EM-453 COMMENTS ON: DRAFT, PHASE III RFI/RI REPORT, ROCKY FLATS PLANT, 881 HILLSIDE AREA OPERABLE UNIT NO. 1 APPENDICES

APPENDIX E - ENVIRONMENTAL EVALUATION

<u>GENERAL COMMENTS:</u>

1. *The RFI/RI report (Vols. I and II) is written in a style that implies less uncertainty than is evident from a review of the appendices. The concerns raised in this appendix would not be apparent from reading the first two volumes of this report.*

   Response: The appearance of inconsistency of viewpoints between Appendix E and the RI has been corrected.

2. *The overall process as it relates to decision-making is not clear. It is recommended that text be added to clarify how the results of the Environmental Evaluation (EE) will be used.*

   Response: A flow chart that shows the decision-making process, clarifying how decisions are made and showing the integration of each step in the RI/FS process related to how the results of the EE will be used, appears in the RI.

3. *It appears that the EE is in need of a decision matrix (or tree) which defines when no further action is necessary. The ten task approach appears to be a template strategy that must be completed in its entirety before the EE can reach a conclusion. As it is currently configured and implemented, the EE approach may not have the flexibility to take advantage of opportunities for early conclusion.*

   The OU1 RFI/RI investigation should be used as a tool to indicate where the EE approach can be streamlined and improved. It is not apparent from the previous OU work plans that potential improvements in the EE strategy can be incorporated into later investigations. One issue that should be apparent from the OU1 EE is the need to verify that the EE process can be justifiably terminated without completing all of the ten steps. In an attempt to address this issue, it is requested that a copy of the Scope of Work to the subcontractors be made available for review.

   Response: The need for a decision matrix that defines when no further action is necessary was addressed in a "Lessons Learned" meeting with DOE, HAZWRAP, EG&G, and EBASCO representatives on July 30, 1992. This question appears to pertain more to improving efficiency on future operable units.

4. *The RFI/RI report would benefit from a consolidation of the text information into a few tables and graphs. As in the OU1 work plan, the EE process relies on phrase instead of clear graphical presentations. The entire process is confusing and seems to wander from point to point without identifying a critical path. The text would greatly benefit from graphical depictions of the strategy being employed to define the EE approach.*

Response: The comment that use clear graphical presentations would help identify the critical path is a good point. EBASCO has prepared graphics to help define the process, e.g., flow charts for screening COCs in Section E4.0.

5. *The first seventy four pages of E.2.0 Site Description read like a field guide to the biota of Rocky Flats. While this information may be necessary for the EE, it should not dominate the report. The descriptive material should be placed at the end of this appendix or briefly presented in tabular form. Physio-chemical and biological evaluations could also be presented in tables. There is a distinct need to reduce this information and provide a means of rapidly compare the results of the field activities.*

Response: The first seventy pages, "the nature study" was presented in the Draft OU1 EE because the data were not available from any other source at that time. Information on the biota at RFP is currently available in the <u>Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant</u> (delivered to DOE in September 1992).

6. *After reviewing the EE process, it is not clear why selection of contaminants of concern (COCs) was considered necessary when the field surveys indicated that contamination was not a problem at OU1.*

In light of the entire process, it appears more desirable to first select COCs and complete the exposure and toxicity assessments for a risk characterization which subsequently would direct the field investigations. Using the risk characterization would provide a more direct and selective approach to identifying targets for further analysis. It is recommended that specific criteria be delineated which would describe conditions under which field surveys would be undertaken and those which would not call for further investigation.

Response: Selection of contaminants of concern was necessary for the OU1 EE because the field survey had not been completed when the EE study began.

7. *It is recommended that a more prominent table of the toxic reference values (TRVs) and final reference values (FRVs) including those that will be used for organisms higher on the food chain be included in this document. The literature cited supporting the use of various correction factors to be applied to the toxicological value was not available for review. Typically, however, a correction factor of 10 is applied for each area of uncertainty. Additionally, the document should present the equations used for derivation of TRVs for arsenic, cadmium, and copper (it is said they are based on biomagnification potential); and the exposure factors used (e.g. bioaccumulation factors for species considered etc.). Where TRVs are based on toxicological literature, the reference should be included in Table E-5.3.1-1.*

Response: The arrival of TRVs and FRVs was based on publications of Lewis et al. (1990) and Weil (1972) and is documented in open literature. Please see Section E7.0 of the Final OU1 EE for the complete citations.

8. *The major conclusion from the EE of OU1 indicates that contamination from the identified sources probably does not have an adverse effect on the biota. The EE does not provide a description [of] conditions necessary to confirm an adverse effect within the biological community at OU1. With such a result, it is not clear if the EE methodology could have detected the presence of an adverse effect.*

Response: The major conclusion of the draft OU1 EE was vague because the surface soils data were not available. This information was incorporated in the Final OU1 EE along with appropriate conclusions based on the strength of data.

9. *The TRVs are said to be set based on bioaccumulation but the equations used to derive these concentrations are not presented. It is recommended the equation appear in the text or in an appendix. All factors used to derive those values should also be presented in the document.*

Response: The TRVs presented in the Draft OU1 EE did not include equations because there were no equations. All data were based on empirical results from laboratory analyses and studies.

10. *It is recommended that the derivation of a benchmark protective of communities be reported in the document. No Adverse Effect Levels (NOAELs) and Lowest Adverse Effect Levels (LOAELs) are based on the responses of individuals so any corrections applied to represent protection at the population/community level should be shown either in the text or in an appendix.*

Response: The use of a benchmark value for protection of communities was suggested. This was done in the Draft, as well as the Final OU1 EE. The report explains the process that used TRVs and FRVs based on the most sensitive organisms from each group of organisms evaluated.

11. *It is recommended that the authors refrain from using the term, significant, in the RFI/RI report unless it refers to a specific statistical analysis where the level of significance is clearly defined.*

Response: The current report does not use "significant" except as related to a specific statistical analysis where the level of significance is clearly defined.

APPENDIX F - PUBLIC HEALTH EVALUATION

GENERAL COMMENTS:

12. *The risk assessment was carried out on data from samples gathered in Phases I and II. Accordingly, what is lacking from this synthesis is a clear-cut description of how well or badly the different phases of the study can be integrated, and how the data quality objectives (DQOs) from the different phases of the study may compare with each other.*

In general, the identification of the ground water samples with a 1990 and 1991 sampling collection effort, although the soil samples date back to 1987, does not give grounds for confidence that the accumulated data will form a coherent basis for the establishment of discrete remediation goals or to allow an adequate testing of the no action alternative. The collection effort was biased towards the Individual Hazardous Substance Sites (IHSSs) again fails to give reassurance that the body of data will serve to provide an adequate basis for a scientifically-based decision on the extent to which the pollutants at the site may constitute a viable hazard to human health.

Response: The risk assessment has been revised to include Phase III subsurface soils, surface soils, surface waters, sediments, and ground water data. Data from the interim period between Phase II and Phase III (more specifically 1990 and 1991) supplemented the surface water, sediment, and groundwater data.

The DQOs for phases of investigation at OU1 have focused on filling data gaps. This type of phased approach is recommended by EPA, with each phase building upon the existing data. As a result, the data generated should be fully integratable.

