RESPONSE TO EPA AND CDH COMMENTS ON THE DRAFT PHASE III RI/FS WORK PLAN

881 HILLSIDE AREA

(OPERABLE UNIT NO. 1)

U.S. DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM

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SECTION 1

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This document presents responses to U.S. Environmental Protection Agency (EPA) comments on the Draft Phase III RI/FS Work Plan for the 881 Hillside Area (Operable Unit No. 1) at the Rocky Flats Plant. The Draft Work Plan was submitted to EPA in February, 1990, and written comments were received from EPA in May, 1990. A revised Final Phase III RI/FS Work Plan for Operable Unit No. 1 will be submitted to the EPA by October 30, 1990.

Comment:

Section 1.4. The Workplan refers to aerial photographs not in the possession of the EPA. EPA requires a copy of all aerial photographs referenced in order to verify the evaluations presented within this workplan.

Response:

Aerial photographs used to determine the locations and types of historical activities at the 881 Hillside Area will be provided by EG&G under separate cover.

Comment:

Section 1.4.6. If, as previously stated in section 1.4.4, asbestos and concrete were placed in these tanks subsequent to use, a pressure test of the tanks conducted after this placement would not reveal whether leakage could have occurred from these tanks.

Response:

The historical summary available in the CEARP Phase I Report (U.S. DOE, 1986) indicates that the pressure tests were conducted in 1973, the year that the Hillside Oil Leak occurred. The tanks were apparently filled with asbestos and concrete (Rockwell International, 1987c), after the pressure testing.

Comment:

Section 1.4.7. Although exact types and quantities of solvents stored at these sites are unknown, waste management history cited within the March 1, 1988, RI/FS for 881 Hillside does state that drums stored at sites 119.1 and 119.2 likely contained acetone and bis (2-ethylhexyl) phthalate. The March 1, 1988 RI/FS also states that these containments were likely to be found at chemical dumping areas (sites 102, 103, and 104).

Response:

The statements in the RI/FS Report that bis(2-ethylhexyl)phthalate and acetone were probable contaminants of SWMUs 119.1, 119.2, 102, 103, and 104 were based on these constituents being present in some wastes generated at the Plant and not on explicit documentation that those wastes were disposed of at these SWMUs (Sections 4.6 and 4.8 of the RI/FS, Rockwell International, 1988a). For example, vacuum pump oil which contains bis(2-ethylhexlyl)phthalate, was stored at the 903 Drum Storage Site and may have been stored at the 881 Hillside.

Comment:

Section 2.2.1.2. The preliminary results of the site wide seismic reflection geophysical survey being conducted at the Plant indicate that the sandstones and siltstones may not be lenticular and are more likely to be continuous to some extent. The continuity of the sandstones at the hillside may be affected by the valley cut erosion of Woman Creek. However, the extent of the sandstone continuity needs to be determined. It is inappropriate to present geometric mean hydraulic conductivities for claystones (wells 5-87BR and 8-87BR) when only two packer tests were conducted. Hydraulic conductivities of the sandstones encountered during investigation of the 881 Hillside should be presented.

Response:

The recent seismic reflection profiling (Rockwell International, 1989a) indicates that the sandstones and siltstones may be more continuous than the available data suggested at the time the original RI report was prepared. The projections of two of the sandstones designated by the preliminary seismic results do extend beneath a small portion of the 881 Hillside Area. Boreholes and wells are planned within and around that zone so that the extent of those sandstone units can be assessed. Further detailed seismic work is not planned explicitly for the 881 Hillside Area within the next year. Other boreholes planned for the 881 Hillside Area will enable exploration for sandstones and siltstones even if they were not predicted by seismic projections.

Packer test results for 5-87 and 8-87 are presented individually (rather than as a mean of two data) in the revised work plan. Available hydraulic conductivity data for sandstones are presented as well.

Comment:

Section 2.2.2. This section should include some discussion of unsaturated flow. This section should also include discussion of vertical gradients between the overlying unconsolidated deposits and the Arapahoe sand units.

Response:

This section has been modified to include information on vertical gradients. Data from the RI report (Rockwell International, 1988a) yield vertical gradients of 0.3 to 2 feet per year, indicating a hydraulic potential for downward flow. The presence of intermittently dry wells and the effect of unsaturated conditions on contaminant migration are discussed in Section 2.2.2.1.

Comment:

Section 2.2.2.1. It is unclear how well 47-87 (a dry well for the first quarter in 1988 and the first two quarters in 1989) can be used to justify the estimate of ground water flow velocity. The fact that 47-87 is a dry well for these three quarters is more an indication of improper monitoring location. The fact that PCE was found in well 64-86 also refutes the conclusion of an estimated ground water velocity of 200 feet in 18 years. DOE's reluctance to stand behind it's own estimates of ground water velocity is perplexing. DOE must present all analytical information for all wells associated with OU1 in the workplan, so that these types of statements can be verified in the data, regardless of the availability of temporally comparable background data. This section should also include discussion of ground water flow velocities in Rocky Flats Alluvium.

Response:

The data from well 47-87 were not intended to provide an estimate of ground-water velocity, but rather to show a constraint on the estimate of the rate of volatile organic contamination migration. The text has been modified to clarify the distinction. Well 47-87 was dry at all but three sampling events. Those samples indicate that well has not yet received definite volatile organic contamination. Only one sample had any reports of volatile organics, and all of those were extremely low levels estimated below detection limit and/or present in the blank [4JB μg/ℓ of acetone, 1J μg/ℓ of chloroform ($CHCl_3$), and 1J μg/ℓ of carbon tetrachloride (CCl_4)]. Thus an initial estimate of the maximum distance that contaminants have migrated was based on well 47-87 (200 feet in 15 to 18 years). The planned monitoring will also check the single, indefinitive report of tetrachloroethene (PCE) at well 64-86 [8J μg/ℓ - estimated below detection limit and flagged "A" (accepted with qualifications)].

DOE supports its ground-water velocity estimates with the best data available at the time of calculation, and presents the hydraulic parameters used in the calculations. Altered velocity estimates can result from revisions to best estimates of hydraulic properties. The estimates of contaminant migration rates do not contradict the ground-water flow rate estimates. They are lower than the flow rate estimates as expected due to attenuation processes. All analytical data are presented in the revised work plan appendices. Ground-water velocities in Rocky Flats Alluvium are not discussed in this section because the alluvium does not occur downgradient of OU1.

Comment:

Section 2.2.2.2. The discussion of ground water flow velocities in sandstone should distinguish whether these are weathered or unweathered sandstones. Hydraulic conductivities for claystones should also be presented.

Response:

The revised discussion of velocities does distinguish between weathered and unweathered sandstones. It also provides available hydraulic conductivity data for claystones.

Comment:

Section 2.3.1. DOE must evaluate and revise the background geochemical report to address comments made on the report by both EPA and CDH. These comments indicated problems with some of the background tolerance intervals, maximum detected values and systematic problems associated with sample numbers. It was also evident that outlier calculations had not yet been performed.

As background temporal variability has not been established and presentation of all analytical data increases our ability to understand the problem, regardless of the data quality, the workplan must not exclude analytical information from presentation just because of the limited nature of the background data presently available or because it has now been rejected as invalid. Data should also be presented when it is below the tolerance interval maximum or maximum detected value. Presentation of this information is important to gaining a greater understanding of the problems at OU1.

Response:

DOE is in the process of revising the Background Geochemical Characterization Report (Rockwell International, 1989b). Evaluation of outliers, seasonality, treatment of radionuclide counting errors, questions regarding tolerance interval calculation, and other comments made on the background report will be addressed by these revisions. The revised work plan on the 881 Hillside Area explains the status of the background report, and emphasizes the background levels used in the work plan are preliminary. All available data for OU1 are presented in the work plan appendices, regardless of their relationship to current estimates of background.

Comment:

Section 2.3.2.1. Analysis of the soils data for OU1 presented in February 24, 1989, Response to Comments on the 881 Hillside RI, indicates that methylene chloride and acetone are present in many of the laboratory blanks, but it cannot be stated that the levels in the blanks are relatively high levels. The majority of the laboratory blanks contain relatively low levels of methylene chloride and acetone. The fact the phthalates are present in many of the soils samples may indicate a sampling problem, but it may also indicate contamination. In general, the phthalate concentrations are orders of magnitude higher than the blank samples.

Trichloroethene was also found in the borehole BH14-87 within the 6.5 - 9.0 foot composite. Tetrachloroethene was found below detection limit in borehole BH12-87 within the 0.0 - 2.5 foot composite. 1,1,1-trichloromethane was also detected below detection limit within borehole BH61-87.

Response:

The discussion of methylene chloride and acetone in the blanks for soils analyses at OU1 does not state that the concentrations in the blanks are relatively high, nor does it draw definitive conclusions on whether those compounds definitely are or are not actual soil contaminants. Similarly the phthalate data are inconclusive, and the revised work plan does report that some phthalate levels are quite high. The low levels of trichlorethene (TCE), tetrachloroethene (PCE) and 1,1,1-trichloroethane (1,1,1-TCA) in boreholes BH14-87, BH12-87 and BH61-87 were reported in the revised work plan, although detailed interpretation of the volatile organic contamination must await presentation of a validated data set.

Comment:

Section 2.3.2.2. Borehole sample designations presented within Table 2-6 do not correlate with the borehole logs presented in earlier RI reports. The designations within Table 2-6 indicate claystone samples are unweathered. Are the borehole composites being compared to the appropriate background samples if unweathered?

Both arsenic and cadmium occurred in soils at levels twice the upper tolerance limit. Given that the individual sites within OU1 were used to dispose of different wastes and that boreholes were placed to characterize individual sites, the comment concerning randomness of metal concentrations exceeding background tolerance limits is unclear. Soils impacted by different disposal practices and wastes will be affected differently. DOE has not determined that the metals associated with the various sites within OU1 are not the result of past disposal activities.

This section should also include a discussion of the presence of metals in the Woman Creek alluvial ground water.

Response:

Table 2-6 has been corrected to correlate with the original borehole logs. The "unweathered" designation for the claystones was in error; it has been corrected to read "weathered". The borehole samples were compared to appropriate background samples.

The elevated arsenic and cadmium results have been noted in the revised Section 2.3.2.2, together with a more complete discussion of all metals above background for all available data. The metal concentrations do not exhibit clear gradients with respect to waste sources, but all elevated constituents are reported because they may be contaminants. The term "random" was intended to describe the absence of apparent patterns in the metals distribution, but it has been removed in the revised work plan because it implies statistical evaluation which is not presently justified because of the preliminary nature of the background data.

