ROCKY FLATS PLANT
GOLDEN, COLORADO

TECHNICAL REVIEW
DRAFT FINAL
REVISED WORK PLAN FOR OPERABLE UNIT NO. 7

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
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than TDS concentrations in groundwater inside the interceptor system. The results of this statistical comparison, however, are used to draw conclusions other than to accept or reject the null hypothesis. For instance, the analysis determined that TDS concentrations at well 71493, which is supposed to be located inside the interceptor system, are similar to TDS concentrations at wells 70093 and 71193, which are located outside the interceptor system. Instead of rejecting the null hypothesis that TDS concentrations are different on either side of the interceptor system and concluding that the interceptor system is not effectively diverting groundwater at this location, the OU7 Revised Work Plan suggests that the results indicate that all three wells are located outside of the interceptor system. Figure 2-40 shows that this part of the interceptor system is an inflow boundary (because it is not believed to be keyed into bedrock in this area), which would suggest groundwater inside the landfill at well 71493 is thoroughly mixed with groundwater from outside the landfill.

This example highlights the major weakness of Section 2.0, that any analysis of the effectiveness of the groundwater intercept and diversion structures depends on first accurately locating the structures. This could have been accomplished with various geophysical methods such as ground-penetrating radar. The analyses of groundwater diversion structures' effectiveness should not be considered conclusive in areas where there is any doubt of their locations. Groundwater analytical results should not be used to determine the locations of these structures.

2. The groundwater flow velocities presented in Section 2.5.3.4 are questionable as a result of errors in quantifying input parameters, particularly in the area beneath and downgradient of the East Landfill Pond embankment. Significant errors were made in the calculation of hydraulic gradient and the estimation of hydraulic conductivity, both of which are addressed in specific comments later in this report. Indicative of the overall quality of this analysis is the assignment of a uniform range of effective porosity (0.1 to 0.2) for the entire range of subsurface materials at OU7, from unweathered claystone to landfill debris. This section should be completely rewritten to provide estimated groundwater flow velocities that are supported by data. If additional data are needed to fully characterize the area beneath and downgradient of the East Landfill Pond embankment, collection of these data should be incorporated into the Phase II field activities.

3. A brief review of Section 2.6.7 revealed two conceptual errors with water balance components. Vertical hydraulic gradients presented in Table 2-10 to support Section 2.6.7.7 include a gradient calculated from well pair 72393/72093. It is inappropriate to include this well pair in the calculation of the mean vertical hydraulic gradient from the fill to the weathered bedrock because both wells are screened in the fill material. This may account for their anomalously low hydraulic gradient. The discussion of the calculation of groundwater base flow to the East Landfill Pond in Section 2.6.7.8 states, "....because most of the East Landfill Pond bottom is underlain by unweathered bedrock, the cross-sectional area of flow is defined by the depth of groundwater at the pond shoreline" (the difference between pond surface elevation and landfill seep elevation). Geologic cross-section G-G' (Figure 2-15) depicts weathered bedrock having a thickness of 15 feet below the pond, which is supported by logs of nearby bedrock wells 0886 and B206789. Therefore, the cross-sectional area should be the difference between seep elevation and the mean elevation of the pond bottom. This statement and any related calculations should be corrected.

The water balance itself is very difficult to understand. The relationship of each of the components listed in the columns of Table 2-14 is not immediately apparent. Two different water balance equations are stated, one on page 2-40 and one on page 2-47. Neither equation can be used to calculate the monthly pond storages listed in column P. To reproduce those numbers, the equation listed on page 2-47 must be used, discharge from the groundwater interception system must be added, and seepage from the landfill pond must be subtracted. Equations used should be accurately and consistently referenced in the document to avoid confusion.

Section 3.0 - Data Quality and Useability

4. The OU7 Revised Work Plan calculated an average relative percent difference (RPD) for each analyte group (such as metals) in each matrix that was sampled, and used this average to assess whether the precision of data for each analyte group (by matrix) was acceptable. The RPD is a measurement of the precision of data and is evaluated by comparing analytical results for real samples with their associated duplicate samples. The RPD for a matrix should be assessed in an individual analyte basis, not as an average for an analyte group. As previously stated in the report, acceptable RPDs are less than 20 percent for all analytes in water (surface and ground) and less than 35 percent for all analytes in soil (surficial,

subsurface geologic material, and sediments). RPDs for individual analytes greater than these values are listed throughout Section 3.1.5 and are not within an acceptable range Therefore, all real data that correspond to this quality control (QC) result should be treated accordingly. The precision criteria formulated for the contract laboratory program (CLP) and non-CLP method analyses should be followed.

