last column in this table. This is inconsistent with the text and other tables and must be corrected where appropriate so that all agree. Also in the spatial/temporal comments, it is irrelevant whether Uranium was disposed of at OU 1 or elsewhere. This does not answer the question: "Is Uranium a contaminant at OU 1 or is its presence naturally occurring?" As noted in the general comments, waste disposal at OU 1 must not be used as a criteria for elimination.
- 54 - Pages 14 through 18 The table was not completed for any potential water quality contaminants.
- 55 Table D 16, Summary of Contaminants at OU 1 This table provides a critical link between the nature and extent of contamination and the baseline risk assessment. This table was found to have numerous inconsistencies with the tables and text from which it was derived. Specifically, 1,2-dichloroethene should have been listed but was not and cis-1,2-dichloroethene was listed twice. As a result of this, the risk assessment did not consider 1,2-dichloroethene, see tables F2-1 and E4-2. Numerous volatile organic compounds are listed as contaminants in subsurface soils in table D-16 but table D-15 indicates that they were not detected in that media (GM column). Page D-26 states that 1,1-dichloroethene and 1,2-dichloroethene were detected in surface water and sediments, respectively, but table D-16 does not reflect this. These discrepancies must be corrected so that all tables and text are in agreement.
- 56 Table D-17 is a partial list of analytes that were eliminated as OU 1 contaminants in all media and is generally well supported by the text in pages D-10 through D-37. However, the table mistakenly lists vinyl chloride instead of vinyl acetate, which was discussed on page D-31. Again, it must be emphasized that this table is not a complete list of the analytes that were eliminated as OU 1 contaminants and it must be supplemented or expanded to thoroughly explain why other analytes (in each media) were eliminated.
- 57 Figure D-2 Determination of Site Contaminants (Inorganic Analytes) is confusing.

for several reasons and would be much more useful if each step were numbered and explicitly related to summary tables that account for all analytes in each media by using some type of notation. At the box that asks ">5% Exceeding Background UTL or Max?" a no answer can take two different directions. This is confusing and should be corrected. If an analyte is eliminated as a contaminant at this point, an additional box discusses the precaution taken for analytes with <5% detection frequency. This step should not be shown here as it is part of the PHE COC flowchart shown in Figure F3.1. Is there a difference between site and site wide contaminants? Both are used in this flowchart.

58 Figure D-4, Determination of Site Contaminants (Volatile and Semi Volatile Organic Analytes) also needs to have each step numbered and reference a corresponding summary table at each step so that every analyte is clearly tracked. The initial step should actually reference the list of all analytes that were investigated for each medium. The next step should reference a table listing all of the above analytes that were not detected, again specific to each medium. Detected compounds are to be compared to lists of compounds disposed at OU 1 or degradation products of these compounds. Here again, summary tables for quick reference are needed to explicitly show which compounds are included or excluded from further consideration. The flowchart indicates that known and detected disposal compounds or their degradation products are listed as contaminants, however, methylene chloride is a degradation product that was eliminated due to its presence as a lab and/or field sampling artifact. The flowchart should be adjusted to allow for this.

59 Figures D-9, D-26, D-35, and D-120 show isopleth maps of the concentrations in groundwater for aluminum, arsenic, barium, and silicon respectively. No values are posted by the wells on these maps. Since these isopleths are actually just one of many possible interpretations, all values used in generating the map should be posted.

Appendix E, Environmental Evaluation

Comments for Appendix E are being transmitted under separate cover.

Appendix F, Public Health Evaluation

60 Page F2-8, Section F2.2.2. The statement is made here that spatial and temporal distributions were evaluated to assess whether particular analytes are "indicative of contamination arising from OUI sources." As discussed in general comment #4, this was not the purpose or the intent of EPA for evaluating spatial and temporal distributions of analytes. EPA had agreed to use of spatial and temporal distribution evaluations for use in determining whether particular analytes are actual contaminants. Whether or not such a contaminant has its source in OU 1 is irrelevant to this.

determination Therefore the last four words arising from OU1 sources must be deleted from this sentence