Discussion of metals in alluvial ground water is now presented in the work plan (Section 2.3.3).

Comment:

Section 2.3.2.3. An environmentally conservative statistical analysis of radionuclide data would propose that if the error term plus the measured value of the sample is greater than the measured value plus the error term for the upper limit of the background range, the sampled value would be considered above background.

The uranium 233-234 to uranium 238 ratios presented in Table 2-8 are generally less than one, indicating that the uranium sampled in the surface scrapes is associated with plant activities. The fact that the cesium, tritium and total uranium concentrations are less than twice the background upper tolerance interval is irrelevant. The infrequency of uranium, cesium and tritium concentrations above background at depth may only indicate that the sampling and analysis presented within Table 2-7 was inadequate and did not characterize the sources of contamination. Cesium occurred above background in 17% of the soils samples. This is not infrequent. The data does not support the statement that radionuclide concentrations in soils represent natural variations.

It is unclear why surface scrapes were collected to characterize site 130, when this site has been covered with fill. Is the fourth paragraph of this section directed only to uranium, cesium and tritium results at depth? The workplan must present all data to evaluate against the tolerance intervals, not just those reported to be higher than the tolerance interval. Without this data, the ratio of uranium 233, 234 to uranium 238 cannot be verified for the previously collected data.

The 1989 CDH surface soils survey results indicate that the plant may be a source of cesium contamination. These results should be evaluated and compared to DOE sampling results.

Response:

The discussion of radionuclide data analysis in the revised work plan addresses interpretation of error expressions, and available background data as follows:

The discussion of uranium isotope ratios shows that there is a mixture of natural and Plant-derived uranium on the site. The presentation of soils data also underscores the potential for dilution of surficial radionuclides because of sample compositing. Because of the compositing, the absolute values and frequencies of the soil radionuclide concentrations in the Phase I data must be considered minima. In the revised work plan, the radionuclide data and subsequent planning are handled accordingly. The results in Table 2-7 are similarly qualified.

DOE did not collect surface scrapes at SWMU 130. The fourth paragraph of Section 2.3.2.3 has been revised so that it clearly refers to uranium, cesium and tritium results in surface and subsurface samples. All data are presented in the Appendix so that uranium isotopic ratios can be examined for all samples.

The recent aerial radiological survey (EG&G, 1989) showed cesium-137 levels ranging from 0.3-0.6 pCi/g averaged over the uppermost six centimeters (cm) of soil. The results were generally uniform over the survey area and consistent with global fallout levels. Studies by CDH and others that are quoted in U.S. DOE (1989) dealt with much shallower sampling intervals and therefore, would be expected to yield higher cesium-137 values derived from fallout.

An additional consideration in the interpretation of cesium-137 data is that if a criticality accident had occurred, it would not have produced sufficient cesium-137 to distinguish affected soils from soils that contain only global fallout. U.S. DOE (1989) provides calculations to show that a moderate accident, with cesium-137 dispersal across the Plant would produce soil concentrations of 0.01 pCi/g. A greater accident would have produced more conspicuous evidence (such as a flash of light).

Estimates of the annual atmospheric flux of cesium-137 (quoted in Robbins and Edgington, 1975), suggests that approximately 10 pCi/cm^2 have been distributed since testing began. If one assumes a soil density of approximately $2g/cm^3$, and cesium-137 distribution in the top cm of soil, the concentration would be 5 pCi/g. If the cesium-137 were diluted in the upper 10 cm of soil, the concentration would be 0.5 pCi/g.

Comment:

Section 2.3.3. The ground water discussion for volatiles should not be limited to a discussion of second quarter 1989 data. Even if previously collected data has been invalidated, this data does shed light qualitatively on the nature and extent of the problem at OU1.

Response:

The revised discussion of volatile organics in ground water covers all available data. The general features of the volatile organics' distribution is similar when all the data are included, but the additional data cover wells which were dry in the second quarter of 1989. In addition they exhibit higher maximum concentrations at some wells than had been apparent in the second quarter of 1989. Table 2-10 in the revised work plan tabulates these maxima.

Comment:

Section 2.3.3.1. Well 1-87 does not appear to be upgradient of SWMU 145. It is possibly side gradient. Contamination of well 1-87 could be a result of the release at SWMU 145. This section should also discuss ground water problems associated with SWMU 177. An evaluation of all previously collected data should be presented to broaden the understanding of the nature and extent of volatile contamination at these sites. There should be a significant amount of information for all wells sampled between the Phase II RI for OU1 (1987) and second quarter 1989. Dry wells do not delineate the nature or extent of contamination.

Bedrock wells 3-87 and 8-87 both contained ground water contaminated with magnesium. All volatile organic, radionuclide, metal and inorganic data should be referenced and evaluated for the bedrock wells even if the data is only qualitative.

Response:

Section 2.3.3.1 has been completely revised to cover all available ground-water data. Revisions include, but are not limited to, the specific items mentioned in the comment above:

- The possibility that well 1-87 is sidegradient to SWMU 145 is acknowledged and additional wells and boreholes are proposed for this site.
- The possibility that SWMU 177 has caused ground-water problems is addressed in Section 5.
- Although dry wells cannot provide a quantitative picture of volatile organic contamination on a site, the prevalence of dry conditions is an important characteristic of the local hydrological/climatic regime which must be integrated into descriptions of contaminant fate.
- All metals and radionuclide data for bedrock wells have been included in Appendix B of the work plan. The elevated magnesium in wells 3-87 and 8-87 was noted in Section 2.3.3.1, together with discussion of all trace constituents elevated above estimated background.

Comment:

Section 2.3.3.2. The appendices presenting volatile organic information for colluvial wells associated with SWMUs 119.1, 119.2 and 130 describes many volatile hits as present below detection or analyzed but not detected, yet the analytical results indicate that the concentrations are present above detection limit. The appendices presented for the valley fill alluvial volatile organic analytical results only presents total xylenes.

Response:

Analytical results that are flagged "J" indicate that the analytes were present, but estimated below detection limit. This flag is applied with reference to the matrix specific detection limit for that particular sample's analysis. In several cases the laboratory operated with a relatively high detection limit due to high matrix "noise". All samples flagged "J" must be treated as estimated, but the results that are well above low-level contract-required detection limits and/or well above CLP-accepted levels for common laboratory contaminants will be considered good estimates of contaminant levels. All data are provided in the revised work plan.

Comment:

Section 2.3.3.3. 8 ppb tetrachloroethene was also present in the second quarter 1989 sample for well 64-86. Until well 1-87 is sampled for inorganics and metals, there is very little chemical data to suggest that inorganic and organic contamination present at SWMUs 102, 103, 105, 107 and 145 is due to a source upgradient of well 1-87.

To state that contamination has not migrated to any appreciable extent is an opinion and should be deleted from the text. DOE's own estimate of ground-water flow velocities refute the theory that contaminants have not migrated to any appreciable extent. The fact that downgradient wells do not show contamination may only be an artifact of poor well location.

Response:

The revised work plan does note the report of 8J $\mu g/\ell$ of PCE for well 64-86. Sampling at well 1-87 and a new upgradient well will be performed to determine whether there is a source upgradient of well 1-87.

The statement that contamination has not migrated to an appreciable extent was removed during revision of the work plan because "appreciable" is a qualitative term. However the data does indicate that the zone of high level volatile organic contamination (hundreds of $\mu g/\ell$), is restricted to the wells within and close to the SWMUs. This contamination is distinctly different from the ambiguous results of the more distant wells (e.g. the 8J $\mu g/\ell$ of PCE at well 64-86), and it is important to note this distinction.

The estimates of ground-water velocities neither refute nor confirm the empirical measures of contaminant extent. They merely express the approximate maximum rate of potential contaminant movement based on hydraulic properties of the aquifer. Contaminants may move more slowly than the ground water because of various attenuation mechanisms.

The available downgradient data for the 881 Hillside Area are presented as the best available information on actual contamination, and do not purport to be comprehensive. However, the presence or absence of contamination in existing downgradient wells is important to the assessment of the extent of ground-water contamination and the formulation of plans for future monitoring. The work plan outlines plans for strategic downgradient sampling designed to examine components of ground-water flow which were not sampled during previous investigations.

Comment:

Section 2.3.4. DOE must present all analytical information related to surface water quality, not just the information from June 1989. It is important to recognize surface water seeps as ground water. All surface water seeps should be analyzed and compared to appropriate ground water background data. The elevation of these seeps can also provide information pertinent to water table and potentiometric surface maps.

Response:

All surface water data are presented in Appendix C of the revised work plan.

Of the surface water stations reported in Section 2.3.4, none are true seeps that can be considered representative of ground water. Station SW-46 is at a pond formed by seepage, but because of residence time in a surface pond, it is inappropriate to call this ground water. Station SW-45, the foundation drain discharge for Building 881, represents ground water that is derived from a very local area around the building, and it seems redundant to repeat discussion of its composition within the ground-water summary. Similarly the surface water stations discussed in this section do not provide data which would significantly alter the potentiometric surface maps as shown in the work plan.

Comment:

Section 2.3.4.1. The narrative presented within this section describing the dissolved metals results found to be above background does not correlate with the data presented within Appendix C. Radium 226, gross alpha and gross beta were found in the surface waters above background.

Response:

The discussion of dissolved metals and radionuclides in surface water was rewritten based on the updated version of Appendix C which includes all available surface water data.

Comment:

Section 2.3.5. The workplan should present the locations of the sediment sampling stations. This could be shown on figure 2-17. The workplan must identify plans to determine if sediments affected by 881 Hillside exist. The present locations of the sediment sampling stations are potentially impacted by OU2. Sediment sampling stations must be identified that can more readily be associated with the problems at OU1. Chloromethane, toluene and acetone were present at sampling station SED-29 at 60 ppb, 2J ppb and 18 ppb, respectively. Trichloroethene was present estimated below detection limits at SED-25 and SED-26 at 5J ppb and 3J ppb, respectively. Chloromethane and trichloroethene were estimated at 19J ppb and 7J ppb, respectively, at SED-30. Trichloroethene was present at SED-31 at 8 ppb.

Aluminum, barium, copper, iron, magnesium, manganese, lead, potassium, lithium, zinc, mercury, strontium, and vanadium were also found above background concentrations for sediment.