5. For sample pairs where a detectable result is reported for one sample and a non-detect result qualifier is reported for another, the RPDs were calculated by substituting the detection limits for the nondetected results. When evaluating a nondetected value, it is inappropriate to assume that value to be the detection limit. The RPD is expressed as:

$$RPD = \frac{(R - D)}{\left[\frac{(R + D)}{2}\right] x\ 100}$$

R = the concentration of the analyte in the real sample

D = the concentration of the analyte in the duplicate sample

Therefore, if D is less than the detection limit, it is improper to assume that value to be the detection limit. Standard practice for the calculation of an RPD where a compound is not detected is to assign one-half the detection limit as the concentration.

Section 4.0 - Nature and Extent of Contamination

6. Overall, the statistical analysis procedures used for background comparison as outlined in this section are consistent with those recommended by Dr. Gilbert (Gilbert 1993) and required for selection of chemicals of concern (COCs) at Rocky Flats. However, distinction between which inferential statistical tests were used to support the selection of the contaminant as a preliminary chemicals of concern (PCOC) should be provided in the text. If the chemical passes only one inferential statistical test, it must be retained as a PCOC.

Typically, PCOCs were selected in the risk assessment, not in a sampling and analysis plan. The text should provide justification and rationale for carrying out the PCOC selection process independent of the risk assessment and prior to sampling.

Due to time constraints, statistical calculations could not be verified. It was assumed that all statistics were calculated correctly.

7. The work plan indicates that East Landfill Pond sediments will require remediation, because analytical results from sediment samples exceed five PCOCs by an order of magnitude or greater. The accumulation of contaminants in the pond sediments suggests a lack of contaminant mobility within this environment. Furthermore, the pond provides a system for the natural attenuation of organic contaminants contained in the landfill leachate. Thus, the pond functions as a collection system for the leachate and as a primary treatment system for organic contaminants. Because leachate collection may be an integral component of the presumptive remedy for CERCLA municipal landfill sites (EPA 1993), the East Landfill Pond should be replaced with a leachate central system if it is removed through remedial activities. The OU7 revised work plan should discuss remediation of the East Landfill Pond in greater detail, and describe how a leachate control system will be integrated into the landfill closure process.

8. The results of volatile organic compound (VOC) analyses conducted on samples collected from the southern section of the landfill indicate that elevated levels of chlorinated hydrocarbons are present in the upper hydrostratigraphic unit. Although these compounds may originate at another operable unit, they may affect the landfill and the selection of landfill remedial strategies. Therefore, the work plan should include the installation and sampling of additional wells to identify the extent of the chlorinated VOC contamination. In addition, existing wells in this area may require sampling and analysis for VOCs to accurately delineate the extent of the chlorinated VOC contamination.

9. The use of averaged concentrations over a 3-year period to evaluate the nature and extent of landfill contaminants is inappropriate. Averaging several years of data provides a false indication of the extent and type of contamination that is currently present at OU7. This approach may potentially obscure high and low concentrations, and does not provide accurate information on the locations and concentrations present in the environment. Each year of data should be averaged and isoconcentration maps prepared from these results. Presented in this fashion, the three sets of data may indicate trends in the transport and fate also the future extent of the contamination.

Section 5.0 - Data Quality Objectives

10. Section 5 discusses the data quality objectives (DQOs) associated with the investigation of the landfill and identifies the number of samples required to delineate the nature and extent of contamination for each media, sediments, groundwater, and the landfill. However, it is not clear from the text in Section 6 (Sampling and Analysis Plan) how this information was used to determine the recommended number of samples to be collected during the additional investigation. The rationale used during the investigation of the DQO process and the sampling design must be clearly presented.

Appendix J, Data Quality Tables

11. Data in Tables J-11 through J-13 are presented in a format that is not consistent with the discussion of data quality in the text or consistent with other tables in the appendix. The text and the other tables present data organized primarily by analyte type (metals, radionuclides). Tables J-11 through J-13 group all analyte types together, and list all compounds in alphabetical order, with analytes that have numerical prefixes preceding all other analytes. Tables J-11 through J-13 should be reformatted to match the text and other tables.