- 61 Page F2 18, Section F2.2.5.3 The presumption stated here that PAHs at OU 1 are due to general urban fallout is contradicted by previous statements that PAHs were not present in background samples collected in other areas of RFP that would also be affected by such urban fallout Since the PAHs cannot be definitely linked to a particular IHSS or historical release their origin is best characterized as being unknown
- 62 Page F2 19, Section F2 2 5 5 Numerous mistakes were found in the third paragraph which discusses plutonium activities in soil samples The first sentence states that activities were detected at more than 10 micro Curies per gram but the actual activity was about 10 nano Curies per gram (11100 pCi/g) Again 9 10 feet instead of 9 10 inches is mentioned And following this it is stated that soil sampling activities resulted in removal of the contamination at this depth This needs to be rewritten to explain that plutonium contamination below the 9 10 inch level was not characterized at SS100493 and is therefore unknown below that depth
- 63 Page F3 6, Section F3 3 3 This section states that the list of radionuclides in surface soil contributing greater than 1 percent of the total risk based on results of the concentration toxicity screen are americium-241 plutonium-239 -240, uranium 233,-234 and uranium-238 According to Table F3 23 uranium-233 234 and uranium 238 did not contribute greater than 1 percent of the total risk. Uranium-235 however contributed 1 percent of the total risk and should have been retained as a COC The tables and text should be corrected
- 64 Page F4-12, Last Paragraph This paragraph and the following page discuss health and safety plans in place at RFP The text states that exposure concentrations will be compared to the health and safety plans for current on site workers This comparison is unacceptable Health and safety plans are not designed to protect workers from OU1 contaminants Regulations to protect workers such as those promulgated by the Occupational Safety and Health Administration (OSHA) pertain to chemical exposures that occur during routine occupational activities In these cases the concentrations of chemicals are well characterized and exposures to the chemicals are monitored. These regulations do not apply to exposure to hazardous contaminants at Superfund sites This discussion and comparison should be eliminated from the risk assessment or the risk corresponding to safe levels under OSHA calculated This discussion should also be removed from Page F7-6 (Section F7 2.1 1) and Page F7-8
- 65 Page F4-15, Section F4.5 This section describes the conceptual site model and discusses complete exposure pathways for the scenarios selected for inclusion in the human health risk assessment External exposure to radionuclides has not been included in any of the exposure scenarios The document asserts that it is an

insignificant risk and need not be evaluated External exposure to radionuclides is a complete exposure pathway for all receptors and should be quantitatively evaluated using OU 1 data The quantitative assessment will then indicate if risks from external exposure to radionuclides are insignificant

- 66 Page F5 8, Third Paragraph The text states information on dermal absorption factors is given in EPA's Dermal Exposure Assessment Principles and Applications (EPA 1992a) The absorption factors referenced in Table F5 1 are cited as being from EPA Region I Supplemental Risk Assessment Guidance for the Superfund Program (EPA 1989b) The text and table should be corrected so that they do not conflict It appears that this paragraph discusses dermal permeability constants not absorption factors Additionally the text states If specific values are not identified for contaminants then a value is used from the range given The most conservative value from the range should be chosen for both dermal permeability constants and absorption factors
- 67 Page F5 11, Equation 12 The deposition velocity used in this equation is 0 002 meter/second (m/sec) whereas Baes and others (Baes 1984) use 0 1 m/sec The value used in the final PHE may underestimate intake from vegetable ingestion Additionally, it is unclear how the intercept fraction to-productivity ratio was derived It should be explained in the text The value presented for the weathering half life ($T_{1/2}$) appears to have been rounded off The value of $T_{1/2}$ in Baes (1984) is 1754201
- 68 Page F5 12 the fourth paragraph states that the upper 95th percent confidence interval on the average values was used to represent the COC concentration Per EPA Guidance the concentration term is derived from the 95th % upper confidence limit of the arithmetic mean (EPA 1992) The sentence should be revised to reflect that the average value is the arithmetic mean
- 69 Page F6 3 The next to last sentence on this page states that modifying factors are applied arbitrarily This is incorrect Modifying factors are applied by EPA's Reference Dose Workgroup based on a thorough evaluation of the available data and an understanding of a chemical's pharmacokinetics The word arbitrarily should be removed from this sentence
- 70 Page F6 9 The first full paragraph on this page states that risk for D carcinogens are quantified on a case by-case basis This is an incorrect interpretation of EPA's Risk Assessment Guidance (EPA 1989) The EPA guidance states that quantitative estimates of slope factors (not risk!) for chemicals in Class C proceeds on a case by-case basis It is regional practice in the Superfund program to quantitate risk for all carcinogens which have a slope factor
- 71 Page F6-18 The second paragraph on this page discusses the absorption factor f_1 for radionuclides Clarify whether this factor was used to adjust the quantitative risk