Response:

Three new sediment sampling stations will be established during Phase III activities that are more explicitly associated with Operable Unit No. 1 than are the existing stations. The locations, as noted in the revised work plan, are tentative, because the presence of rip rap in portions of the South Interceptor Ditch may preclude sediment collection. The locations of the previously sampled stations are described in Section 2 of the work plan. They are all up- or downstream of the main 881 Hillside Area so they are not shown on Figure 2-17 (surface water station map). Their distances from surface water stations in Figure 2-17 are provided in the text.

All volatile organic compounds which were present in sediment samples, and all metals which occurred above background are listed in Section 2.3.5.

Comment:

Section 2.4. The maximum concentration of acetone found within the 881 Hillside area is 57B ppb. The ARAR for acetone is exceeded. 1,1-dichloroethane is an Appendix VIII constituent; ethylidene dichloride, and background is therefore relevant and appropriate. Chloroform is present at 22 ppb in well 10-74. The ARAR for chloroform is 0.19 ppb.

Table 2-11 presents the ARAR units of measurement as micrograms per liter for the metals. The correct units of measure are milligrams per liter for metals. Table 2-11 presents the preliminary ARARs for tetrachloroethene and 1,1,2-trichloromethane as below detection limits. This is incorrect. The preliminary ARAR for tetrachloroethene and 1,1,2-trichloromethane is 5U ppb for both constituents, not 10 pbb. The ARAR for toluene is 2000 ppb, not 2420 ppb.

The correct detection limit for dissolved cesium is 0.1 ppm, not 1.0 mg/ℓ. The correct detection limit for lithium is 0.01 ppm, not 0.1 ppm.

Response:

The potential ARAR values for $CHCl_3$, PCE, 1,1,2-TCA and toluene have been corrected in Table 2-11 to 0.19 μg/ℓ, 0.8 μg/ℓ, 0.6 μg/ℓ and 2000 μg/ℓ, respectively. All of the maximum values detected on-site have been revised to incorporate all available data rather than just the second quarter of 1989. The unit of measurement for metals was corrected to mg/ℓ. The detection limits for dissolved cesium (1.0 mg/l) and lithium (0.1 mg/l) are correct as originally presented. Section 2.4 has been revised so that it is compatible with the new National Contingency Plan (NCP).

Comment:

Section 2.5. This section presently identifies only one technology for treatment of radionuclide contaminated soils. This section should present other potential technologies to evaluate for treatment of radionuclide contaminated soils.

Table 2-13 does not present the data requirements necessary to evaluate the effectiveness of attrition scrubbing of soils for removal of plutonium.

Response:

The revised version of Section 2.5 presents immobilization via vitrification and cementation, as well as attrition scrubbing for treatment of radionuclide-contaminated soils. Table 2-13 has been revised to show that data on the radionuclide composition of the different soil grain-size fractions are necessary to evaluate the effectiveness of attrition scrubbing.

Comment:

Section 3.1. With regard to the conclusions drawn from the Phase I and Phase II investigations, the reason radioactive contamination has not been detected at SWMU 130 is due to inadequate characterization. Can it be stated that soil contamination by volatile chlorinated hydrocarbons is limited to soils in the vicinity of BH01-87, BH57-87 and BH58-87 in light of the validity of the borehole analytical results? How will this data be used and what conclusions can be drawn from the invalidated data? Confirmatory borehole drilling should be conducted to verify the extent of the soil contamination.

Response:

The conclusions in Section 3.1 do not state that there is no radionuclide contamination at SWMU 130. They do state that characterization of radionuclides in soils is incomplete.

The revised conclusions reiterate the invalidated status of the volatile organic data for soils, demonstrating that the apparent limitation of contamination to the vicinity of BH01-87, BH57-87 and BH58-87 is a qualitative observation. As stated in the text of the report, the invalidated data are presented as possibly valuable indicators of the worst area(s) of contamination, but they are not considered comprehensive indicators of all areas of contamination. Comparisons with the previously rejected data will be possible as well.

Comment:

Section 3.2. It would benefit the reviewers of the workplan to be given the appropriate sections of the SOP and QA/QC plans pertinent to the work anticipated at the 881 Hillside in order for the reviewers to completely understand the work to be performed. Data quality objectives also need to recognize the data and data quality requirements predicated by potential remedial alternatives to be evaluated and utilized.

Under the objective of characterizing site physical features, Table 3-1 must include determination of the location of the various weathered and unweathered bedrock units (claystones and sandstones), their lateral and vertical extent, interconnection with the overlying alluvial/colluvial materials, ability to transport contaminants and flow directions within these bedrock units. This objective must also include as data needs, preparation of detailed east-west and north-south geologic cross sections and determination of vertical gradients.

Under the objective of characterizing the nature and extent of contamination, Table 3-1 must include determination of the radionuclide contamination associated with SWMU 130. This objective must also recognize the new location of some of the SWMUs as presented in section 1.4 of the workplan. The objective of characterizing the nature and extent of contamination must include as a data need, determination of the nature and extent of contamination with the bedrock materials associated with 881 Hillside. In characterizing surface water quality, Table 3-1 must include as a data need locating and sampling sediment stations directly associated with 881 Hillside if possible.
Under the objective of providing a baseline risk assessment, Phase III results must be incorporated into the risk analysis.

Response:

The Standard Operating Procedures (SOPs) and Quality Assurance Project Plan (QAPP) were provided to the reviewers in August 90. The General Radiochemistry and Routine Analytical Services Protocol (GRRASP) was also submitted in February 1990.

The data quality objectives are listed with the understanding that they must meet the needs of evaluation of potential remedial alternatives.

Table 3-1 has been revised to include further work towards determination of the location and relevant hydraulic properties of bedrock units as listed in the comment above. Cross-sections will be prepared as appropriate, and vertical gradients will be measured where possible.

Determination of the horizontal and vertical extent of radionuclide soil contamination will include both surficial soil scrapes and subsurface sampling of the soil profile in the vicinity of SWMUs at OU1 which are inadequately characterized. This will cover SWMU 130 as well as revised locations of other SWMUs.

The revised work plan establishes three new sediment sampling locations which are more directly associated with the 881 Hillside Area than the stations covered by the previous RIs.

Phase III data will be incorporated into the Phase III baseline risk analysis.

Comment:

Section 4.1.3. The field investigation is designed to meet the objectives outlined in section 3.0, not Section 4.

Boreholes must also be constructed and sampled to verify the nature and extent of contamination. Previously collected information has been invalidated and the results must be verified.

Response:

The typographic error in section 4.1.3 of the draft work plan has been corrected so that it is now clear that the Phase III objectives are listed in Section 3, not Section 4.

Phase III boreholes will be sampled within SWMUs to determine the nature of contamination associated with source areas. Boreholes planned for Phase III will determine the nature and extent of soil contamination within SWMUs. Contamination beyond the limits of sources (SWMUs) is presumed to originate via transport by ground water, and is addressed by existing and proposed wells.

Comment:

Section 4.1.5.3. Care must be taken in the use of kriging to contour isopleths as this method can oversimplify the problem and does not have a very good track record.

Response:

DOE is aware of the risks in the use of kriging for contouring isopleths, and will only use the kriging technique if deemed appropriate. The work plan has been revised to clarify this point. In any case isopleth contours must be interpreted with great care because they necessarily are based on data which are limited both in space and time.

Comment:

Section 4.1.6. In general, the draft workplan for the baseline risk assessment conforms to EPA guidance for risk assessments. However, you should be aware that the region is now in the process of developing a "generic" workplan for risk assessments. Once completed, EPA will forward this information to you. This workplan will, in general, conform to plans now in existence and those under development in other regional offices. Included in the workplan will be a set of regionally specific exposure parameters to be used in the exposure assessment portion of the baseline risk assessment. Deviation from these exposure parameters will require adequate documentation, and the approval of EPA.

Objective 2 includes fate and transport analysis within environmental media. It is also essential that the baseline risk assessment address cross-media fate and transport. For instance, such analysis must include contamination of ground water from soil sources, contamination of air from soils or water, etc.

In addition to the documents listed in Table 4-1, EPA will be using documents included on the attached list for development and review of the baseline risk assessment.

The following criteria must be used in identifying chemicals to be addressed in the baseline risk assessment:

a.) Those chemicals positively detected in at least one CLP sample (RAS or SAS) in a given medium, including chemicals with qualifiers attached indicating known identities, but unknown concentrations.

b.) *Chemicals detected at levels elevated above background.*

c.) *Chemicals which have bene tentatively identified and may be associated with the site based on historical information, or have been confirmed by SAS.*

d.) *Transformation products of site associated chemicals.*

Chemicals must not be eliminated based upon environmental fate predictions until the exposure assessment phase of the baseline risk assessment is completed.

Scenario selection should proceed regardless of the ability to quantify exposure. This may require exposure to be addressed qualitatively under circumstances where quantitative evaluation is not possible.

It may be advantageous to consider receptor characteristics rather than "exposure scenarios" for the purpose of the baseline risk assessment. Each of the scenarios listed include several of the same receptor subpopulations. To avoid a duplication of effort, it may be more efficient to directly assess exposure and potential toxicity to subpopulations.

It is not clear what is meant by the statement "Doses or the dose might result in an excess cancer risk for noncarcinogenic health." Please explain.

It will be unnecessary to generate toxicity values for subchronic exposure. Chronic exposure will provide a more conservative assessment and will drive the rationale for any cleanup activity which may be indicated.

The preferred terminology for acceptable intake for chronic exposure (AIC) is now "risk reference dose" (RFD). To avoid confusion, this terminology should be used throughout the baseline task assessment and the AIC terminology should be discontinued.

The reasonable maximum estimate of exposure (RME), based upon the 95% upper confidence limit of the exposure data, must be used throughout the baseline risk assessment process. Details must be provided regarding the rationale and methodology for development of subchronic exposure estimates.

Where applicable, assessment of sediment toxicity must be included in the environmental portion of the risk assessment.

Response:

Region-specific exposure parameters determined by EPA will be used where available. Any proposed deviation from the parameters will be documented and submitted to the EPA for approval prior to preparation of the risk assessment.

Cross-media fate and transport will be considered.

Table 4-1 of work plan has been revised to include the documents which EPA listed for use in risk assessment preparation and evaluation.

Criteria a,b, and c as listed in the comment above will be used in selecting site contaminants. It is not clear what level of detail is expected in the evaluation of potential transformation products. The prediction of the transformation products is dependent on the availability of transformation information in the scientific literature and on information regarding chemical, physical and microbial site conditions. Quantitative estimates of transformation products would be complicated and depend on-site specific conditions as well as information regarding the approach to evaluating transformation products.