3.0 SPECIFIC COMMENTS

1. Page 2-20, Paragraph 3. The text states, "groundwater in the upper hydrostratigraphic unit (UHSU) generally flows to the east, but is diverted around the landfill by way of the groundwater intercept system..." However, Figure 2-40 shows that groundwater passes beneath the intercept system along the northwestern boundary of the landfill. There is also some question as to whether the slurry walls effectively divert water away from the landfill. This statement should be revised to be consistent with the conclusions stated elsewhere in the text.

2. Page 2-28, Paragraph 1. The text specifies an average horizontal groundwater gradient through the surficial materials at the East Landfill Pond embankment that is calculated from water levels at wells TH04742 and 4187. Well 4187 is screened across an unweathered sandstone at a depth of 81 to 94 feet and should be considered part of the lower hydrostratigraphic unit (LHSU), whereas well TH04742 is screened across artificial fill

(embankment material) and subcropping, weathered sandstone. This well should be considered to be screened in the UHSU. Geologic cross-section G-G' (Figure 2-15) also depicts groundwater in well 4187 as having a different (about 70 feet lower) potentiometric surface than well TH047492. Therefore, well 4187 should not be used to calculate hydraulic gradients in surficial materials, or in the UHSU. Wells TH047292 and TH047492, both of which are screened across artificial fill and subcropping, weathered bedrock, should be used to calculate the UHSU hydraulic gradient instead.

3. Page 2-28, Paragraph 2. This paragraph provides average linear groundwater flow velocities in weathered bedrock along three flow paths, one of which is below the East Landfill Pond embankment, between wells TH047492 and 4187. The input parameters for this calculation include a geometric mean hydraulic conductivity value of 4.37×10^{-7} centimeters per second (cm/sec) estimated using drawdown recovery test data from wells 70193 and 70493. Wells 70193 and 70493 are both screened in claystone and clayey siltstone, whereas well TH047492 is screened in sandstone. Therefore, the hydraulic conductivity value derived from wells 70193 and 70493 is inappropriate to use for the area beneath the East Landfill Pond embankment, which is underlain, at least in part, by sandstone. The phase II field investigation should include a drawdown recovery test in the weathered sandstone beneath or adjacent to the East Landfill Pond embankment, either in well TH047492 or in a new well that is screened in sandstone.

4. Page 2-31, Paragraph 2. This paragraph discusses the effectiveness of the south slurry wall at diverting water away from the landfill. Hydrograph EE-EE' (Figure 2-36) is cited as an indication that the slurry wall is diverting water from the landfill because water levels are 2 to 6 feet lower on the north (downgradient) side of the wall. The paragraph also cites the potentiometric (Figures 2-21 through 2-24) and isopach (Figures 2-29 and 2-30) maps as supporting this interpretation because they show lower water levels north of the wall. However, the isopach and potentiometric maps also show a large unsaturated area east of the wall, which is in a downgradient direction beyond the end of the wall. Groundwater should be diverted to this area if the wall is functioning properly. This paragraph should discuss the presence of this large unsaturated area, and the implications that this unsaturated area may have on the evaluation of the south slurry wall's effectiveness.

5. Page 2-50, Paragraph 3. The text states that western wheatgrass is both the dominant graminoid in the mesic mixed grassland community of OU7, yet also describes it as a species present in lesser amounts than a dominant species. The text should be clarified to indicate the correct category for western wheatgrass.

6. Page 2-51, Paragraph 3. The text states that the disturbed community included 27 species, of which seven were grasses, 18 were forbs, and two were subshrubs. The text then states that the only shrub present was wild tarragon. Fringed sage is included with forbs. It is not clear what species were considered to be subshrubs or what criteria were used to distinguish shrubs and subshrubs. The text should be clarified to describe the criteria used to distinguish the components of the disturbed community, and to identify the species included in each.

7. Pages 2-52 and 2-53. The text discusses wildlife surveys undertaken at Rocky Flats but cites only the environmental impact statement (EIS) produced in 1980. It is not clear whether the majority of the text is based on the EIS or on more recent studies. Because more recent data exist, a 14-year-old EIS report based on older data should not be used as the primary source of information on the site. The most recent data should be used.