One objective of the Phase III investigation was to collect subsurface soil data to confirm that the subsurface soils were not a source of volatile organic compound contamination. This concept was based on the fact that volatile organic compounds were not observed in the 1987 boreholes. The 1987 data, in conjunction with the Phase III data, provide a basis for the conclusion that volatiles are not retained in subsurface soils; thus, these soils do not act as a source. These data were used together to support the source characterization in the subsurface at OU1. The low-level semivolatile organic compounds detected in subsurface soil in both the 1987 and 1991 samples are not observed in ground water from 1990, 1991, Phase III. The combination of these data sets (subsurface soils and ground water) indicates that semivolatile organic compounds are immobile and adsorbed to the subsurface soil. These types of conclusions would not be possible if all phases of investigation were treated as separate and discrete events.

For the PHE, the delineation of contamination at the IHSSs is the most important. Maximum concentrations observed were used to identify COCs. Data generated to assess the extent of contamination was not used for this purpose.

13. *Tables 1 and 2 of Appendix F-6 give a well thought out demonstration of how various bodies of carcinogenic and non carcinogenic risk data may be pooled. This has been done, for non-carcinogenic endpoints, according to target organ, or, for carcinogenic endpoints, according to the weight-of-evidence classification. A large amount of raw data has been summarized in a readily assimilable form.*

A step by step demonstration of how these risk values were derived is needed. Such a demonstration could perhaps best be achieved by using a tabular format. The derivation should include more than merely the product of an intake concentration with either the slope factor or the reciprocal of the Reference Dose (RfD). What are required are specific derivations of the intake concentrations for the exposure scenarios, using clearly defined input values, whether the arithmetic mean, geometric mean, or 95% Upper Confidence Limits (UCL) etc., factored with specified verifiable physiological estimate parameters.

The application of quantitative uncertainty analysis to the conversion of field data to an approximation of dose concentration, and how such intake values might then be used to calculate risk, should be much more clearly described. Large figures in Section 5, with much more descriptive annotation would be a useful additional component of this clarification process. The use of the results of the uncertainty analysis in the further determination of intake concentration is another important requirement. Every effort should be pursued to give assurance that the mathematical approach is sound by providing enough data and guidance to allow readers to follow the transformations from field data to computed risk. <u>The present compendium of field data, descriptive statistics, estimate parameters, and risk estimates contained variously in Tables 2-3 through 2-6,</u>

Table 3-11, Tables 5-2 and 5-4, and Tables 6-1 and 6-2, do not allow an informed reader to manipulate the data and readily confirm the reported risk values.

Response: Additional explanation of the estimation of risk values and quantitative uncertainty analysis was provided in Attachments F4, F5, and F7 of the October 1992 draft PHE.

14. *The rationale for the exclusion of potentially important exposure scenarios and pathways should be discussed in detail. Reference to Tables 1 and 2 of Appendix F-6 makes clear that no risk determinations have been carried out based on the ingestion of ground water or home-grown vegetables under the future on-site residential exposure scenario, whereas home-grown vegetables are considered under the current off-site scenario. Although agricultural land uses are prominent in the vicinity of the Rocky Flats Plant (RFP), no agricultural exposure scenarios are evaluated for future conditions.*

Response: The rationale for the inclusion/exclusion of pathways was discussed in Technical Memorandum No. 6, Exposure Scenarios. The home-grown fruits and vegetables pathway was included for the hypothetical future on-site residential scenario.

15. *Methodologies used to derive exposure concentration should be revised. Although the methodology used to derive exposure concentrations for soils is not clearly defined, apparently, subsurface soil samples were used to derive the exposure concentrations. The use of subsurface soil data (e.g., soil samples collected at a depth of greater than 1-2 feet) in the calculation of human health risks due to ingestion and inhalation exposure routes in inappropriate, especially in view of the potential importance of wind-blown radionuclide contamination.*

Response: Due to the 3-month schedule extension, surface soil data became available and was included in the October 1992 draft PHE.

16. *Taking Volume XVII as a stand alone report, the apparent absence of a clear statement of the site-specific objectives of the risk assessment, and of any delineation of adequate Data Quality Objectives (DQOs) using the methodology recently developed by the EPA Quality Assurance Management Staff, cast doubt on whether the plan has conformed to the requirements for remedial investigation scoping as set forth in Guidance for Conducting Remedial Investigations and Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), U.S. Environmental Protection Agency (EPA) EPA/540/G-89/004 (1988). Failure to conform with the guidelines for such scoping activities and for the establishment of DQOs and preliminary remediation goals may result in a data collection and analysis effort which does not adequately control uncertainty and does not provide a quantitative basis for scientifically justifiable decision-making.*

Response: The DQOs specific to the PHE prescribed in the Phase III work plan specified the use of existing data to conduct the PHE. In this sense, the objective was met. However, the objective was abandoned in favor of using interim monitoring and Phase III data to conduct the PHE. The rationale for using 1987 borehole data was discussed in response to General Comment 12.

17. *Applicable or Relevant and Appropriate Requirements (ARARs) should be evaluated in addition to risks computed from the actual levels of pollutants in the environmental matrix. In this report Reference Doses (RfDs), Reference Concentrations (RfCs), and slope factors, as derived from EPA's Integrated Risk Information Service (IRIS) and other secondary references have almost exclusively used, as their source of human toxicity reference values. This appears to ignore the importance of ARARs in limiting concentrations or doses of potential contaminants in various media.*

Response: Evaluation of ARARs is an important step of the FS and is currently in progress.

18. *Volume XVII of this report should be written to be less repetitive. For example, the same material appears in chapter six of Volume I, often in almost identical language. The same material then reappears in Chapter 7 of Volume XVII, and in Appendices F1-F6. Again the prose and tables are nearly identical.*

Response: Considerable information is presented in Technical Memoranda Nos. 6, 7, 8, 9, and are presented, as issued, as Attachments to the PHE. Due to the dual goal of writing a PHE that is appropriate both for inclusion in the RI and as a stand-alone document, some redundancy cannot be avoided. Where possible, redundancy has been reduced.

19. *The pooling of carcinogenic risk according to the weight-of-evidence classification is harder to justify. An equally good case could be made for pooling the cancer risk data according to target organ specificity in a like manner to the non-carcinogenic data. Similarly, one could justify pooling all the cancer risk data into one category.*

Response: Assignment of a single target organ for presentation of risk purposes involves simplification, as does the current classification scheme for carcinogens. The weight-of-evidence classification has been retained, but recommendations for changing the classification scheme made by the Center for Risk Analysis at the Harvard School of Public Health have been included.

20. *The statement "the impacts calculated under the on-site residential land use scenario are extremely health-conservative; actual exposure, even under plausible future use scenarios, will undoubtedly be much lower" [and] should be thoroughly explained. More detailed justification for this statement should be provided in view of: (1) the large uncertainty surrounding the risk estimates, (2) the fact that Phase III data were not used in the risk calculations, (3) the extremely long-term persistence of radionuclides in the environment, (4) the apparent use of subsurface soil data in the development of soil ingestion and inhalation exposure concentrations, (5) the exclusion of ground water and home-grown vegetable ingestion pathways, and (6) the exclusion of agricultural exposure scenarios.*

Response: In the October 1992 draft PHE, an expanded uncertainty analysis was performed that supports the statement. Also, Phase III data were included in this revision.