Chemicals will not be eliminated based on fate predictions until the exposure assessment is completed.

All plausible exposure scenarios will be identified, regardless of the ability to quantify exposure.

To avoid duplication, the scenarios will be based on discrete subpopulations (e.g., residents and workers).

The statement "doses or the dose might result in an excess cancer risk for noncarcinogenic health" has been rewritten to state, "doses might exceed risk reference doses (RRDs) and or might result in an excess cancer risk greater than the acceptable target risk as deferred by EPA (i.e, to 10^{-6} to 10^{-4}).

Toxicity values will be generated for chronic exposure only.

The term (risk) reference dose (RfD) will be used in the risk assessment to describe the toxicity value for acceptable chronic daily intake.

The upper 95 percent confidence limit of the exposure data will be used to calculate the exposure concentrations.

Based on the previous comment that there is no need to generate subchronic toxicity values; it is assumed that there will also be no need to develop subchronic exposure estimates.

An assessment of sediment toxicity will be included in the environmental evaluation if applicable.

Comment:

Section 4.1.7. As soils contaminated by radionuclides exist at the 881 Hillside, treatability studies germane to the 881 Hillside must also focus on treatment technologies designed to remove radionuclides from soils.

Response:

Treatability studies will also address radionuclides in soils. Possible technologies include attrition scrubbing and selected methods of contaminant immobilization in soils, both on- and off-site. Section 4.1.7 has been revised accordingly.

Comment:

Section 4.2.3. The narrative describes submittal of a draft Final FS, a revised draft Final FS and preparation of a Final FS incorporating public comments. The IAG does not anticipate the FS going to public comment. This section should be clarified to reflect the requirements of the IAG and CERCLA.

Response:

Section 4.2.3 has been modified to clarify the expected sequence of deliverables and associated comments. There will be a Draft FS and a Final FS which incorporates EPA and CDH comments.

Comment:

Section 5. The overall objectives of the Phase III RI must include better definition of the nature and extent of bedrock contamination and bedrock ground water contamination.

Response:

Sections 5.0 and 3.0 of the work plan have been revised to clarify the inclusion of bedrock contamination in Phase III investigations.

Comment:

Section 5.1. Bedrock wells should be installed where borehole sampling indicates bedrock is contaminated. The installation of bedrock wells must not be limited to locations where weathered sandstone is encountered within source areas.

Response:

The planned drilling program will include installation of bedrock wells at all locations where borehole drilling encounters sandstone. In addition, three wells are proposed to further investigate the sandstone which was encountered at well 5-87.

Comment:

Section 5.1.1.1. Given the potentiometric surface presented in figure 2-3, it may be appropriate to locate well MW03 30 to 50 feet east of its presently proposed location. The well needs to be located downgradient of the retention pond.

Response:

Well MW-03 has been moved approximately 50 feet to the east (Figure 5-1 in the revised work plan) in accordance with the potentiometric surface map.

Comment:

Section 5.1.1.2. The downgradient monitoring well, MW05, needs to be constructed downgradient of the site. The potentiometric surface map in Figure 2-3 must be used to locate this well.

Response:

Monitoring well MW-05 will be located downgradient of SWMU 103 based on the best available potentiometric surface data available when Phase III work begins.

Comment:

Section 5.1.1.4. Boreholes BH17 and BH18 should be located on the southern sides of the tank locations.

Response:

Boreholes BH17 and BH18 have been moved to the southern sides of the tanks in Figure 5-1 in the revised work plan.

Comment:

Section 5.1.1.6. It is stated that ground water samples will be taken within this SWMU, yet no wells are proposed for this location.

Response:

The revised work plan proposes that MW17 be installed just downgradient of SWMU 107 to monitor ground-water quality there. Note that the well numbers greater than or equal to MW17 have been changed from the February 1990 draft of the work plan because of the addition of some new proposed wells.

Comment:

Section 5.1.1.8. The borehole samples taken from SWMU 130 need to be carefully planned as the exact depth at which radionuclide contamination is present is unknown due to the disturbance at the site and placement of fill over the site.

Response:

Boreholes drilled into SWMU 130 will penetrate fill, and discrete samples will be collected every two feet. Additional samples will be collected from the core at layers which show staining, textural changes, or other irregularities which may indicate a transition between contaminated/uncontaminated or fill/native material.

Comment:

Section 5.1.1.9. SWMU 145 is at the southwest corner of building 881. The RI summary presented within section 2.3.3.1. indicates that well 1-87 is above background for certain major ions, trace metals and organics. This well is not upgradient of SWMU 145. It is possible that the problems associated with well 1-87 are a result of contamination from SWMU 145. This site should be more directly sampled to verify that no further action is required.

Response:

Two boreholes (BH48 and BH49) and one monitoring well (MW18) are proposed in the revised work plan to determine whether there is contamination from SWMU 145 and whether that SWMU can account for the elevated constituents which have been observed in well 1-87.

Comment:

Section 5.1.1.10. It is the understanding of EPA that any ground water problems associated with this site would be addressed under the RI/FS process. If this is true, the nature and extent of ground water contamination associated with this site needs to be determined.

Response:

A borehole (BH50) will be drilled and a well (MW19) will be installed downgradient of SWMU 177 in order to test for ground-water problems there.

Comment:

Section 5.1.2.1. DOE must evaluate the need to modify procedures to analyze constituents to a lower limit of detection for contaminants where the CLP detection limit is above the ARAR.

Response:

DOE will select a laboratory that will analyze to a detection limit that is at or below the potential ARAR. If this is not possible for any analyte(s), DOE will consult with EPA and CDH to decide upon the appropriate course of action.

Comment:

Section 5.2.1.1. A monitoring well should also be located in the bedrock sandstone immediately downgradient of SWMU 130.

Response:

The revised work plan states that when sandstone is encountered during drilling, a bedrock well will be installed adjacent to that borehole. Monitoring well MW29 in sandstone was proposed for installation just downgradient of SWMU 130.

Comment:

Section 5.2.1.2. The deletion of parameters from further analysis must not be implemented prior to review and approval by EPA and CDH.

Response:

The work plan states that no parameters will be deleted from the list of analytes without consultation and approval from EPA and CDH.

Comment:

Section 5.2.1.3. The proposed hydraulic testing should also include determination of vertical gradients between the confined Arapahoe sandstones and the surficial geologic units. This section should also specify the methods proposed to analyze the hydraulic testing data.

Response:

Determination of vertical hydraulic gradients between confined Arapahoe sandstones and the surficial geologic units will be based on water level data and the hydraulic parameters measured in those strata. The revised Section 5.2.1.3 lists the methods which will be used to analyze the hydraulic testing data as follows:

Slug tests	Bouwer and Rice (1976)
Bail-down/Recovery Tests	Theis (1935), Thiem (1906) or Cooper et al. (1967)
Single Hole Pumping Tests	Theis (1935), Cooper and Jacob (1964)
Multi-well Pumping Tests	Theis (1935), Cooper and Jacob (1964)
Tracer Injection Tests	Ogata (1970)

Comment:

Section 5.2.2.1. The workplan must locate the bedload sampling stations used for the October, 1989 sediment sampling. As previously stated in these comments, the sediment sampling stations must be located to determine effects of 881 Hillside. Previously sampled stations were unable to distinguish between affects from OU1 and OU2. Dependent on the location of these sediment sampling stations, more sampling stations may have to be established and sampled during the phase III RI. Flow measurements/estimates of surface water discharges during sampling should be made concurrently.

Response:

The revised work plan describes the locations of the existing sediment sampling stations with reference to surface water stations shown on Figure 2-17. The stations are west and east (up- and downgradient) of the 881 Hillside Area shown on that map. Three new sediment stations have been proposed in the revised work plan (SED-37, SED-38 and SED-39) which are more clearly associated with the 881 Hillside than are the existing stations.

Comment:

Section 5.3. It should be clarified that the IM/IRA proposes discharge of the treated ground water.

Response:

Section 5.3 has been modified to explicitly state that water discharged due to the IM/IRA will be treated water.

Comment:

Section 5.3.5. This section should provide more information on how the packer tests will be conducted and how the data will be analyzed.

Response:

Section 5.3.5 of the revised work plan contains information on the strata and depth intervals which will subject to packer testing in the Phase III RI. Additional details on field and analytical procedures are described in the Standard Operating Procedures (EG&G, 1990a), and are referenced, but not repeated, in the revised work plan.

SECTION 2

RESPONSE TO PRC COMMENTS

SECTION 2

RESPONSE TO PRC COMMENTS

1. Comment:

Section 2.2.2.1, Page 2-15, Paragraph 3. The text provides an estimate of ground water flow velocity based on the downgradient extent of volatile inorganic contaminants from a source. This approach is not sound because it does not consider the possible chemical and biological processes that can facilitate or retard movement of a contaminant, nor does it consider the effect that seasonally unsaturated conditions may have on contaminant transport. In most cases, velocity will be underestimated as the net result of these processes, as it is in this case. The flow velocity estimate of 11 to 13 ft/yr is five times less than the flow velocity estimate of 61.7 ft/yr that PRC computed using the minimum hydraulic conductivity of 4×10^{-5} *cm/sec reported on page 2-15.*

Response:

The extent of volatile organic contaminant migration was not intended to provide a direct estimate of ground-water velocity. The text of work plan has been revised to make the distinction between ground-water flow rate and contaminant migration rate clear. The estimated contaminant migration rate is much less than the ground-water velocity due to attenuation processes.

2. *Comment:*

Section 2.2.2.2, Page 2-17, Paragraph 4. The results of the 1987 slug tests and the 1986 and 1987 packer tests should be presented in this paragraph. The text states that three sets of aquifer tests were performed to estimate the hydraulic conductivity of sandstones, however only the results of the 1986 drawdown-recovery test are presented in this paragraph.

Response:

The results of slug and packer tests are presented together with the drawdown-recovery test results in the revised Section 2.2.2.2. The drawdown-recovery tests typically yielded somewhat higher (and therefore more conservative) hydraulic conductivity estimates in this investigation.

3. *Comment:*

Section 2.3.2.1, Page 2-28, Paragraph 2. This paragraph states that volatile organic data for soils have been rejected during the data validation process because the data did not meet quality control specifications. An explanation of why the data did not meet quality control specifications should be given.

Response:

The volatile organic results for the soil samples were rejected because the aliquots analyzed were smaller than required by CLP protocol. This raised the detection limits and made it more difficult to determine whether common laboratory contaminants are actually present in the soils at the 881 Hillside Area.