8. Figure 2-40. The analysis of groundwater levels at well pair 6787/6887 (pages 2-30 and 2-31) concludes that "groundwater appears to be flowing over and/or through the slurry wall." Figure 2-40, which depicts groundwater inflow and outflow boundaries of the landfill, should be revised to reflect this conclusion. Water balance calculations in Section 2.6.7 should also be revised to reflect the longer inflow boundary.

9. Figure 2-42. The figure indicates that two locations in the pond were sampled for water and sediment toxicity studies. The results of those studies were not provided in the discussion of ecological data provided in the text. These results should be discussed.

10. Table 2-9. This table summarizes lateral (horizontal) hydraulic gradients that were calculated for surficial materials and weathered bedrock. The hydraulic gradient values are questionable for a number of reasons. Horizontal hydraulic gradient is defined as a change in head from one well to another well divided by the horizontal distance between the two wells. Therefore, it is impossible that two different horizontal hydraulic gradients representing two different geologic units could be calculated between the same two well screens, as has been done for

each pair of wells listed in the table. Furthermore, hydraulic gradients in weathered bedrock are provided for each well pair even though five of the six wells are screened in surficial materials. The only well screened in bedrock is screened in the LHSU and should not be included in this analysis of UHSU hydraulic gradients. Horizontal hydraulic gradients should be recalculated in a manner that makes sense hydrogeologically, and raw data (water level measurements and their dates) should be included with the table. Furthermore, this analysis would be less confusing if the wells were divided primarily by hydrostratigraphic unit rather than by geologic unit, because some wells are screened across two geologic units.

11. Figure 2-8. The groundwater intercept system is depicted in Figure 2-8 as consisting of perforated pipe along the entire length of the system. This depiction contradicts all of the other figures, which show the perforated section extending only to, or slightly beyond, the western ends of the north and south slurry walls. The figure should be corrected to accurately depict the perforated section of the groundwater intercept system.

12. Figure 2-13. Text and figures are not consistent regarding the location of well B106089 relative to the groundwater intercept system. Well B106089 is clearly depicted as being inside the groundwater intercept system on geologic cross-section E-E' (Figure 2-13) and on all of the potentiometric and isopach maps. However, hydrograph FF-FF' (Figure 2-37) states that well B106089 is located outside the groundwater intercept system. The text on page 2-29 (which discusses hydrograph FF-FF') and page 2-34 (which discusses the evaluation of the leachate control system) also indicates that well B106089 is outside the groundwater intercept system. Figures and text should be revised to be consistent. If the location of well B106089 relative to the groundwater intercept system is not known with certainty, it should be clearly stated in the text.

13. Figures 2-29 and 2-30. The two isopach (saturated thickness of surficial materials) maps are poorly drawn and may lead to errors in the calculation of landfill leachate volume. The most prominent feature on these maps is a groundwater mound that is greater than 20 feet thick at wells 72093 and 72393 in the center of the landfill. This mound extends from the area northwest of the landfill, where the groundwater intercept system is not keyed into bedrock, and terminates abruptly beyond this well pair. The only data points in the downgradient direction within the landfill are well pair 72293/72493, where the saturated thickness is about 2.5 feet. The bedrock topography map (Figure 2-17) shows that this well pair is situated on a

bedrock ridge (interfluve) and that a channel incised into the bedrock surface probably leads from well pair 72093/72393 to cone petrometer test (CPT) point 01493 to a location at or slightly north of CPT point 02293 and then below the East Landfill Pond. This channel passes north of well pair 72293/72493, which may be the reason that the saturated thickness is only 2.5 feet at this location. Given the bedrock surface depicted in Figure 2-17, the most logical interpretation would be that groundwater below well pair 72093/72393 will follow the incised channel surface down to East Landfill Pond, forming a complete groundwater/leachate pathway to the pond. This interpretation would be consistent with the statement on page 2-20 of the text: "....in the incised stream valley, groundwater flows toward the drainage or the East Landfill Pond, following the topography." Figures 2-29 and 2-30 should be revised to be consistent with this interpretation. Calculations of landfill leachate volume should also be revised to be consistent with this interpretation.

14. Section 3.1.6. This section discusses the accuracy of the OU7 data. Accuracy measures the bias in a measurement system. Bias is defined as:

$$\%B = 100 - \%R$$

%R = the percent recovery of a spike of a known analyte.