21. *The validity of data obtained from samples that were collected during the Phase III subsurface soil sampling program can be questioned. During this event, subsurface soil samples were composited from 6 feet intervals for all analytes except volatile organic compounds. The resolution capabilities of such a sampling design should be questioned. Composite samples represent an average over a wide depth or area. As such, they can "dilute" high concentrations in any one depth or area within its range. In addition, no measurement of the variance within composites can be obtained and thus no measurement of precision can be made. Composites measure the variability of the parts of the population but not the variability within each part which could be significant particularly if contamination is stratified and the thickness of contamination is less than the sample interval. It is suggested that RFP reevaluate the soil sampling program and recognize the limitations and define the decisions that can be made from results of the samples that were collected.*

Response: The subsurface soil sampling protocol was prescribed in the Phase III work plan, and was based on the findings of Phases I and II; thus, the validity of the protocol should not be questioned here.

22. *The utility of site-wide background concentrations in addressing unit-specific conditions should be reviewed. It is recognized in Section 4 of this report that for various common rock-forming elements, on-site concentrations exceed site-wide concentrations. However, these constituents are not considered contaminants on the basis that they are common rock-forming elements. It is possible then that additional on-site constituents may also exceed site-wide background concentrations, but may be present at site background concentrations, and be considered as contaminants on the basis that they are not "common rock-forming elements." We suggest that RFP aggressively embrace the use of site-specific background data (such as that identified for the surficial soil sampling*

conducted during Phase III) and employ rigorous statistical techniques (defined in the report) by which possible contaminants will be identified.

Response: The Site-wide Biochemical Characterization Program was designed to be used in conducting the RFI/RIs at RFP. The locations selected are upgradient of all RFP OUs and provide true background for the plant. OU1 is situated downgradient of other RFP operable units; thus, a site-specific background for OU1 would not be out of the influence from other contaminated areas. The use of such a background may result in elimination of contaminants at OU1 that are attributable to contamination from other OUs. This would raise the question of the utility of performing a risk assessment for the site-specific background. By using upgradient background values, or by using background values from other operable units, outside the influence of contamination from other OUs, the point of reference for all operable units is consistent. This is a better approach for assessing contaminants at individual operable units.

It should also be noted that the location of the background surface soil samples does not support the concept of site-specific background. Background locations are situated upgradient of all RFP operations and operable units. Thus, the locations could be considered representative of a site-wide surface soil background condition. They should not be considered OU1 specific background.

23. *The source of all data used in the baseline risk assessment should be identified. If the data used were generated from different sampling phases, the useability of the data should be carefully examined.*

Response: The source of the data is indicated in the text of the report by indicating the sample location and the time frame of data acquisition.

24. *To further understand the report certain elements should be clarified. Although RAGS does not require a <u>quantitative</u> uncertainty analysis, a quantitative uncertainty analysis was conducted for the public health evaluation in this RFI/RI report. Sensitivity analysis and uncertainty propagation were applied for some exposure modeling and risk characterization. However, the following issues need clarification or were not addressed in this report:*

(1) The number of data points used in determining the probability distribution type (e.g., normal or lognormal distribution) for a particular input parameter was not provided. If data points are not adequate or representative, additional uncertainty may be introduced into the whole assessment.

Furthermore, the description of the distribution determination was not justified. Those situations where normal or lognormal distributions were not observed should be discussed further.

This report indicated that professional judgment was used when insufficient data were available. Data/information combination techniques (e.g., the Bayesian's Approach, fuzzy logic theory, Dempster-Shafer method, or the classical probability theory) should be used when objective (i.e., sampling or monitoring) and subjective (i.e., professional judgments) sources of information are utilized. This should be carefully evaluated. Otherwise, the effects caused by the "uncertainty of uncertainty" may be unacceptable.

Response: Probability distributions for input concentrations were derived from surface soil data (26 points) and soil gas modeling (100 points). Distributions for human exposure parameters were derived from EPA data in the Exposure Factors Handbook, and distributions for toxicity constants were derived at ORNL using EPA data and a nonparametric bootstrap method. Where data were not described by normal or log normal distributions, cumulative or uniform distributions were used. By using EPA data, the need for professional judgment was reduced. Consequently, the effects caused by the "uncertainty of uncertainty" were reduced.

(2) It is not clear why the sensitivity analysis was applied on soil-gas modeling and risk calculation only. Why sensitivity analysis is not conducted on other transport models should be explained.

It is not clear how the sensitivity analysis results (Appendix F, Table 5-6) of the final risk calculation were used. The purpose of a sensitivity analysis is to select the most sensitive parameters and determine their probability distributions (use deterministic values for those insensitive parameters). There is no evidence of the use of the analysis to address sensitive parameters.

Response: Limited sensitivity analysis has been applied to the air emission and transport model. The surface water overland flow model was simplified when measured concentration data (Phase III sediment and surface water data) became available for use in the exposure assessment. Sensitivity analysis on the simplified model was not necessary. The sensitivity analysis on the effect of each parameter of the final intake/risk equations was not conducted because distributions for each parameter were available.

(3) The input parameters required for running the Monte Carlo trials of the final risk calculations were not provided. The number of iterations should be determined to generate a representative sampling set. This information should be provided.

Response: Input parameters have been provided. The number of iterations was started at 100 for testing purposes and increased. Convergence was observed and 1,000 iterations were selected for each simulation.

25. *The cumulative effect of contaminants from different pathways should be addressed. Significant emphasis is placed on the range of risks calculated for single contaminants (i.e., 10^{-6} to 10^{-4}). Although attention is given to the cumulative risks in Appendix F-6, the Executive Summary and text fail to discuss this important aspect of the risk assessment.*

Response: Cumulative risks are discussed in the text and Executive Summary of October 1992 draft PHE.

26. *A detailed description of the risk and uncertainty calculations should be given.*

For the scenario with the greatest calculated risk (1.8×10^{-5}), the report states that the uncertainty is "large." It should be clarified whether this is a relative measurement or absolute measurement.

Response: A more detailed description of the risk and uncertainty calculations is provided the October 1992 draft PHE. The range of uncertainty is described in orders of magnitude.

27. *Uncertainty analysis calculations should be provided. Appendix F-7 is referenced for details of the uncertainty analysis. Appendix F-7 contains only a "review checklist."*

Response: The Monte Carlo simulations have been located in Attachment F7 of the October 1992 draft PHE.

28. *Justification for the risk screening criteria should be given and references for the information should be provided. It is not clear why 10^{-7} (carcinogenic) and 0.1 (non-carcinogenic) were used for risk screening criteria.*

Response: The screening criteria questioned has been modified. The comment is no longer valid.

Response: The NCP risk range is identified as 10^{-4} to 10^{-6}. Accordingly, risks down to 10^{-6} were identified, including 10^{-7} risks that potentially could sum to 10^{-6}.