estimates

72 Pages F7 18 through 20 The application of quantitative uncertainty analysis to toxicity values (e.g. cancer slope factors) must be limited to a qualitative discussion of the results as they provide a fuller characterization of the uncertainty surrounding EPA's slope factors contained in IRIS and HEAST and verified by the Cancer Risk Assessment Verification Endeavor and the Human Health Assessment Group. Use of anything other than EPA's verified slope factors in the quantitative risk assessment would be a departure from EPA policy. Therefore, toxicity values other than those approved by EPA must not be used in any quantitative risk assessment documents, public documents, or public meetings pertaining to the Rocky Flats site. As we have stated previously, DOE should submit the toxicity assessment uncertainty analysis to the appropriate experts at EPA Headquarters for review and guidance on the appropriate use of the results. We would be happy to facilitate such a review.

No agreement has yet been reached between DOE, EPA, and CDH on the appropriate central tendency values or the shape of the distribution curves for each exposure value used in the Monte Carlo uncertainty analysis. There are a number of problems which remain to be resolved between all three agencies. For example, averaging times for carcinogens and non-carcinogens should be different since the averaging time depends on the type of toxic effect being assessed. Since non-carcinogenic intakes are calculated by averaging intake over the period of exposure (exposure duration), the averaging time is equal to the exposure duration. In DOE's Monte Carlo analysis, the averaging time must be set equal to the exposure duration in each iteration of the Monte Carlo analysis so that the ratio of exposure duration to averaging time is always 1:1 for noncarcinogens. Carcinogenic intakes, on the other hand, are calculated over a lifetime. The shape of the distribution curve for the lifetime estimate needs to be agreed upon by all three agencies.

As another example, it appears that body weight and inhalation rates are distributed independently in the Monte Carlo analysis. This is incorrect. Body weight and inhalation rates are dependent variables (a 15 kg child will not have a 20 m³/day inhalation rate) and should be correlated in the Monte Carlo analysis. In addition, it is difficult to ascertain the central tendency and distribution curves used for soil ingestion since the units are m³/day and the numbers are nonsensical. Until DOE, EPA, and CDH can collectively review the literature that is the basis of the distributions and agree on the appropriate scope of the Monte Carlo uncertainty analysis, the uncertainty analysis must contain the statement that the values and distributions used shall not be considered as an acceptable format or precedent for use on other EPA Superfund sites.

73 Page F7-22, Last Paragraph This paragraph lists PAHs as an example of a naturally occurring carcinogen. This cannot be substantiated because there is no approved method for determining background concentrations of PAHs. PAHs should be

removed from the list of naturally occurring background carcinogens

- 74 Page F7 25, paragraph 3 Addition of radiological and non radiological risks is inappropriate Because of differences in the derivation of the slope factors for radionuclides and non radionuclides the estimated risks are not comparable Risks from the two types of carcinogens must be evaluated separately and not added together Therefore this paragraph must also be deleted
- 75 Page F7 28 and other pages The chemical 1 1 1 trichloroethane is occasionally misspelled 1,1 1 trichloroethene This should be corrected
- 76 Page F8 11, Third Paragraph This paragraph presents the cancer incidence rate of the Denver metropolitan area (0 33) and a calculated incidence rate for hypothetical residential receptors at OU1 (0 09) It is not clear how the incidence rate specific to OU1 was calculated An incidence rate of 9 percent is significant and should be further investigated It represents an increase of nearly one third over the current incidence rate of cancer for the Denver metropolitan area

Appendix F, Tables

Section F3 Tables

- 77 The tables in Section F3 which present summary statistics for all contaminants in all media are confusing Discrepancies exist in data between Appendix D and the tables in Section F3 Carbon disulfide, for example is described in Appendix D as not being detected in groundwater but according to Table F3 3 it was detected in groundwater and retained for risk-based concentration screening It is unclear why the chemicals not retained for toxicity screening were eliminated. Additionally these tables should be modified to correctly indicate which chemicals were evaluated in the concentration toxicity screens For example several polynuclear aromatic hydrocarbons (PAHs) are identified in Table 3 9 as being retained for the toxicity screening However no concentration toxicity screen was performed for these chemicals
- 78 Table F3 3, Summary Statistics, Volatile Organics - Groundwater Total xylenes and cis-1 2-dichloroethene are marked potential contaminants in the site investigation and should have been included in the concentration-toxicity screen However they were not included in the toxicity screen (Tables F3-15 and F3-16) This discrepancy should be corrected.