Accuracy was measured only for the dissolved and total metals of groundwater samples. All matrices and analytes should be assessed for accuracy to fulfill the DQOs.

15. Table 3-2. Table 3-2 summarizes the actual QC samples collected at OU7. There are discrepancies between the required frequency of QC samples (Table 3-1) and the actual QC samples collected. For example, of the 48 real soil gas samples collected at IHSS 203, only two field duplicate samples were collected. The required frequency of field duplicates as stated in Table 3-1 is one duplicate per 10 real samples or one duplicate per sampling event (whichever is more frequent). Therefore, the required QC sample criterion was not met.

16. Section 3.1.2.2, Page 3-4, Third Paragraph; and Table 3-5. This section discusses the results of the data validation. These results are presented in Table 3-5. Discrepancies exit between the table and the discussion on page 3-4. For example, the percent results rejected (%R) of subsurface geologic material analyzed for radionuclides was calculated as 8%R. This value is

really 10%R. Also, this section states that 72 percent of groundwater data were validated. This value was recalculated to be 55 percent. The values in this section should be recalculated for accurate results, and the text and tables corrected to be consistent.

17. Section 3.1.5.4, Page 3-12, Third Paragraph. The RPDs were not calculated for VOCs in subsurface geologic material duplicate sample pairs. When assessing the data quality and usability, it is important to evaluate the precision of the data. Without the RPD, an overall assessment of precision is impossible. RPDs should be calculated and reported for all analyses on all matrices.

18. Section 3.1.7.1, Page 3-23, Third Paragraph. This section concludes that based on the frequency of detection and concentrations detected in equipment rinsates, the data are well represented. However, Table J-9 presented analytes (for example, trichloroethylene [TCE]) that were detected in every equipment rinsate. Therefore, the statement that the data are well represented based on the frequency of detection is unfounded. This should be corrected to state that the frequency of detection and concentrations of analytes in equipment rinsates may have affected the representativeness of soil gas samples.

19. Section 3.1.7.3, Page 3-23, Fifth Paragraph. This section states that the metals detected in the equipment rinsates were "most likely" present in the distilled water (source water) used to rinse the equipment. The source water used for equipment rinsates should be analyzed and reported so that data support this statement.

20. Sections 3.1.7.3 through 3.1.7.7. These sections discuss the representativeness of the data. Representativeness is analyzed with results from the equipment rinsates. Inaccurate equipment rinsate data are presented. For example, Section 3.1.7.4 states that 10 equipment rinsates were collected. However, corresponding Table J-12 shows that many analytes are not represented 10 times. All statements presented in the text should be supported by correct data in the tables.

21. Section 3.1.8, Page 3-30, Third Paragraph. The second sentence states that analytical data for soil gas did not meet the target 90-percent completeness goal. The third sentence claims that the soil gas analytical data exceeded the 100-percent completeness goal. These are

conflicting statements. The percent completeness for soil gas needs to be reassessed and consistently reported.

22. Section 3.1.8, Page 3-31, Second Paragraph. Section 3.1.8 discusses completeness, which is represented in Table 3-5. As previously stated in specific comment number 16, discrepancies exist throughout Table 3-5. Therefore, Section 3.1.8 needs to be reassessed after Table 3-5 is reevaluated.

23. Section 4.1, Page 4-1, Second Paragraph. The text states that histograms and box-and-whisker plots for each analyte from each medium were generated for both site and background data. Gilbert (1993) recommends that probability plots also be generated in order to determine the distribution of the data (that is, lognormal, normal, Weibull, or gamma). At a minimum, the text should describe how the distribution of the data was determined. Knowing the distribution of the data helps to select the optimum statistical test.

24. Page 4-5, Second Paragraph. The text states that the hot-measurement test will compare each measurement to a corresponding upper tolerance limit $(UTL)_{99/99}$ value. The computed 99-percent UTL $(UTL_{99/99})$ is such that one is 99-percent confident the UTL is equal to or greater than the true 99th percentile of the population of background measurements. Gilbert (1993) recommends the use of a $UTL_{95/95}$ value. The result of using the $UTL_{99/99}$ is a larger false negative error rate (that is, measurements from contaminated OUs would not be flagged). In other words, the use of a $UTL_{99/99}$ increases the possibility of eliminating a chemical as a PCOC based on background comparison when it is actually above background. This type of error should be minimized to the extent possible. An explanation of why the $UTL_{99/99}$ rather than the $UTL_{95/95}$ was used and the potential outcome of using this criterion should be provided for the reader.