29. *For some of the site conceptual models shown in this report, no "exposure routes" were indicated (e.g., Appendix F, Figure 3-4). These omissions should be explained or the models revised.*

Response: Figure 3-4 was designed to show pathways applicable for modeling. Exposure routes may be inferred from the information provided. Text defining exposure routes could make the figure too "busy."

30. *The two approaches for estimating overall uncertainty in the risk assessment (i.e., summation of variance and propagated error technique) should be evaluated. Determination to which one should be used and why should be provided.*

Response: Uncertainty was estimated with Monte Carlo simulations since this method relies less on statistical approximations than does summing the various technique.

31. *Whether the values of mean and standard deviation provided in Appendix F, Table 5-2 are in normal or lognormal distribution should be clarified.*

Response: Clarification of the input parameters and calculations has been provided in Attachment F4, F6, and F7.

32. *For verifying the calculated intake in each pathway (or route) a list of Contaminants of Concern (COC) concentrations should be given. An independent risk calculation for path #2 (shown in Appendix F, Section 5, Table 5-4) using the exposure assumptions given in Appendix F-4, Table 3, resulted in an Arsenic concentration of 4.9 x 10 mg/m^3 which compares closely to the concentration provided in Table 5-4 of 2.3E^{-6} mg/m^3. However, an example to support these calculations would be helpful.*

Response: Contaminant concentrations at exposure points are provided in Attachment F4 to allow verification of intake calculations.

33. *The quality control data presented in Appendix D includes trip and rinsate blanks only. The analysis and use of duplicate and split samples is not provided. The EPA guidance for assessing errors, A Rationale for the Assessment of Errors in the Sampling of Soils, (EPA/600/4-90/013) includes clear definitions of QC samples and their purpose. This guidance should be followed to determine the components of variance associated with the sampling process and natural or spatial variances.*

Response: An evaluation was performed comparing results for soil samples and the field duplicates taken during Phase III. The results are presented in Appendix D.

APPENDIX A1 - BOREHOLE DATA

GENERAL COMMENTS:

34. *Field Standard Operating Procedures (SOPs) are poorly referenced. It is recommended that references to specific SOPs for each aspect of the field work be given in the first paragraph of this section rather than the general reference.*

    Response: References to specific SOPs are made for each aspect of the field work as suggested.

35. *It is unusual for a field program of this magnitude to proceed entirely as planned. Any deviations from approved sampling plans or SOPs should be documented in this section.*

    Response: Deviations from the work plan, field sampling plan, and/or appropriate SOPs are documented regarding drilling locations (Section A1.1.1.3), well and piezometer installation (Sections A1.1.3.2 and A1.1.3.3), and soil sampling (Section A1.2.1.6).

36. *Well development is not discussed. There should be a reference to an SOP and a brief discussion of methods and criteria in the text. Development logs should be included in an attachment.*

    Response: Section A1.2.2 references appropriate SOPs for well development and water sampling. Because well development and sampling was conducted by another contractor as part of the routine monitoring program, development logs are not included as attachments to this report.

37. *It is recommended that a brief description of disposal methods for drill cuttings and waste water be included in the field summary.*

    Response: A brief discussion of disposal methods for drill cuttings and waste water is included in Section A1.1.2.1 as suggested.

38. *The well construction logs in Attachment A1 appear to be rough field logs. Final logs, that have been edited and checked for completeness, should be included with the report. These logs usually include water levels, spatial coordinates and elevations. (The boring logs are also rough field logs, however, the cover sheet indicates that final logs will be available July 30.)*

    Response: Final well construction logs and geologic borehole logs, which have been edited and checked for completeness, have been included in the attachments instead of the field logs.

39. *The report would benefit from a paragraph or more on well construction, e.g., required materials, dimensions, and a reference to a specific SOP.*

Response: Well construction specifications and references to appropriate SOPs are included in Section A1.1.3.1.

40. *No understanding of how well locations or screened intervals were chosen is conveyed either here or in Volume 1. It would be appropriate [in Volume 1] to develop and present this information in Volume 1.*

Response: Drilling locations were chosen to meet the guidelines in the work plan and were generally defined in relation to one or more of the 11 IHSS locations at OU1. Chemical sampling within and near these IHSS locations was intended to further characterize them as potential sources of contamination, and to develop a thorough understanding of the nature and extent of contamination at OU1. Geologic data supporting the physical characterization of the site were collected from every drilling location. Tables 2-3 and 2-4 (Section 2.0, Volume I) present the locations, purpose, and completion details for all boreholes and monitoring wells on an IHSS-by-IHSS basis.

41. *The text and the boring logs refer to continuous core sampling, the text indicates that all sampling was done using a 2 ft split spoon. Since continuous coring literally means that a coring device was used, it would be preferable to refer to continuous split spoon sampling.*

Response: The text has been revised to clarify sampling methods as recommended.

APPENDIX A-2 - GEOTECHNICAL DATA

GENERAL COMMENTS:

42. *Methods for geotechnical analyses should be specified.*

Response: ASTM methods for geotechnical analyses have been specified in the text in Section A2.3, Analytical Methods, as suggested.

43. *It would be proper to detail sampling methods here and discuss sources of error and uncertainty. For example, from the discussion in Appendix A1, it appears a standard split spoon rather than a Shelby tube was used to take these samples. What is the likelihood that this method disturbed the samples and affected measurements, especially permeability?*

Response: A section on sampling methods and sources of error and uncertainty has been added to Section A2.3, Field Methods. Samples were collected with sleeve-mounted split-spoon samplers according to procedures in ASTM D1586 because shelby tubes used in ASTM D1587 procedures do not have sufficient structural strength to penetrate the alluvial and bedrock materials at OU1. Because split-spoon procedures were followed, the permeability values should be used with caution (EPA 1991; *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*). Internal method consistency does, however, justify relative permeability comparisons of alluvial and bedrock materials.

APPENDIX A4 - FRENCH DRAIN GEOLOGIC CHARACTERIZATION

GENERAL COMMENTS:

44. *The significance of this data to the main report is not explained well. How this data complements the OU1 Phase III RFI/RI data and how it provides a comprehensive geologic/hydrogeologic characterization of OU1 is not clear.*

Response: The french drain geologic characterization was conducted during construction of the IM/IRA to provide information on the geology and hydrogeology of the french drain alignment for the site characterization of OU1. The most important information gathered as part of this study was the size and morphology of slumps and the occurrence of ground water in slump blocks in the alluvial ground water flow system.

45. *A general structure/design of the French Drain would improve the text. The French Drain's depth below ground surface, collection system, etc. are also information that should be presented either in this Appendix or referenced to the report. A brief description [would] of how this data relates spatially to the OU1 RFI/RI is also recommended.*

Response: A diagram showing the general structure/design of the french drain as well as a discussion of the design itself has been added to clarify the text.

46. *No vertical dimensions or sense of scale are given in the text or figures in the discussion of lithologic units or slump structures. In addition to the detailed cross sections, a scaled sketch and lithologic units encountered would be useful.*

Response: Approximate vertical and horizontal scales have been added to the figures and a range of slump dimensions have been added to the text discussion. Constructing an accurate, scaled sketch with lithologic units is inappropriate because the french drain excavation only allowed for two-dimensional views of the slump blocks.