4. *Comment:*

> <u>Section 2.3.2.1, Page 2-37, Paragraph 2.</u> *The soil sampling objectives should include a statement that samples will be analyzed for the entire suite of volatile organic compounds, as listed in Table 2-5, thereby providing a quantitative determination of volatile organic contamination.*

Response:

> This section states that future sampling and analysis will provide a quantitative determination of volatile organic contamination in soils, although the more explicit commitments to planned sampling and analysis of the full suite of volatile organic compounds are in Section 5.1.2.1 of the work plan.

5. *Comment:*

> <u>Section 2.3.2.2, Page 2-37, Paragraph 3.</u> *This paragraph reports metal analytes that exceeded background, based on the criterion given on pages 2-19 for consideration of a constituent concentration that is greater than the one-sided 95 percent tolerance interval at the 95 percent confidence level as preliminary representing contamination. However, the possibility that these metal concentrations represent background is subsequently discounted on the basis of two vague and arbitrary criteria: (1) the concentrations occur "randomly" throughout the 881 Hillside soils and (2) the concentrations "...did not exceed a factor of two of the upper limit of the background tolerance interval or range." These criteria should not be substituted for tolerance intervals to determine whether a constituent concentration preliminarily represents contamination; nor should they be used to qualify the results of the tolerance interval analysis without being adequately explained or referenced.*
>
> *Furthermore, the list of trace metals exceeding background does not include zinc (9.2 percent of the samples), aluminum (8.0 percent), chromium (5.7 percent), strontium (5.7 percent), iron (3.4 percent), cobalt (2.3 percent), nickel (2.3 percent), and vanadium (2.3 percent). Cadmium exceeds its highest background value by a factor of two in 17 percent of the samples, but is not considered a possible contaminant. These analytes should be preliminarily considered to represent contamination, based on their tolerance intervals.*

Response:

> The revised work plan does not discount the possibility that the elevated metals are contaminants. All constituents which exceed the preliminary background estimates are considered to be potential contaminants for the purposes of planning the Phase III investigation. There are some remaining questions about whether many constituents which exceed background by small amounts and in erratic locations are actual site contaminants. However the revised work plan emphasizes that these issues cannot be resolved until the background geochemical characterization has progressed further (Section 2.3.1).
>
> The list of trace metals above background has been revised to cover all available data (through the first quarter of 1990) as well as the omissions that were noted in the comment above.

6. *Comment:*

> <u>Section 2.3.2.2, Page 2-37, Paragraph 3.</u> *Appendix A shows that the results for cesium, lithium, molybdenum, and tin were not reported. It should be stated that these analytes were not reported, and an explanation for their omission should be provided.*

Response:

> Appendix A in the revised work plan contains all available metals data (not restricted to one quarter of 1989), and some cesium, lithium, and molybdenum analyses are included in that appendix.

7. *Comment:*

Section 2.3.2.3, Pages 2-37 through 2-42. Section 2.3.2.3 describes the nature and reviews extent of radionuclide contamination of soils in the 881 Hillside area but presents ambiguous and contradictory statements that are based on poor supporting data.

Paragraph 2 on page 2-38 presents the results for the 1987 soil sampling effort. The text states that 12 to 24 inch composite samples were obtained to characterize surface contamination. These data are summarized in Table 2-7 on page 2-39. The first sentence on page 2-42 implies that the data in Table 2-7 were derived from the raw data contained in Appendix A. However, examination of Appendix A reveals that only two surface sample depth intervals (BH1-57 and BH58-87) are less than 24 inches; the majority of the surface sample depth intervals are in the 5-to-10 foot range. The text should be revised to state the correct sample depth intervals. Furthermore, Table 2-7 does not specify sample depth intervals for "surface" and "subsurface" samples.

The large composite soil sample depth intervals cited in Appendix A are not capable of yielding meaningful information on the distribution of radionuclides in the vertical soil profile. This is due to the dilution of high concentrations of radionuclides (particularly in the surface layer) with relatively uncontaminated soil. The statement on page 2-38 that "the origin of this contamination is likely the 903 Pad Area resulting from wind dissemination of plutonium/americium contaminated dust" cannot be justified on the basis of these soil sampling results. Table 4 in the 1976 EPA guidance document "Evaluation of Sample Collection and Analysis Techniques for Environmental Plutonium" shows that 2.5-cm intervals can be obtained using the trench/tray method, while 5.0-cm intervals can be obtained with an auger. This guidance documents also recommends that a surface sample depth interval should be 5.0 cm.

Paragraph 1 on page 2-42 uses the uranium isotope radio (U-233/234 to U-238 activity ratio) to identify borehole radionuclide concentrations as natural background concentrations. However, these ratios are not presented in Table 2-7, nor can they be derived from the data contained in Table 2-7 or Appendix A. The ratios cannot be calculated from Appendix A data, because Appendix A does not present all soil sampling data above detection limits (see comment 41). Supporting data should be presented in either the text or appendices.

It should be noted that analytical results for uranium 235 (U-235) are not reported in Appendix A. If this information cannot be reported, an explanation should be provided in Section 2.3.2.3. The ratio of U-235 to U-238, when compared against a background ratio, can indicate the presence of uranium that is enriched as a result of processing activities. The soil concentrations of U-235 are essential information and should be provided in the RI work plan.

Response:

The errors in Table 2-7 have been corrected and the description of soil results explicitly states that these data cannot support quantitative interpretation of surficial radionuclide distribution because of sample compositing. Consideration of the importance of wind dissemination of contamination dust from the 903 Pad Area is not based solely on these soil sampling results. More rigorous testing of that possibility will be performed in the Phase III investigation with detailed sampling of soil profiles. Other investigations, including soil sampling by CDH and soil sampling planned for Phase III RFI/RI investigations for the 903 Pad, East Trenches and Mound Areas (EG&G, 1990b), will also provide information that is important for understanding the distribution and origin of soil radionuclide contamination. The revised OU1 work plan references and explains the status of these investigations.

Appendix A of the revised work plan provides all available uranium data for all three isotopes. The data indicate that there is a mixture of natural and enriched uranium in some soil samples.

8. *Comment:*

Section 2.3.3, Page 2-42, Paragraph 4. This paragraph states that the first quarter 1988 data were included in Appendix B because they are the most recent data pertaining to the same season for which the background water tolerance intervals were calculated. The resulting data set is very small due to the number of dry wells encountered during the sampling period. This is especially true of the Rocky Flats alluvium data set; reportable results were provided for only one well out of three. If additional validated data sets are available, they should be included in the appendix. If it is felt that data from the second, third, or fourth quarters cannot be compared to tolerance intervals derived from first quarter data, then new tolerance intervals should be developed that are applicable to all four quarters.

Response:

All available data are provided in the appendices of the revised work plan. All data are compared to the only available quarter of background data. Thus this is a necessarily preliminary assessment of the relationship to background as stated in the revised work plan. Ongoing work on the background geochemical characterization will permit more rigorous comparisons in future work (based on seasonal comparability, consideration of outliers, etc.).

9. *Comment:*

Section 2.3.2.1, Page 2-48, Paragraph 1. The text states the elevated uranium concentration in well 1-87 suggests that the general inorganics and low-level organic contamination in this area (OU 1) may not be from the OU 1 solid waste management units (SWMUs). It is not understood how the test results for one analyte (uranium) from a sidegradient well can be used to characterize all inorganic and organic contamination in the vicinity of seven SWMUs at 881 Hillside. This should be explained.

Response:

The presence of constituents above background in well 1-87 is not attributed to sources outside of OU1 with certainty in the revised work plan. The possibility that well 1-87 is sidegradient to SWMU 145 is discussed in Section 2.3.3.1, and the steps planned to investigate that SWMU are described in Section 5 and in the response to the EPA comment on Section 2.3.3.1 (two boreholes and a monitoring well will be installed). The uranium concentration in well 1-87 is not used to characterize all the contamination in the vicinity of seven SWMUs.

10. *Comment:*

Section 2.3.1, Page 2-48, Paragraph 2. It should be noted in this paragraph that uranium 235 was detected at a level greater than two times background in well 8-87.

Response:

The elevated uranium at well 8-87 noted in Section 2.3.1.

11. *Comment:*

Section 2.3.3.1, Page 2-48, Paragraph 2. This paragraph should state that the concentration of strontium in well 8-87 (1.768 mg/ℓ) exceeds the upper limit of the background tolerance interval by a factor of three.

Response:

The maximum concentration of strontium in well 8-87 exceeded background by more than a factor of four and was noted as such in the revised discussion of metals in ground water (Section 2.3.3.2 in the revised work plan).

12. Comment:

Section 2.3.3.2, Page 2-49, Paragraph 1. The statement "it appears that volatile organic contamination in the colluvial ground water is limited in proximity downgradient of SWMU 119.1" is vague and has little supporting data. This statement appears to be based on the absence of detectable quantities of volatile organics at well 64-86, which is located 800 ft. downgradient from SWMU 119.1 and on the south side of the south interceptor ditch. Wells 47-87, 48-87, 49-87, and 6-87, which are located north of the south interceptor ditch and closer to SWMU 119.1, are all dry. This discussion was supported by Appendix B data. Other data sets should be used to support the discussion, because Appendix B data were gathered during a dry season (see comment 8).

Response:

The complete data set (presented in the revised Appendix B) supports a conclusion that the zone of worst contamination is at SWMU 119.1. The work plan does not state that there is no contamination that is downgradient of the SWMU. However the dry conditions persist at many downgradient wells (three were always dry and the others yielded only a few samples over two years). This is an important characteristic of the site which retards contaminant migration. The few data that are available from the occasionally yielding wells indicate no contamination or contamination that is much lower than that within SWMU 119.1.

13. Comment:

Section 2.3.3.2, Page 2-49, Paragraph 2. Colluvial well 43-87, located at the downgradient edge of SWMU 119.1, also has levels of total dissolved solids (TDS) and major ions significantly above background concentration. TDS has been detected at greater than three times the background level. Nitrate, chloride, and sulfate have been detected at greater than 16, 12, and 2 times background levels, respectively. This should be noted in the text.

Response:

The discussion of TDS and major ions at well 43-87 and other wells in that vicinity has been rewritten to incorporated all available data and to note the marked elevation of some constituents.

14. Comment:

Section 2.3.3.2, Page 2-52, Paragraph 3. This paragraph states that uranium is the only radionuclide detected above background in alluvial ground water downgradient of SWMUs 119.1, 119.2, and 130. It should be noted that sampling results for strontium 89, 90, and cesium 137 were not reported for all wells, and americium 241 results were not reported for wells 9-74, 10-74, and 43-87.