25. Page 4-24, Second Paragraph. The text states that the activity of americium-241 in one surface water sample from location SW098 exceeded the $UTL_{99/99}$ value. According to Table 4-20, it appears that uranium-235 and americium-238 also exceed their corresponding $UTL_{99/99}$ values. The text should be corrected to be consistent with the table.

26. Page 4-25, Second Paragraph. The text states that Table 4-20 lists six VOCs and one semivolatile organic compound (SVOC) as PCOCs. Table 4-20 presents four VOCs and two SVOCs as PCOCs. The text should be corrected to be consistent with the table.

27. Page 4-27, Third and Fourth Paragraphs. These sections state that total VOC concentrations were estimated by summing the concentrations of the most frequently detected VOCs at OU7. This procedure is not typically performed in risk assessments and is not consistent with current Risk Assessment Guidance for Superfund (RAGS) EPA 1989). The text should describe how this information will be used in the risk assessment.

28. Page 4-35, Fifth Paragraph. The text states that methylene chloride and acetone were detected in laboratory blanks. RAGS states that common laboratory contaminants may not be eliminated from the COC selection process unless they are less than 10 times the contaminant concentration in the blank sample. The text should provide this information and these chemicals should not be eliminated unless they are less than 10 times the concentration in the laboratory blank.

29. Page 4-27, Paragraph 3. The use of "total" VOC concentrations to evaluate the nature and extent of VOC contamination is not appropriate. The nature and extent should be evaluated for individual constituents or groups of similar compounds (such as chlorinated VOCs). The text should be modified to include this evaluation.

30. Page 5-11, Paragraph 1. The text concludes that two sediment samples collected from the East Landfill Pond are sufficient to characterize the extent of contamination in East Landfill Pond sediment. This conclusion is based on a calculation using an equation presented in Section 5.4.7. However, the variance used in this calculation was determined from the analysis of three samples. In general, analytical results from three samples is not considered sufficient to provide an accurate estimate of variance. Therefore, additional sampling of the East Landfill Pond sediments is necessary to determine the nature and extent of contamination in pond sediments. The additional data would also be useful in assessing the fate and transport of contaminants entering the pond and in determining the remediation potential of the system (see general comment 7).

31. Section 5.6.3, Page 5-22, Item 1. The first item of this paragraph lists types of data needed for landfill cap design, but does not address future landfill settlement. An effort should be made to predict future settlement of the landfill. Differential settlement will occur across the site based on the overall thickness and age of the waste, moisture content, and type of waste. The design of the landfill cap or post-closure maintenance of the cap will be affected by the overall settlement. Evaluation of the settlement prior to design will provide a more realistic and functional cap design or post-closure maintenance program.

32. Section 5.6.3, Page 5-22, Item 2. The second item of this paragraph lists information needed for leachate control, but does not address migration of upgradient groundwater through or beneath the groundwater diversion system and into the landfill. Further evaluation or discussion of the existing leachate control/groundwater diversion systems should be included to assess their impact on the volume and rate of leachate generated.

33. Section 5.6.5, Page 5-25, Decision Route 4. Landfill gas control is typically necessary to ensure cap integrity and meet potential air emission applicable and relevant or appropriate requirements (ARARs). If gas treatment is not necessary based on ARARs, gas control should still be considered to ensure cap integrity and potential gas migration problems. The text should be modified to address potential gas migration problems.

34. Section 6.4, Page 6-14. This section presents the methodology for collecting samples to determine the physical properties of the interim soil cover. It is assumed that this determination will be used to evaluate the appropriateness of the interim soil cover as a final cover or as a structural base for the final cover. The text should be modified to clearly support this assumption.

The procedures state that the samples will be collected from the upper 2 inches of the cover. This appears to be inadequate to evaluate the properties of the interim cover. Samples that represent the entire profile of the interim soil cover would be more appropriate. The stability or structural quality of the soil will also be based on the stability of the refuse. The decomposition or consolidation potential of the refuse should also be determined to evaluate final cover options (see specific comment number 31).

Additionally, physical properties of the soil are being evaluated. Therefore, procedures related to collection of samples for chemical analysis (such as equipment rinse blanks and decontamination) are not necessary and should be deleted from the discussion.