47. *The attachments, in particular the cross sections, are not included with this appendix.*

Response: Appendix A4 text has been bound with the corresponding attachments, including the cross sections, in Volume V of the draft final report.

VOLUME I, SECTION 6

SPECIFIC COMMENTS:

1. *Section 6.1.2.1, pg. 6-4, para. 1: The OU1 Work Plan (DOE 1991b) referenced was not available for review. This and subsequent sections were reviewed based upon the assumption that the description of the physical setting provided in Section 3.0 will not change significantly.*

Response: Comment noted.

2. *Section 6.1.2.3, pg. 6-6, para. 1 and Addendum to Technical Memorandum No. 6, pg. 2, Bullets 1 and 3: Values for soil adherence, body surface area, and inhalation rate differ from the values in RAGS, 1989 (EPA/540/1-89/002). Please provide the background information utilized to arrive at the values listed. Please provide the calculation for dermal absorption factors for metals and volatile organic compounds. Adherence factor units should be changed to mg/cm^2.*

Response: References are provided for the exposure parameter values used in the October 1992 Draft PHE. In some cases, EPA documents have provided values that reflect more recent EPA information.

3. *Section 6.1.2.5, pg. 6-7, para. 1 and Appendix F-3, pg. 2-1, para. 2 and Figure 2-1: The discussion of the modeling parameter of environmental fate should be expanded to include potential degradation products resulting from potential chemical, physical, or biological transformation processes. These potential degradation products may be more or less mobile or toxic than the parent material. These issues should be addressed and incorporated into the exposure assessment. Figure 2-1 Fate column should be revised to account for transformation of potential contaminants of concern.*

Response: This section was changed in the October 1992 Draft.

4. *Section 6.1.2-5, pg. 6-7, para. 2 and Appendix F-3, Section 3.2, pg. 3-2, para. 1: Please change the references to soil gas conceptual model to Figure 2-3.*

Response: This section was changed in the October 1992 Draft.

5. *Section 6.1.2.5, pg. 6-7, para. 2 and Appendix F-3, Section 3.2.1, pp. 3-8 and 3-9: Discussions of assumptions and limitations of the Johnson model are confusing in two areas: Bullet 7 on page 3-8 and Bullet 1 on page 3-9. Each of these bullet items refer to the Jury model. Please correct these items.*

Response: This section was changed in the October 1992 Draft.

6. *Section 6.1.2.5, pg. 6-7, para. 2 and Appendix F-3, Section 3.2.2., pg. 3-12, Table 3-1: The soil adsorption coefficient (Kd) is a unitless value. Please correct this item.*

Response: The soil adsorption coefficient (Kd) is not a unitless value. The reviewers may be confused with "retardation," which is unitless.

7. *Section 6.1.2.5. pg. 6-8, para. 1 and Appendix F-3, Section 3.3.2, pg. 3-15: Section 6.1.2.5 is confusing. The last sentence states that ground water transport was not simulated, but in Appendix F-3 a model description and data summary are provided for ground water modeling. The impression is that the french drain will collect shallow ground water and preclude the need for ground water transport modeling. Please revisit this paragraph. Consideration should be given to the volatility of potential contaminants of concern from water in the french drain as a potential route of exposure to on-site and off-site receptors.*

Response: Contaminants have not yet reached the french drain and an extraction well is operating in IHSS 119.1, reducing the possibility of volatilization of contaminated water in the french drain and subsequent exposure.

8. *Section 6.1.2.5, pg. 6-8, para. 1 and Appendix F-3, Section 3.3.2, pg. 3-17, Table 3-2: The adsorption coefficient (Kd) is a unitless value. Please correct this item.*

Response: See Response 6.

9. *Section 6.1.2.5, pg. 6-8, para. 2 and Appendix F-3, Section 3-4, pg. 3-18, para. 1: These sections reference a probable source of contamination of the South Interceptor Ditch as surface runoff from the 903 Pad Area. Please define how contaminants of concern in the surface water runoff from OU1 will be quantified independently from surface runoff from the 903 Pad Area.*

Response: Quantifying surface water contamination attributable only to OU1 is accomplished by excluding the full suite of surface water data from the COC process. After the identification of OU-specific COCs in surface soil and ground water, the concentrations of only these contaminants in surface water are assessed.

VOLUME XVII, APPENDIX F:

SPECIFIC COMMENTS:

10. *Table of Contents, whole section: A number of sections are ascribed to the wrong page number in the Table of Contents. This is most evident in Chapters 5, 6, and 7. In addition, Sections 5-4, Uncertainty Error Propagation, and 5.5, Summary of Uncertainty Analysis are omitted. These errors should be corrected.*

Response: These items were corrected.

11. *Executive Summary, pg. 1, para. 2: The discussion of DQOs should be reviewed. The reference to DQOs in this paragraph appears to use the concept of data quality objectives in the wrong context. DQOs are rigorous criteria that establish the type and quality of data required to support decisions regarding remedial response activities. The various phases of the DQO process are an integral part of RI/FS scoping, and as such should have played a major role in the design of sampling protocols, thereby allowing the generation of data with a predetermined level of statistical power and level of uncertainty. The use of DQOs in this paragraph appears to have more relation to the context of analytical sensitivity. The authors should endeavor to show that the extent of their sampling and analytical effort was adequate to delineate the potential hazard to human health posed by the occurrence of pollutants at the site with predetermined and acceptable levels of probability and uncertainty.*

Response: The text has been modified.

12. *Executive Summary, pg. 1, para. 2: The ready acknowledgement that the risk assessment is based on Phase I and II data only raises the question as to whether this risk assessment is likely to meet Phase III DQOs. More details should be given about how the sampling and analytical effort in Phase III differs from and extends the effort carried out in Phases I and II.*

Response: The Phase III DQOs established in the Phase III work plan provided for the conduct of the PHE with existing data. The objective was abandoned in favor of using more recent data (i.e., Phase III and interim monitoring data). This was deemed a more technically sound approach than the Phase III work plan approach.

13. *Section 1.2, pg. 1-1, para. 1: Accounts of historic activities and a summary of known disposals of pollutants at the various IHSS's are an important descriptive element of the conceptual site model. Accordingly, this section should contain either a brief account of these features or give a reference to the material contained in Section 1.2.2 of Volume I.*

Response: A reference to the appropriate section of the RI has been provided.

14. *Section 1.5, pg. 1-4, para. 3: The second sentence should read ". . . information <u>are</u> located . . ."*

Response: This item was corrected.

15. *Section 2.1, pg. 2-1, para. 2: This report needs to address the delay in analysis and receipt of results from the analytical laboratory for the Phase III samples. A key issue which should be established is the integrity of the analytical protocols regarding holding times.*

Response: Delays in Phase III analysis were mostly related to radiological constituents. However, the assessment of holding times is a routine part of data validation. If warranted, the data was rejected and therefore not included in the PHE.

16. *Section 2.1, pg. 2-1, para. 3: The question is raised as to whether it is valid to include such temporarily separated material in the same risk assessment. The risk assessment contained in Volume XVII appears to be based on groundwater data obtained from samples collected in 1990 and 1991, and on soil samples collected in 1987. Comments on the considerable period of time which had elapsed between these two collection efforts should be made.*

Response: See General Response 12.