Response:

The discussion of radionuclides in Section 2.3.3.2 of the revised work plan does not state that uranium is the only elevated radionuclide. The incomplete analytical results for strontium-89,90, cesium, and americium are noted as well.

15. Comment:

Section 2.3.3.2, Page 2-60, Paragraph 1. The conjecture that well 43-87 is sidegradient to a single source of uranium located upgradient of well 6-87 is not supported by the fact that the concentration of uranium isotope 235 is much higher at well 43-87 (greater than 14 times background), than at well 6-87 (greater than 3 times background).

Response:

The text of the revised work plan does not speculate on the specific locations of sources for elevated radionuclides in well 43-87 or other nearby wells.

16. Comment:

Section 2.3.3.2, Page 2-60, Paragraph 3. Lithium has also been detected at a concentration that is significantly above background at bedrock well 5-87 (25 times above background). Lithium should be included in the discussion of the analytes that were detected above background at well 5-87.

Response:

The relatively high concentration of lithium in well 5-87 is noted in Section 2.3.3.2.

17. Comment:

Section 2.3.3.2, Page 2-61, Paragraph 1. This paragraph lists trace metals that were detected at levels slightly above background ranges in well 45-87. However, many of these analytes (barium, copper, iron, lithium, silver) were not detected in background ground water samples. The statement that these metals were "...slightly above background" is not clear and these concentrations should be compared to applicable or relevant and appropriate requirements (ARARs) or detection limits.

The statement that manganese was detected at a level slightly above background is contradicted in Appendix B-5.2. Appendix B-5.2 shows that manganese was detected at a level greater than seven times the background level for unweathered sandstone. The text should resolve this contradiction.

Response:

The revised discussion of elevated metals in ground water does not use the phrase "slightly above background" to describe concentrations of elements which were undetected in the background characterization. Comparisons with ARARs are in Section 2.4.

Manganese was reported at levels well above background in Appendix B and is reported as such in the revised text.

18. Comment:

Section 2.3.3.3, Page 2-61, Paragraph 2. There may be a discrete source of lithium contamination upgradient of wells 5-87, which is located in SWMU 119.1. This should be noted in the discussion of discrete sources.

Response:

The discussion of the extent of ground-water contamination in Section 2.3.3.3 has been revised such that discrete sources within SWMUs are not differentiated. This revision in no way minimizes the extent or magnitude of contamination concentrations. Rather, it avoids attributing well-by-well contamination to possible specific sources within SWMUs. The resolution of available data is inadequate to identify such relationships. Thus, although the elevated lithium in well 5-87 is noted in Section 2.3.3.2 and necessarily implies some upgradient source, a discrete source is not identified in Section 2.3.3.3.

19. Comment:

<u>Section 2.3.5, Page 2-65, Paragraph 3.</u> *There should be a figure depicting sediment sample stations at 881 Hillside.*

Response:

The locations of the previously sampled stations are described in detail in Section 2 of the work plan. They are all up- or downstream of the main 881 Hillside Area so they are not shown in Figure 2-17 (surface water station map). Their distances from surface water stations in Figure 2-17 are provided in the text.

20. Comment:

<u>Section 2.3.5, Page 2-66, Paragraph 4.</u> *The conclusion that the plutonium found in the samples from stations SED-25, SED-26, SED-29, and SED-30 is likely attributable to "wind dissemination of plutonium contaminated surface soil from the 881 Hillside Area," must be supported.*

Response:

The presence of plutonium at sediment locations SED-25, SED-26, SED-29, and SED-30 is considered to be consistent with the known soil plutonium contamination at the 881 Hillside and 903 Pad Areas. The work plan does not state conclusively that wind transport is the known mechanism by which plutonium has reached the sediments. Planned sampling, outlined in Section 3, will help delineated the radionuclide distribution.

21. Comment:

<u>Section 2.4, Table 2-11.</u> *This table lists the ARARs, detection limits, and maximum concentrations for compounds and elements detected at the 881 Hillside area. The units designated in the ARAR column for inorganics and radionuclides appear to be incorrect. ARAR units for inorganics are usually given in milligrams per liter. The units should be changed from micrograms per liter to milligrams per liter. The values given for ARARs would then be consistent with the values given in the Colorado Department of Health (CDH) Classifications and Numeric Standards, South Platte River Basin (1990) for many metals and all conventional pollutants. The CDH South Platte River Basin standards should be considered applicable as ARARs, even though they are considered as goals for Woman Creek, upstream of Pond C-2, until February 1, 1993. ARAR units for radionuclides should also be changed from micrograms per liter to picocuries per liter. The values given for ARARs would then be consistent with the CDH South Platte River Basin standards. Units should also be designated for maximum concentrations.*

ARARs are identified to assure compliance with environmental standards during and after remedial activities. Remedial activities that are presently being studied, will probably not be implemented at OU1 until after 1993. Two organic ARARs should be updated to be consistent with the South Platte River

Basin standards that are scheduled to go into effect in 1993: (1) tetrachloroethane (0.8 ug/ℓ) and (2) 1,1,2-trichloroethane (0.6 μg/ℓ). Although these ARARs are below the current detection limit of 1.0 μg/ℓ for both compounds, the regulatory agencies are assuming detection limits will be lower in 1993.

Response:

The erroneous units for inorganics and radionuclides have been corrected to mg/ℓ and pCi/ℓ, respectively. Maximum concentrations are reported in Table 2-11. The CDH Standards for Segment 4 of Woman Creek are goals for Segment 5 (OU1 vicinity). Although goals, they are considered ARAR. Section 2.4 has also been modified to incorporate provisions of the new NCP.

22. *Comment:*

<u>Figure 2-16.</u> It appears that the 30 pCi/ℓ contour lines were drawn to exclude well 49-87, which is dry. The most conservative interpretation of the 30 pCi/ℓ contour line that could be made using the available data would show wells 43-87, 4-87, and 6-87 encircled by a single contour line. The 30 pCi/ℓ contour line should be redrawn.

Response:

Contour lines are omitted in Figure 2-16 of the revised work plan because of the limited data, but the text explicitly refers to the uranium concentrations in the vicinity of dry well 49-87. It is logical to conclude that uranium is elevated in the vicinity of that well.

23. *Comment:*

<u>Section 2.5, Table 2-12, Page 2-77.</u> This table provides general response actions and corresponding potential component remedial technologies to be evaluated during the 881 Hillside FS. When considering on-site treatment and backfill technologies (see associated remedial technologies column), solidification and stabilization should be presented as an option. In-situ contaminated soil treatment technologies to be considered in the FS should include biodegradation. Additionally, coagulation and precipitation technologies should be considered for treatment of ground and surface water (for example, addition of aluminum sulfate or ferric chloride for the removal of metals).

Response:

The revised versions of Table 2-12 and 2-13 do consider solidification and stabilization as part of the immobilization option for on-site treatment. Coagulation/filtration technologies will be considered for ground and surface water.

24. *Comment:*

<u>Section 2.5, Table 2-13, Page 2-79.</u> This table provides the specific data requirements necessary to evaluate the identified technologies. It should be made clear in the table that a full suite of inorganic and organic analyses is necessary in order to adequately evaluate technologies other than thermal treatment technologies.

The data needed in order to evaluate the technical feasibility and cost effectiveness of thermal technologies can be obtained by an ultimate analysis on contaminated soil. In addition to an ultimate *analysis, an analysis to determine the higher heating value will be necessary. The term BTU content is inconclusive.*

Response:

The full suite of organic and inorganic analyses will be available for all soils and water considered for treatment during the FS. Ultimate analysis is now specified for thermal technologies. The footnote for entire column on "Data Needs" in Table 2-13 states that the chemical data are essential for feasibility of all the technologies.

25. *Comment:*

Section 3.1, Page 3-2, Paragraph 1. Conclusion four states that "confined ground water flow occurs in deeper sandstones." If there are any data to substantiate this conclusions, they should be presented in the text.

Response:

The conclusion that ground water in the deeper sandstones is confined was based on water level data from previous remedial investigations. Those data were included previous reports and it seemed inappropriate to repeat those water level data in a work plan.

26. *Comment:*

Section 3.1, Page 3-2, Paragraph 1. Conclusion nine is based on poor quality data. Accurate determinations of surface and subsurface radionuclide contamination cannot be made using composite soil sample intervals in the 5-to-10 foot range (see comment 7). This conclusion should be deleted unless acceptable supporting data can be presented.

Response:

Conclusion nine is based on the known history of the 903 Pad Drum Site, a 1968 plutonium survey (Owen, 1968), and previous sampling events (Seed et al., 1971; Navratil et al., 1979), as well as RI data (Rockwell International, 1988a). The revised work plan refers to the independent CDH data set. The composite soil sampling in the RI is inadequate to delineate surface/subsurface soil contamination and the text of Section 2 of the work plan explicitly addresses the deficiencies. The conclusion in Section 3 reemphasizes the need for better determination of the distribution of radionuclides in surface and subsurface soils.

27. *Comment:*

Table 3-1, Page 3-5. This table states that collecting surface soil scrapes will fulfill the data quality objective of determining the horizontal and vertical extent of surficial radionuclide soil contamination due to wind dispersion. The conclusion that radionuclide soil contamination is surficial and attributable to wind dispersion should not be made because the supporting data are poor in quality (see comment 7). Therefore the data quality objective should be treated as "to determine the horizontal and vertical extent of radionuclide soil contamination." The vertical distribution of radionuclides can be characterized by excavating trenches and sampling the trench walls at small, discrete intervals. The sampling should be continued to the depth necessary to characterize possible radionuclide leakage from SWMUs.

Response:

The sampling plan does entail detailed sampling of soil profiles as well as surface soil scrapes in order to delineate both the vertical and horizontal extent of contamination. The wording of Table 3-1 has been modified such that assumptions about surficial contamination are eliminated.

28. *Comment:*

Section 4.1, Page 4-1. Section 4.1 specifies various tasks for the RI. As specified in "guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA," health and safety protocols should be identified in the preparation of a RI. This activity should be included in Section 4.1.

Response:

Preparation of a Health and Safety Plan to define protocol for protection of field workers and the environment is included in Task 1 (Section 4.1.1) of the RI/FS plans.

29. *Comment:*

Section 4.1.3, Page 4-2, Paragraph 1. This section states that "...the Phase III RI/FS field investigation is designed to meet the objectives outlined in Section 4." An outline of these objectives is not provided in Section 4. It is suspected that a typing error was made, and Section 4 should read Section 3 in this statement.