35. Page 6-4, Paragraph 4. This paragraph proposes eight additional monitoring wells to meet three objectives, one of which is to evaluate the effectiveness of the groundwater intercept system. However, no action is proposed to close the gap in data for the north slurry wall. The slurry wall should be accurately located relative to well pair 6787/6887. If it is determined that the well pair straddles the slurry wall, it should be concluded that the slurry wall is ineffective and that groundwater recharges the landfill along this boundary. Water balance calculations, leachate volume calculations, and inputs to the Hydrologic Evaluation of Landfill Performance (HELP) model should be revised accordingly. If it is determined that the well pair does not straddle the slurry wall, a monitoring well should be installed on the opposite side of the wall from the well pair at this location.

36. Page 6-12, Paragraph 1. The discussion on drawdown recovery testing states that the test will be started immediately after the last bailer of water is removed from the well. The test should be more accurate if it is started the instant the bailer is lifted above the water level in the well.

37. Figure 6-3. The well pair that is to be drilled astride the north groundwater intercept system is not depicted on this figure showing proposed phase II monitoring well locations. These wells should be added to the figure.

38. Section 7-1, Page 7-1, Second Paragraph. This paragraph discusses the list of field QC samples collected at OU7. Matrix spike (MS) and matrix spike duplicates (MSD) are not included in this list. MS/MSD samples are collected in the field at the time of sampling and are used to evaluate analytical precision and accuracy. MS/MSD is a routine application of QC procedures for controlling the reliability and defensibility of data collected. MS/MSDs should be included in the field QC program and discussed in this section.

39. Section 7-1, Page 7-1, Sixth Paragraph. This paragraph states that trip blanks will accompany each shipment of water samples for VOC analysis. Trip blanks are used to assess sources of contamination and cross contamination and their impact on data quality. Trip blanks should

accompany all matrices that receive VOC analysis, including water samples. The sampling program and the text should be modified to include trip blanks with all VOC samples collected.

40. Section 7.2, Page 7-2, Second Paragraph. This paragraph states that QC procedures for non-CLP methods will be developed as needed. QC procedures should be addressed prior to sampling and analysis. All analytical methods and QC procedures should be discussed in the revised work plan.

41. Section 7.3.2, Page 7-3, Second Paragraph. This section states that accuracy is expressed as a %R of a spike. Accuracy is not only the assessment of the %R but also evaluation of field and trip blanks. Accuracy measures the bias of the sampling and analytical procedures and all appropriate QC samples should be evaluated and described in the revised work plan.

4.0 CONCLUSION

The OU7 Revised Work Plan has three significant problems: (1) the site hydrogeology is poorly characterized; (2) the analysis of data quality and useability is incomplete and deviates frequently from standard practices; and (3) it is not clear from the text how the presumptive remedy will be implemented and whether enough data will be collected to assure efficient operation and maintenance of the closed landfill.

Most of the problems with the hydrogeologic characterization can be attributed to uncertainty in the location of landfill structures. Broad assumptions regarding the effectiveness of the groundwater diversion/leachate control systems and slurry walls are incorporated into the water balance and the calculations of leachate volume, and ultimately will be incorporated into the modeling of leachate flow rate. These assumptions and data gaps would be reduced if landfill structures were accurately located. In addition, poor application of basic hydrogeologic principles is evident in the calculation of hydraulic gradients. The presentation of the water balance is unfocused and confusing and does not appear to be linked to a site conceptual model.

The data quality analysis often deviates from established practices or is inconsistently applied to different analyte groups. A more thorough data quality analysis should be performed; other sections of the report may then have to be revised, depending on the results of the analysis.

The presumptive remedy is not presented in sufficient detail to ascertain whether significant issues in the operation and maintenance of the presumptive remedy, such as landfill settlement and gas control to ensure cap integrity, will be addressed. Furthermore, it is never explicitly stated whether the existing landfill boundary structures (groundwater collection/leachate control systems and slurry walls) are to be incorporated into the design and whether they will require any upgrading. Finally, the remediation of the East Landfill Pond should be discussed in more detail, particularly regarding how leachate control will be handled if the pond is significantly altered during remediation.

5.0 REFERENCES

Gilbert, R.C. 1993. Letter Report to Beverly Ramsey, Systematic Management Services, Inc.

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