17. *Section 2.1, pg. 2-1, para. 4: The comment that both collection programs were biased towards identifying and monitoring the most contaminated areas at OU1 should be explained. It should be explained to what extent efforts were concentrated on samples from within or near the IHSSs, and make a formal expression of what the DQOs were.*

Response: The text has been modified to indicate compliance with the Phase III work plan.

18. *Section 2.1, pg. 2-2, para. 3: The section on data validation qualifiers should be restructured. In some cases there is too much detail and in others not enough. For example, there is no mention of what criteria would require data to be rejected, and perhaps more importantly, it is never made clear whether the number associated with the Undetected (U) designation is the sample detection limit (i.e., ug/kg of soil).*

Response: The section has been deleted.

19. *Section 2.2, whole section: The section dealing with the delineation of the chemicals of concern has been very clearly expressed.*

Response: Comment noted.

20. *Section 2.2.4, pg. 2-6, para. 1: The whole question of the choice of site and the sampling regiments for the collection of background data is not really addressed in this document. It should [be] state when and where they collected their background samples.*

Response: Reference to the background locations has been added to the text.

21. *Section 2.2.4, pg. 2-6, para. 2: It should explain why the determinant of statistical significance is 0.9.*

Response: The text has been modified.

22. *Section 2.2.5, pg. 2-7, para. 2: The Eisenbud reference should be included in the reference list.*

Response: The reference has been included.

23. *Section 2.2.5.2, pg. 2-7, para. 1: The value 1 x 10^{-6} is the incremental or excess individual lifetime cancer risk. This should be stated in the text.*

Response: The text has been modified.

24. *Section 2.2.5, pg. 2-8, para. 1: It should be made clear that the metal and radionuclide contaminants persist because of their insolubility, probably either as the oxide or sulfide, or by absorption to soil particles. The fourth sentence reads as if the contaminants persist in the environment because of their long half-lives.*

Response: The text has been modified as suggested.

25. *Section 2.3, pg. 2-12, Table 2-3: The correct units for americium and plutonium, which are probably pCi/L should be specified.*

Response: The table has been eliminated.

The concentrations of methylene chloride and tetrachloroethylene in ground water should be included in Table 2-3.

26. *Section 2.3, pg. 2-14, Table 2-5: The whole question of the true meaning of the qualifier U, raised earlier, is brought into focus in this table. The value 30U for antimony implies that 30 ug/L is the sample detection limit for this element. However, in Table 2-3, the evaluation concentration for this element is 17.2 without the qualifier. Please clarify this discrepancy.*

Response: The text has been modified to indicate "u-qualified" concentrations correspond to the sample detection limit. The use of the "evaluation concentration" has been eliminated.

27. *Section 2.3, pp. 2-12 to 2-15, Tables 2-3 to 2-6: The choice of arithmetic mean, geometric mean, or median as the parameter to describe the central tendency should be justified.*

Response: The use of central tendency values has been eliminated.

28. *Section 3.0, pg. 3-1, para. 1: The second bullet should also mention the transport of contaminants.*

Response: This item was corrected.

29. *Section 3.2.1, pg. 3-10, Table 3-1: The title "Vicinity of the Rocky Flats Plant" should be changed to "Vicinity of the Predominant Downwind Direction from the Rocky Flats Plant."*

Change for the year 2010, Sector Column D, Segment Column 4, the projected population number "0" to "14"; Sector Column Sum, Segment Column 4, the projected population number "1846" to "1860"; Sector Column D, Segment Column Sum, the projected population number "25" to "39"; and the Sector Column Sum, Segment Column Sum, the projected population number "21,694" to 21,708".

Response: These items were corrected.

30. *Section 3.2.1, pg. 3-11, para. 1: Change the number "8, 172 to 21,670" in the second bullet to "8,196 to 21,708."*

Response: This item was corrected.

31. *Section 3.4, pg. 3-16, Table 3-2: Please change the titles "Off-Site Resident" and "On-Site Commercial/Industrial Workers" to "Current Off-Site Resident" and "Current On-Site Commercial/Industrial Workers" respectively under the first vertical column heading "Potentially Exposed Population."*

Response: This table was deleted in Section F3, but is presented as requested in Attachment F2.

32. *Section 3.5.1, pg. 3-15, para. 1: Soil should be included as one of the major components of the site model.*

Response: This item was corrected.

33. *Section 3.5.1, pg. 3-16 et seq., Tables 3-2 and 3-3: These tables should be reconfigured to clearly delineate the five major features of complete exposure pathways as they may operate in the different exposure scenarios which were chosen. For example, the five key features of complete exposure pathways could be presented in a table as separate headings.*

Response: These tables were deleted from Section F3 and one presented in Attachment F2. They were formatted to be consistent with EPA guidance (RAGS).

34. *Section 3.5.1, pg. 3-23, para. 3: The reference to the absence of leaks and spills at site OU1 appears to contradict some aspects of site history, and the account of pollution events which are described in Section 1.2.2 of Volume I. The whole thrust of that section is to provide an account of how each IHSS came to be contaminated. An attempt to resolve this apparent discrepancy should be made.*

Response: This paragraph was changed.

35. *Section 3.5.1.2, pg. 3-25, para. 4: The reference to "Portions of the SID and Woman Creek* <u>*within*</u> *OU1" is confusing, because from the various site diagrams and figures these water courses do not appear to be within OU1 at any point. An attempt to provide more informative figures which explain the relationship of these streams to OU1 should be made, or this sentence should be changed.*

Response: This item was corrected.

36. *Section 3.5.2.1, pg. 3-29, entire section: The whole section devoted to the geology of Green Mountain is not really essential to the major point of this section which appears to be that the 881 Hillside may be an unsuitable area for building.*

Response: Green Mountain was identified as the nearest area with a similar slope that is under development pressure. This case history provides support to expert opinion that the area is unsuitable for building.

The 881 Hillside area is designated as an "Active landslide" area by Colton & Holligan (1977). The Green Mountain study was used to further support the unsuitability for development at OU1.

37. *Section 3.5.2.1.1, pg. 3-33, para. 1: Following the sentence that begins with, "However, a preliminary review" is confusing and probably not in place here. It has two possible meanings. First, it could mean that the concentrations in ground water are greater than those in soil. Second, it could mean that, taking the site matrices as a whole and quantifying the contaminants, there was a greater amount of contamination in the total ground water than in the total soil. (The sentence should probably be omitted.)*

Response: This item was corrected.

38. *Section 3.5.2.1.1, pg. 3-33, para. 2: For greater understanding, a figure should be in place to illustrate this equation.*

Response: Refer to Johnson and Ettinger (1991) for a more detailed explanation of the equation.

39. *Section 3.6, pg. 3-58, Table 3-11: The on-site concentrations of the pollutants in the soil appear to represent the 95% upper confidence limit of the evaluation concentrations of the different constituents, it should be explained why these concentrations are not the critical exposure inputs for the calculation of intake, and consequently why these numbers are not included where appropriate, such as in Table 5-4.*

Response: Clarification of the input parameters and calculations has been provided in Attachments F4, F6, and F7.