Response:

The typing error was corrected in the revised work plan, and the text now reads, ". . objectives outlined in Section 3".

30. *Comment:*

Section 4.1.5.3, Page 4-4, Paragraph 3. The text states, "for organic compounds, any detectable concentrations in samples that are not attributable to laboratory contamination will be considered likely evidence of contamination." Procedures and criteria that are to be used to determine laboratory contamination should be stated in this paragraph.

Response:

Determination of laboratory contamination was based on CLP protocol (U.S. EPA, 1988) and is clearly referenced in the revised work plan.

31. *Comment:*

Section 4.1.6.1, Page 4-8, Paragraph 1. This section states that, for the risk assessment, "...all contaminants at Operable Unit No. 1 will be considered unless the following criteria are met for their deletion:

- *Determination that a chemical has not been detected above risk based detected limits;*
- *Environmental fate information which shows that exposure will not occur; or*
- *A low frequency or occurrence (less than 10 percent) in environmental media."*

It is not clear if all three criteria must be met or if just one of the three criteria must be met to consider deleting a contaminant. In addition, the term risk based detected limits should be defined.

The meaning and rationale for the third criterion are unclear and should be explained. Although a contaminant may be detected infrequently, its concentrations could be high enough to warrant remediation.

Response:

The section regarding the criteria for selection of site contaminants has been rewritten in accordance with recent EPA guidance. Frequency of detection is no longer a criterion. The term "risk-based detection limits" has been deleted.

32. *Comment:*

<u>Section 4.1.6.2, Page 4-12, Paragraph 5.</u> *This discussion of the environmental evaluation states that the investigation will include the collection of several types of organisms to determine if there is a bioaccumulation of contaminants in the vicinity of OU 2. The remainder of the discussion does not describe the procedures used when determining whether bioaccumulation has occurred. This should be added to the discussion.*

Response:

The portion of the section on environmental evaluation which addresses bioaccumulation now reads:

> Field surveys of aquatic invertebrates in Woman Creek and terrestrial organisms found within the 881 Hillside Area will be conducted to determine if these organisms have been adversely affected by contaminants at the site. Ecological endpoints selected for the aquatic survey will include, at a minimum, biomass, relative abundance, species richness, and community evenness. The upper reaches of Woman Creek will serve as a "control" for comparison with results from the site survey. Similarity between stations will be evaluated using statistically appropriate indices (Sorenson and/or Jaccard coefficients and Van Horn Index of Similarity).

A separate environmental assessment work plan has been prepared by EG&G which addresses the sampling and analytical approach to the environmental evaluation in further detail. This plan is presented as Section 6 of the revised work plan.

33. *Comment:*

<u>Section 4.1.6.2, Page 4-13, Paragraph 4.</u> *The text discusses biomarkers. However, the discussion of population-ecosystem density, diversity, or nutrient cycling as measured in individual organisms does not indicate an understanding of the methods used to evaluate ecological systems. This, in turn, suggests that biomarkers are not well understood. The discussion should be rewritten with an explanation of the specific procedure to be used for the Rocky Flats evaluation.*

Response:

The revised text of Section 4.1.6.2 clarifies the discussion of biomarkers in the context of ecosystem evaluation. The principal paragraph dealing with biomarkers is:

> Biochemical or physiological responses (biomarkers) in individual organisms can provide sensitive indices of exposure or sublethal stress. The evaluation of biomarkers can therefore provide an understanding of the dynamics of community structure, such as abundance, diversity and nutrient utilization. Biomarkers for sublethal stress include overt symptomology such as skeletal abnormalities (lordosis, scoliosis), gas exchange in plants, and measurable processes

at the cellular and molecular level such as enzyme function. Examples of biomarkers that may be considered for this assessment include microbial bioassay (microtox) and enzyme function in small mammals (amino-lerulinic acid dehydrase[ALAD]). Procedures to be used for the field and laboratory activities are presented in the "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference (U.S. EPA, 1989).

34. Comment:

Section 4.1.6.2, Pages 4-12 and 4-13. The text describes the need for field and laboratory activities that would determine the effects of contaminants from the facility on the area's flora and fauna. The discussion of field activities in Chapters 3 and 4 do not indicate even the possibility of field work for biological systems. If ecological field activities are to be part of the Phase III RI work, they need to be described in the work plan. The environmental risk assessment should be described based on actual projected Phase III activities.

Response:

Conclusion fourteen has been added to the list in Section 3:

Although the remedial investigations have not provided biological data which specifically address conditions at the 881 Hillside Area, previous studies in that vicinity (903 Pad Area and Plant-wide), indicate nondetectable impacts to biota. Considering the locally high concentrations of contaminants and proximity of the 881 Hillside to water and feed for wildlife, further characterization of OU1 is needed.

35. Comment:

Section 4.1.7, Page 4-14, Paragraph 1. It is indicated that treatability studies and pilot testing to be conducted or reviewed will focus on removal of metals and organic compounds from water. Three water treatment technologies are being considered for treatability studies and pilot tests and two have already been performed. Specific treatability studies and pilot tests for soil treatment technologies, on the other hand, are not mentioned. The rationale for emphasizing water treatment technology testing should be specified.

Response:

The Inter-Agency Agreement (IAG) specifies development and implementation of site-wide treatability studies for contaminated soil and water at the Rocky Flats Plant. This is noted in the revised Phase III plan.

36. Comment:

Section 5.1.1.5, Page 5-6, Paragraph 1. The text states that if the Building 887 sewer pump is not found to be the source of SWMU 106, no further investigation of the site will be needed. It does not state what other possible sources may exist, and what steps would be necessary to verify the source.

Response:

Possible sources of contamination at SWMU 106 other than the outfall pipe are unknown. If the outfall pipe is not the source, additional soil sampling will be conducted to determine if there is contamination in the vicinity of SWMU 106.

37. *Comment:*

Section 5.1.1.9, Page 5-8, Paragraph 4. The text states "as no hazardous or radioactive constituents were released to the environment by this leak and the leak was repaired, no further investigation of this site is necessary." The source of this statement should be referenced.

Response:

The statement that no contaminants were released and that the leak was repaired was made by Rockwell International (1987) in their summary of historical data on SWMUs. However the statement was not specifically referenced within that document, and further information is unavailable. Because of that uncertainty, and because of the proximity of SWMU 145 to well 1-87 which has elevated constituents, two boreholes are proposed to check for contamination from SWMU 145. A downgradient monitoring well will also be installed.

38. *Comment:*

Section 5.1.2, Pages 5-9 through 5-14. It should be recognized that sample handling procedures exist that avoid both phthalate and volatile organic contamination. This may be an appropriate section in which to state that the laboratory chosen to perform analyses will be expected to employ procedures that avoid volatile organic and phthalate cross-contamination.

Response:

The expectation that field and laboratory contamination of samples can and will be avoided during Phase III work was noted in Section 5.1.2.2 of the revised work plan.

39. *Comment:*

Section 5.2.1.3, Page 5-16 through 5-27. The design of the pumping and tracer tests is basically sound. However, the tight spacing of the wellpoints may introduce significant error due to aquifer heterogeneity. The following potential sources of error have been identified:

- *Error may be introduced by sediment stratification. All of the observation wells are within 4.5 feet of the pumping well. Distances of three to five times aquifer thickness are generally required to negate the effects of stratification.*
- *Well construction may compact alluvium around the casing. Compaction may result from displacement from driving the casing and settling from vibration. If significant compaction occurs, the true hydraulic conductivity may be greatly underestimated.*
- *Wells must be developed carefully, so that the percentage of fine-grained material in the surrounding sediment is neither increased or decreased. If a well is underdeveloped, the true hydraulic conductivity may be underestimated. If a well is overdeveloped, the true hydraulic conductivity may be overestimated.*

Sources of error related to well spacing should be included in a discussion of aquifer test results.

Response:

The design of the aquifer tests considered the potential sources of error listed above. The revised work plan explicitly addresses the influences of sediment stratification, artifacts of close well spacing and well development at the end of Section 5.2.1.3.

40. Comment:

Section 5.2.3, Page 5-3, Paragraph 2. This paragraph states that all ground water samples other than those for organic compounds, major ion, and tritium analyses will be filtered in the field. EPA's "Resource Conservation and Recovery Act Ground-Water Monitoring Technical Enforcement Guidance Document" (TEGD) suggests that ground water samples for metal analyses be split into filtered (0.45 microns) and non-filtered portions. This is done because "particles which may be present in the well even after well evacuation procedures, may absorb or adsorb various ionic species to effectively lower the dissolved content in the well water." Ground water samples should be analyzed for total metals, as well as dissolved metals.

Response:

Due to the limited saturated thickness in many wells at the Rocky Flats Plant, the analyte list is restricted to dissolved metals.

41. Comment:

Appendices A-D, General Comments. The appendices only present data above calculated upper tolerance limits. All data above detection limits should be presented, regardless of whether the detection limits are above or below upper tolerance limits. Tolerance limits and maximum background values for radionuclides should have an associated error term reported.

Response:

Appendices A through D in the revised work plan present all available data for the 881 Hillside Area.

42. Comment:

Appendix C. Results from Woman Creek surface water sampling (SW-32, SW-33, SW-34) should be reported in Appendix C.

Response:

Data from the surface water stations SW-32, SW-33, and SW-34 are reported in Appendix C.

SECTION 3

RESPONSE TO CDH COMMENTS

SECTION 3

RESPONSE TO CDH COMMENTS

Comment:

1.4.8 Radioactive Site - 800 Area #1 (SWMU Ref. No. 130).

A copy of the Owen and Stewart Report 1973 is requested for review. It is likely that this report will be reviewed and summarized in the historical release report to be submitted under the IAG. Additional information may be gained by reviewing this report at an earlier time.

Response:

The Owen and Stewart Report will be forwarded under separate cover.

Comment:

1.4.10 Building 885 Drum Storage Site (SWMU Ref. No. 177).

Ground-water contamination from SWMU 177, if present, is to be addressed under OU10 as outlined in the 1989 IAG draft. However, if it is technically more practical to address clean up of contaminated ground water at SWMU 177 under OU1, then the closure of SWMU 177 must be addressed prior to ground-water clean up at OU1.