This table also indicates that cis-1 3-dichloropropene will be retained for risk-based concentration (hot-spot) screening. However, this chemical was not detected in groundwater according to this table. This discrepancy should be resolved.

79 Table F3-9, Summary Statistics, Semivolatile Organics, Subsurface Soil This table indicates that several chemicals (all PAHs) will be retained for the concentration toxicity screen but these chemicals do not appear in Table F3-18 which presents the concentration toxicity screen PAHs should be included in the concentration toxicity screen

80 Table F3-11, Summary Statistics, Metals and Inorganics, Surface Soil This table indicates that antimony will be included in the concentration toxicity screen but it is not included in Table F3-21 which presents the concentration toxicity screen This discrepancy should be resolved

81 Table F3-13, Summary Statistics, Semivolatile Organics, Surface Soil This table presents frequencies of detections and summary statistics for SVOCs detected in surface soil However the mean concentrations were not calculated for acenaphthylene, acenaphthene benzo(a)anthracene benzo(a)pyrene benzo(b)fluoranthene benzo(g,h,i)perylene benzo(k)fluoranthene bis(2-ethylhexyl)phthalate chrysene and di-n-butylphthalate Mean concentrations should have been presented since these chemicals have detection frequencies of 4 percent and greater Additionally these chemicals should have been included in the concentration-toxicity screen According to this table they were not included in the screen although some were designated as COCs in other tables

This table should have indicated that several other SVOCs would be included in the concentration-toxicity screen or risk based concentration (RBC) screening, including dibenzofuran, indeno(1,2,3-c,d)pyrene naphthalene, phenanthrene pyrene dibenzo(a,h)anthracene fluoranthene, and fluorene Some of these contaminants were included in the concentration-toxicity screen but Table F3-13 does not present this information

82 Table F3-18, Subsurface Soil, Organic/Inorganic, Noncarcinogenic Contaminants Toxicity Screen The maximum concentrations presented in this table are inconsistent with Table F3-8 The values should be verified and tables corrected accordingly Additionally, a carcinogenic concentration-toxicity screen is missing and should be added to the evaluation of subsurface soil contaminants

83 Table F3-20, Subsurface Soil - Organic/Inorganic, Risk Based Concentration Screen This table presents an RBC screen for contaminants that were detected at a frequency of less than 5 percent This comparison, which is designed to detect hot spots, follows the COC selection process previously outlined, but is inappropriately applied in some instances In particular, if a chemical does not have an RBC, it should be retained as a COC unless other tests are conducted to prove that it is not a hot spot For example, phenanthrene was detected at a maximum concentration of 895 mg/kg Phenanthrene does not have an RBC However the results of this screen indicate that it is not an anomaly and will not be considered a COC This conclusion cannot be

substantiated if there is not RBC Therefore the comparison is inappropriate Phenanthrene was detected at a frequency of 5 percent and should be considered a COC It should be qualitatively evaluated unless other reasons for its exclusion can be provided

Section F5 Tables

84 Many of the tables in Section F5 which present reasonable maximum exposure (RME) concentrations are inconsistent For example Tables F5 23 and F5 28 present a different exposure concentration for 1 1 1 trichloroethane in indoor air from basement use than is presented in Table F5 12 Although there are different receptors the exposure concentration should not change It is unclear if these discrepancies are typographical errors or are due to various data aggregation methods for the different exposure scenarios The same data sets should have been used for all scenarios with the exception of the residential scenarios which were clearly explained Other discrepancies in the tables include

- Tables F5 23 and F5 28 present different exposure concentrations for americium 241 in airborne particulates and uranium 238 in sediment
- Tables F5 33 and F5 38 present different concentrations for benzo(a)pyrene in fruits and vegetables

These tables should be verified for accuracy

85 Table F5 1. Chemical Specific Dermal Exposure Constants The dermal permeability constant for PCE presented in this table is the estimated value (EPA 1992a) A measured value which is more conservative, is available from the same reference The measured value of 0 37 centimeters per hour should be used as the dermal permeability constant for PCE

86 Table F5 2. Exposure Parameters Current On Site Worker (Security Specialist) The exposure frequency presented for the current on site worker is 16 days per year based on professional judgement This value should be supported by site specific documentation as it presents a large departure from the default value of 250 days per year for this receptor

87 Tables F5 2, F5-11, F5-18 An ingestion rate of 0 00002 liters (L) per event is used as the ingestion rate of surface water The standard default value for incidental surface water ingestion is 50 milliliters (ml) (EPA 1989a) The ingestion rate should be changed to reflect the RME ingestion rate of 50 ml per event

88 Tables F5-3, F5-12, F5-19, F5-23, F5 28, F5-33, F5-38, and F5-43 These tables

present estimated RME concentrations of COCs for different receptors. However, the RME exposure concentration of Aroclor 1254 in sediment is not presented, even though it is a COC according to Table 6-9. Exposure to Aroclor 1254 in sediments should be assessed and presented in these tables.