40. *Section 4.1, pg. 4-1, para. 1: The expression ". . . EPA principal approach and rationale . . ." is needlessly ornate, could say that the RfD is a chronic human equivalent dose concentration based on the observed No Adverse Effect Level (NOAEL) in animal dose response toxicological studies.*

Response: This item was changed.

41. *Section 4.1, pg. 4-1, para. 3: The inclusion of radionuclides in the final sentence is misleading. In general, radionuclides are important in toxicology because of their carcinogenicity and as such are unlikely to have reference doses. The authors should therefore omit the word radionuclides from this sentence.*

Response: This item was corrected.

42. *Section 4.1, pg. 4-2, para. 1: The final sentence gives a misleading picture of the mechanism of induction of systemic toxicity and should be deleted. Many of the systemic responses which might qualify for consideration as a toxicological endpoint are not necessarily associated with cell depletion or cell death. For example, comparative elevation of plasma cholesterol in test versus control animals would be a toxic response reflective of the interaction of a number of subtle physiological and biochemical changes.*

Response: The example has been changed to indicate that a large number of cells must be affected, avoiding the implication that cell death is the only toxicological endpoint.

43. *Section 4.2, entire section: The explanation should be shortened. It is sufficient to make the key point that the animal NOAEL is factored with a number of uncertainty factors which yield a human equivalent RfD which is conservative.*

Response: The uncertainty or degree of conservatism involved is stated since the toxicity constants typically represent some of the largest sources of uncertainty in a risk assessment.

44. *Section 4.3, pg. 4-5, Table 4-1: The inclusion of the uncertainty factors in this table SHOULD be re-evaluated. They are used to calculate the RfDs, and consequently their presence in this table is somewhat misleading.*

Response: The uncertainty factors are presented to inform or remind the reader of the large uncertainty involved in deriving low dose, low dose rate, toxicity constants applicable to humans from high dose, high dose rate, animal data.

45. *Section 4.3, pg. 4-5, para. 3: The final three sentences of this paragraph should be deleted, they are almost identical to the second paragraph on this page.*

Response: This section was changed in the October 1992 Draft PHE.

46. *Section 4.3, pg. 4-6, para. 5: The consideration of the EPA classification of categories of carcinogens appears to be irrelevant to the concept of uncertainty. Please evaluate this material.*

Response: In part, the current carcinogen classification system reflects the uncertainty involved with the numbers presented. Those based on human data generally involve extrapolation from high doses and high dose rates to low doses and low dose rates, while carcinogens based on animal data involve an additional step of extrapolating from small animals to humans.

47. *Section 4.4, pg. 4-7, whole section: The need for all the descriptive toxicological summaries given in this section should be evaluated. It should be sufficient to give the reference doses and slope factors. The key point is to make sure that these parameters are correct. Thus, in Table 4-2, the oral slope factor for methylene chloride should read "7.3E-03". Also, the units for the inhalation slope factor are incorrect. These should be $(mg.kg^{-1}.day^{-1})^{-1}$. As a further general point it is recommended that all the values for reference doses and slope factors given in this section be verified.*

Response: The toxicological profiles are provided for audiences that are not readily familiar with these contaminants. Toxicity constants in the October 1992 draft PHE have been verified with the most recent quarterly update of IRIS.

48. *Section 4.4, pg. 4-8, Table 4-2: Footnote (c) is incorrect and contrary to statements and values given elsewhere in the document, Section 7.3.3 of RAGs, Volume I (Part A) EPA/540/1-89/002, states that slope factors for category C carcinogens are derived on a case-by-case basis.*

Response: This item was corrected.

49. *Section 4.4, pg. 4-11 para. 4: In the final sentence of this paragraph it is written, that the uncertainty factor is necessary to transform the RfD in some way. It has been used to calculate the RfD.*

Response: Uncertainty factors are not used to transform the RfD, but are provided to illustrate the uncertainty involved with the point estimate.

50. *Section 4.4, pg. 4-12, para. 1: A cancer slope factor should be established as a health protective standard. It is more true to say that the slope factor is an index of extra unit risk, and can thus be used to define doses and concentrations which are equivalent to predetermined levels of extra risk.*

Response: This section was changed.

51. *Section 5.3, pg. 5-7, para. 1: Please evaluate this discussion. Much of the material in this paragraph is repetitive and should be deleted. The final sentence puts the wrong emphasis on the weight-of-evidence classification. The reference to the weight-of-evidence category does not reflect uncertainty in the context (numerical) that it is used in the rest of this account.*

Response: This section was changed and the weight-of-evidence category is used in the qualitative discussion of uncertainty.

52. *Section 5.3, pg. 5-7, para. 2: The final sentence about the ability to compare carcinogenic and non-carcinogenic slope factors is extremely confusing and should be deleted. It is recommended that the acronym "Appendix ORNL" be defined and its relation to this matter be explained.*

Response: The derivation of toxicity constant distributions from EPA animal data is presented in Attachment F5.

53. *Section 5.4, pg. 5-7, para. 1: The final sentence in this paragraph is an overly compressed account of some of the most important material in the whole risk assessment section. It is vital that inputs for a subset of key scenarios, perhaps the seven listed in Table 5-2 be highlighted, and that it be demonstrated step by step precisely how results are derived. At the present time, it is not clear to the reviewers (1) how the concentrations listed in Table 5-4 were derived, (2) where the apparently incorrect slope factors came from, or (3) what relationship the concentration values in Table 5-4 have to those listed in earlier evaluation concentration listings (e.g., Tables 3-11, or 2-3 to 2-6). Result summaries such as those in Table 1 of Attachment F6 can be taken as read if there is sufficient assurance through a subset of demonstration calculations within the text that the overall approach is sound. For simplicity, perhaps such demonstration calculations could be presented in tabular form.*

Response: Clarification of the calculations has been provided in Attachments F4, F6, and F7.

54. *Section 5.5, pg. 5-8, para. 1: The first sentence should refer to Tables 5-2 through 5-5.*

Response: This section was changed.

55. *Section 5.5, pg. 6-8, para. 2: The first and second sentences should refer to Table 5-2.*

Response: This section was changed.

56. *Section 5.6, pg. 5-8, whole section: Section 8 of RAGS (Part A) advises against carrying out a quantitative uncertainty analysis unless there is an overwhelming justification. The reasoning for such an analysis of the data should be explained.*

Response: Since RAGS was issued in 1989, there has been criticism of the RME approach. By combining a mix of median and upper bound values, risk assessors have no knowledge of whether the resulting risk is conservative or not. Quantitative uncertainty analysis provides estimates of the risk distribution, which may be used to determine the relation of the RME to various percentiles.

57. *Section 5.5, pg. 5-9, Table 5-2: The second column of this table should refer to a scenario rather than a pathway.*

Response: This section was changed.

58. *Section 5.5, pg. 5-17, para. 1: In this section Table 5-4 is referred to as Table 5-3, and Table 5-5 is referred to as Table 5-4.*

Response: This section was changed.

59. *Section 5.5, pg. 5-18, Table 5-4: The justification for the use of different slope factors to those found in IRIS should be explained. It should also justify the use of 1.4 (presumably m^3/h) for the inhalation rate in pathways 4 through 7. It is also unclear as to what the concentration units are. In general, there should be enough detail to allow for computations to be independently reproduced. This is a very necessary element of quality control which needs to be carried out at source, as well as in the review phase.*

Response: This section was changed. Toxicity constants in the October 1992 draft PHE have been verified with the most recent quarterly update of IRIS. Clarification of the calculations has been provided in Attachment F4, F6, and F7.

60. *Section 6.3, whole section including Tables 6-1 and 6-2: To give assurance that these determinations are based on correct assumptions, and have used the occurrence data in a scientifically valid manner, this section needs to be expanded to demonstrate, using a step by step approach, and the integrity of their determinations. As with the data presented in 5-2, there is no clear indication of how the calculated risk values presented in Tables 6-1 and 6-2 and within the body of the text were derived. Tables 1 and 2 of Attachment 6 do not shed further light on this matter either, but merely give a summary of a wider spectrum of information.*

Response: Clarification of the calculations has been provided in Attachments F4, F6, and F7.

61. *Section 6.4, pg. 6-8, para. 3: Please provide more detailed justification for the statement that the cancer incidence in the United States not associated with the site is 0.33, and include "Harrison 1987" in the reference list. The passage appears to imply that one in three citizens of the USA contract cancer, which is very hard to believe. Also please change 0.33001 to 0.33004 in this and other places where this mistake occurs.*

Response: An updated value and reference from the Colorado Department of Health Cancer Registry is provided in the October 1992 draft PHE.

62. *Section 7, entire section: This section should be revised. The section appears to be little more than an abbreviated version of the whole of the first six chapters of Volume 17. The only unique material appears to be the summary of exposure assessment results contained in Table 7-6. Once again, a key omission from this risk assessment is an adequate step by step demonstration of how these dose concentrations were obtained from whatever transformations of the evaluation concentrations which were used, and the standard or best estimate physiological parameters.*

Response: Section 7 was condensed to reduce repetition and key elements of the risk characterization were emphasized. Clarification of the calculations has been provided in Attachment F4, F6, and F7.

63. *Appendix F-7, whole section: In contradiction of the table of contents, this section appears to be a reviewer checklist.*

Response: This item has been corrected. The Monte Carlo simulations are located in Attachment F7, and the reviewer checklist is located in Attachment F8 of the October 1992 draft PHE.

64. *Appendix F, pg. 7-30, Table 7-8: The unit mg/m^3, for inhalation SF should be $(mg/kg/day)^{-1}$.*

Response: This item has been corrected.

APPENDIX A1 - BOREHOLE DATA

SPECIFIC COMMENTS:

65. *Section A1.1.2, p. A1-3 through A1-5: The discussion on these pages mixes the description of sampling intervals with sampling methods and sample handling. The text would be much easier to follow if these aspects were described separately.*

Response: The text in Section A.1.2.1, Soil Sampling, has been organized so that it is easier to follow. Subsections include the following: analytical suites; sample collection methods; sample containerization, preservation, handling, and shipping; sampling intervals; and deviations from the work plan.

66. *Section A1.1.2, p. A1-5, paragraph 1: Methods for geotechnical analyses should be specified. Detailed discussion of geotechnical sampling may be more appropriate in Appendix A2.*

Response: Discussions of geotechnical sampling and methods for geotechnical analyses have been included in Appendix A2 as recommended.

67. *Section A1.1.2, p. A1-6, paragraph 3: The Quality Assurance/Quality Control (QA/QC) section is superficial and raises many questions; e.g., were ambient blanks taken, and why were duplicates only analyzed for Semi-volatile Organic Compounds (SVOCs)? There needs to be at least a reference to the full QA/QC discussion that, presumably, is in another section of the report.*

Response: A complete discussion of the quality assurance program for OU1 is included in Appendix D. The text references Appendix D as suggested.

68. *Section A1.1.2, p. A1-7, paragraph 3: Effluent and drum sampling are alluded to here. A more detailed description of sampling methods or a reference to a more appropriate section are needed.*

Response: A detailed description of effluent and drum sampling is included in Section A1.2.4 as recommended.

69. *Tables A1-1 and A1-2; Specific analytical methods should be specified on these tables.*

Response: Analytical methods have been specified on Table A1-2 as suggested. It is not appropriate to specify analytical methods on Table A1-1.

APPENDIX A4 - FRENCH DRAIN GEOLOGIC CHARACTERIZATION

SPECIFIC COMMENTS:

70. *Section A.4.2.1.3, p. A4-8, paragraph 2: It would be appropriate to explain why a No. 230 sieve was used instead of the standard No. 200 for coarse/fine boundary definition of particle sizes.*

Response: In deviation from SOP guidelines, a #230 sieve was used for determination of percent silt and clay for all alluvial and bedrock samples. In order to classify alluvial materials according to the USCS, the percentage of fines was interpolated from the grain-size distribution curve. The text on page A4-8 has been revised to explain how the coarse/fine boundary was defined.

71. *Section A4.2.3.1.2, p. A4-13, paragraph 3: Concerning the potential crown cracks that were unnoticed prior to construction, it is unclear if the statement should read ". . . prior to construction possibly due to vegetative cover that existed at the time of the field construction. The crown cracks may have developed during construction and may not have been present earlier."*

Response: Crown cracks developed during construction of the french drain. As the slope was excavated for the keyway, the bodies of potential slumps were undercut, releasing pressure and allowing movement to occur along the glide plane. The text on page A4-13 has been clarified.

72. *Section A4.2.4.1, p. A4-17, paragraph 3: The question of how much water these units produce or what the rate of flow from these units was on average should be addressed. Some idea of the rate of flow would establish a relative benchmark for the reader.*

Response: In situ hydraulic conductivities were measured in bedrock samples at 100-foot intervals unless prevented by construction or excavation activities. Hydraulic conductivity for ground water bearing bedrock units was measured at 7.084×10^{-7} centimeters/second. No measurements were taken in ground water bearing alluvial units; therefore, flow rates within the alluvium cannot be quantified. It appears that much of the flow may have been induced by gravity due to release of geostatic pressure along the excavation wall.

73. *Section A4.2.4.1, page A4-18, paragraph 1: It is suggested that a discussion of any evidence or possibility of perched groundwater within the curved slump basin above the surface of rupture, and its effect on the slope stability of the slump should be incorporated into the text.*

Response: A discussion of perched ground water within slump blocks and slope stability has been added as suggested.

REFERENCES

Colton, R.B. and J.A. Holligan. 1977. Photo Interpretive Map Showing Areas Underlain by Landslide Deposits and Areas Susceptible to Landsliding in the Louisville Quadrangle, Boulder and Jefferson Counties, Colorado; U.S. Geological Survey Miscellaneous Field Studies Map, MF-871, 1:24,000.

Johnson, P.C. and R.A. Ettinger. 1991. Heuristic Model for Predicting the Intrusion Rate of Contaminants into Buildings, Environmental Science Technology, Vol. 25, pp. 1445-1452.