89 Tables F5.6 and F5.22 The adult ingestion rate for fruits and vegetables is given in these tables as 0.78 kg/day. This is inconsistent with EPA's Standard Default Exposure Factors (EPA 1991b) which recommends that 0.122 kg/day be used for ingestion of homegrown fruits and vegetables.

90 Tables F5.32 and F5.37, Exposure Parameters - Future On Resident Scenarios These tables do not present exposure parameters for the fruit and vegetable ingestion pathway, even though this pathway is quantitatively assessed. The exposure parameters should be presented and should follow EPA guidance (EPA 1989c) for RME assumptions.

91 Table F6.2, Toxicity Constants for Chemicals of Potential Concern (for carcinogenic effects) Some of the carcinogenic slope factors (CSFs) presented in this table appear to be incorrect. The inhalation CSF for DCA is listed as 1.2, but if calculated from the inhalation concentration, it should be $0.175 \text{ (mg/kg-day)}^{-1}$. The inhalation CSF for PCE should be $1.82 \text{ E-3 (mg/kg-day)}^{-1}$ according to the reference cited. The oral CSF for benzo(k)fluoranthene should be $0.73 \text{ (mg/kg-day)}^{-1}$, not 0.073 as listed. Apparently, the incorrect toxicity equivalency factor was used because the oral and inhalation CSFs for uranium-238 are listed. According to the Health Effects Assessment Summary Tables (HEAST) 1993 and 1992 (EPA 1992b and EPA 1993c), the values should be 1.6 E-11 and 2.4 E-8 , respectively.

Additionally, incorrect weight of evidence classifications are provided for TCA, Aroclor 1254, and toluene. Toluene and TCA are both Class D carcinogens according to the Integrated Risk Information System (IRIS). Aroclor 1254 is a Class B2 carcinogen. The table should be corrected accordingly.

92 Particulate Inhalation The particulate emission factor should be included in all of the exposure assumption tables which have inhalation of particulates as an exposure pathway. The default exposure factor recommended in EPA's Risk Assessment Guidance for Superfund Part B (EPA 1991a) for particulate emission is $4.63 \times 10^9 \text{ m}^3/\text{day}$. If a site-specific particulate emission factor is being used in each of the exposure scenarios, then the derivation of that factor should be shown (i.e., width of contaminated area, wind speed, diffusion height, etc.). The appropriate tables should be revised to include the particulate emission factor for inhalation of particulates.

Section F7 Tables

93 Tables F7-7 and F7-8 It appears that risk estimates were calculated for exposure to

subsurface soil but none were calculated for exposure to surface soil. Construction workers are exposed to surface soil hence these calculations (ingestion and dermal exposure to subsurface soil) should be included in the risk estimate.

Appendix G

94 Table G 2 Listing of Rejected Data with Reason Code. The numbers provided in this table do not appear to correlate to the numbers of rejected results shown in Table G-1. Therefore both tables need to be cross checked for accuracy. Resulting corrections and/or explanations must be made in this appendix to resolve this inconsistency.

REFERENCES

U S Environmental Protection Agency 1989 Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual Office of Emergency and Remedial Response EPA/540/1 89/002

U S Environmental Protection Agency 1991a Human Health Evaluation Manual Part B Development of Risk based Preliminary Remediation Goals OSWER Directive 9285 7 01B

U S Environmental Protection Agency 1991b Human Health Evaluation Manual Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285 6-03

U S Environmental Protection Agency 1991c Exposure Factors Handbook. Update to Exposure Factors Handbook EPA/600/8 89/043 May 1989 Office of Health and Environmental Assessment Washington D C

U S Environmental Protection Agency 1992 Supplemental Guidance to RAGS Calculating the Concentration Term Publication 9285 7-08I May 1992 Office of Solid Waste and Emergency Response Washington D C