Response:

The investigation of ground-water contamination at OU1 must encompass SWMU 177 because of its upgradient location relative to other SWMUs within OU1, i.e., it must be determined to what extent SWMU 177 contributes contamination observed at the other SWMUs. As you state, it may even be technically more practical to remediate ground-water contamination emanating from SWMU 177 as part of the final remedial action for OU1. If it appears a source control measure is the most effective measure for addressing any contamination emanating from SWMU 177, then closure will be undertaken prior to the schedule for OU10.

Comment:

2.2.1.1 Surficial Geology

The text states that artificial fill covers the colluvium at SWMU 130. The map in figure 2-2 does not indicate this and needs correction. The text does not describe in detail the composition, grain size, and sorting and hydrologic properties of the surficial deposits. These properties are important in understanding the transport capabilities of contaminants in ground water.

<u>Colluvium</u>

The text states that the area south of SWMU 130 is undisturbed colluvium. This is not consistent with Figure 2-2. The area immediately south of SWMU 130 is shown to be disturbed.

The text sites the correlation of basal gravel in wells 59-86, 69-86, and 8-87 BR. Figure 2-1 shows well 8-87 but not 8-87BR. It is assumed that 8-87 and 8-87BR are the same wells. Text and figures must be reviewed for consistency.

It is important to illustrate in cross section the correlation of the gravel zones within the colluvium. Cross sections can thus be used to provide a better understanding of ground-water flow conditions in the area.

Response:

Figure 2-2 has been modified to be consistent with the text in regard to the location of areas of disturbed ground and artificial fill.

Wells 8-87 and 8-87 BR are the same wells. The "BR" nomenclature has been dropped because the well number is unique. The text has been changed accordingly.

Several cross sections presented in the RI Report attempted to correlate the gravel lenses in the colluvium. The work proposed in the Phase III RFI/RI Work Plan will help confirm the continuity of the lenses. Because of contamination in wells 43-87 and 4-87, the cross section for the sand and gravel zone present in wells 43-87/BH57-87, 4-87 and 47-87 is presented in the Phase III RFI/RI Work Plan.

Comment:

2.2.1.2 Bedrock Geology

If reference(s) were used in this section, they must be cited.

Claystones

The thickness of claystones and fracture density in the Arapahoe Formation must be stated in specific terms. Generalizations (i.e., mild fracturing) does not lend to understanding the hydrogeologic conditions at the site. Well 5-87BR and abandoned well 7-87 BRA are identified as 5-87 and 7-87A on Figure 2-1. Consistency between the text and figures is necessary. The results of Packer tests at wells 5-87BR and 8-87BR must be presented separately. Averaging the values does not seem appropriate as bedrock in well 5-87BR was "mildly" fractured and only one "45 degree" fracture was found in the bedrock at well 8-87BR. Additionally, these locations are greater than 600 feet distant to each other.

Explain how fractures are distinguished from drying of clay bedrock upon removal and storing of core.

Cross sections illustrating the vertical extent and degree of fracturing and the extent of weathering in the claystone are necessary.

Sandstones

Although the extent of sandstone units are not well defined, it is known that more than one sandstone unit is present. A summary of findings accompanied with cross sections is appropriate.

Ground-water Flow Directions

Potentiometric surface maps should be updated to reflect the 1989 water-level data. Any changes or trends in data between 1988 and 1989 should be noted and evaluated. Data collected from 1989 wells may contribute greatly to interpretation of ground-water flow conditions.

The interconnection between the south interception ditch and ground-water flow can be better determined using water level data from wells to the south of the ditch and also west of 47-87 (i.e., 2-87, 59-86R, 55-87 and 64-86).

If ground water is below the base of the interceptor trench, the potential for contaminated ground water to migrate downgradient toward Woman Creek is likely. Ground water could potentially emerge at seeps and flow into the creek.

Ground-water Flow Rates

The mean ground-water velocity through colluvium is calculated to be 155 feet per year rather than 150 feet per year as stated in the text.

Contaminants have not been found at well 47-87 because the well was dry during sampling events. The values determined for ground-water velocity vary two orders of magnitude (1,400 feet per year to 13 feet per year) indicating that the packer test results were not conclusive and that the flow velocity is highly dependent on the geologic medium through which it passes.

More evaluation is necessary to determine flow velocity in regard to future remedial actions and past releases. It is possible that preferential subsurface pathways with the high hydraulic conductivities exist which would allow for release to Woman Creek especially prior to construction of the interceptor ditch.

The flow of water to evapotranspiration is critical to evaluating ground-water conditions and total distance traveled in a year.

The supporting data for the evapotranspiration evaluation should be illustrated graphically to show seasonal variations and trends.

The ground-water velocity, based on the geometric mean hydraulic conductivity of 1.5×10^{-3} *cm/s is 326 feet per year and not 220 feet per year based on the equation:*

$$\overline{v} = k \frac{dh}{dl}$$

where $K = 1.5 \times 10^{-3}$ cm/s

$$\frac{dh}{dl} = .021$$

$$n = 0.1$$

and $1 \frac{cm}{s} = 1.035 \times 10^{-3}$ feet per year

When ground water is not flowing during one season, due to evapotranspiration, there is less water available in the system. The available water is capable of flowing at the same velocity as during the other seasons. Thus, the reasoning behind dividing the flow velocity by four and multiplying by three to arrive at a maximum possible velocity does not seem reasonable.

Response:

References are provided in the revised work plan.

Claystone

In general, the weathered claystone shows mild fracturing. Abundant fracturing and shearing were not noted in weathered claystone on any of the borehole logs. Specific packer test results are presented separately in the revised work plan.

Fracture patterns are determined in the field immediately after the core barrel is open. The core is first examined for recovery and then for rock quality designation (RQD). RQD is computed by summing the lengths of all pieces of core equal to or longer than four inches and dividing by the total length of the sample run. In general, natural fractures exhibit slickensides and iron oxide coated surfaces which distinguishes them from secondary fractures caused by drilling.

Available data are insufficient to permit preparation of cross sections showing the extent and orientations of fracturing and weathering. The work plan addresses the need to collect this type of data during borehole logging.

Sandstones

Attempts were made to correlate sandstones found in 3-87BR, 59-86, and 8-87BR in cross section C-C' (Plate 5-2), and in 59-86, 8-87BR, 7-87BRA, and 5-87BR in cross section H-H' (Plate 5-4) of the RI report. Phase III RFI/RI boreholes and wells are planned to further assess the extent of sandstone units.

Ground-Water Flow Direction

Potentiometric surface maps have been completed for January 1989, May 1989, August 1989, and October 1989 and included in the revised work plan. There do not appear to be any significant changes and/or trends in data between the 1988 and 1989 data.

Wells 2-87 and 59-86R have sufficient saturated water thickness to show flow from the colluvial ground water into the South Interceptor Ditch. Wells 55-87 and 64-86 are generally dry throughout the year except during spring runoff.

There is potential for contaminated ground water to migrate downgradient to Woman Creek and the valley fill. However, the french drain will be designed to collect and treat this alluvial ground water, thus, eliminating this potential for flow.

Ground-Water Flow Rate

The mean ground-water velocity through colluvium is approximately 155 ft/yr as stated in the comment.

Well 47-87 was usually dry, but the samples that were obtained did not contain volatile organic concentrations above detection limits (Table 2-10 of the Phase III RFI/RI Work Plan).

The 11 to 13 feet per year value represents an estimate of the organic contaminant migration rate, not ground-water flow rate. Well 47-87 is usually dry throughout the year, therefore contaminant migration would be less than calculated ground-water flow rates. The results of the packer tests are fairly representative values for hydraulic conductivity in gravel and sandy clay layers within the colluvium. The flow velocity is very dependent on the geologic medium through which it passes, therefore, it can be quite variable in the heterogeneous formations found in surficial and bedrock deposits of the Rocky Flats Plant.

Evapotranspiration

With a hydraulic conductivity of 1.5×10^{-3} cm/sec (1,550 ft/yr), the resulting ground-water flow velocity should be 326 ft/yr, not 220 ft/yr. The revised discussion does contain this new value.

If the saturated thickness of the Woman Creek alluvium is zero during one quarter of the year, then water and contaminants are not moving within the aquifer during that period. In other words, there is no available water capable of flowing at any velocity during this period. Therefore, the three quarters factor is appropriate to calculate effective contaminant migration rate within the Woman Creek alluvium.

Comment:

2.2.3 Surface Water Hydrology

2.2.3.1 Woman Creek

The time of year during which the surface water measurements were taken along Woman Creek must be referenced as seasonal fluctuations have a large impact on the ground-water flow and interconnection to Woman Creek. The statement that there is frequent interaction between Woman Creek, the South Interceptor Ditch and the shallow ground-water system indicates that a flow path for contaminant release exits into the surface water drainages.

Response:

The dates for surface water measurements are provided in the revised work plan. Frequent interaction between ground water and surface water indicates a flow path for contaminant release to surface water. However, surface water quality data for Woman Creek indicate this pathway may be insignificant. Potential ground-water discharge to the South Interceptor Ditch enters Pond C-2 which is monitored and treated in accordance with the Plant's NPDES permit.

Comment:

2.3 Nature and Extent of Contamination

2.3.1 Background Characterization

CDH comments on the Background Geochemical Characterization Report apply to this section of the RI report.

Probability distributions for measured values where the error team is larger than the measured value should be avoided by taking a minimum of 25 readings from each sample.

Background samples should have been analyzed for VOCs to verify that they are unaffected by known and unknown contaminated areas.

Data evaluation must include graphical analysis showing the sample locations where parameter concentrations are measured as greater than background.

Borehole locations, depths, and sample locations should be shown graphically in cross section (Table 2-6).

Response:

Responses to CDH comments on the draft Background Geochemical Characterization Report have been prepared, and these comments will be incorporated into the final report and RI report as appropriate. Ground-water and surface water samples are being collected in background areas for VOC analysis. Borehole locations are identified on Figure 2-1. A cross section relevant to the proposed plans for the Phase III RFI/RI is provided in the revised work plan as previously discussed.

Comment:

2.3.2.3 Radionuclides

Plutonium in surface scrape at 881-14 also occurred at an elevated level. This location is at least 1,500 feet southwest of the 903 pad and may not be related to contamination from the pad.

Uranium cesium and tritium values (Appendix A) should be shown graphically in cross section.

The question regarding cesium occurring as a natural constituent or from a criticality accident depends on if the isotope is present or the metal. If cesium 137 is present due to fallout, then values of fallout must be provided with references for comparison.

On Figure 2-10, the data does not support the lines of equal TDS concentration. For example, the TDS concentration at well 10-74 is indicated as 1646 mg/ℓ but falls within the bullseye for the 1770 mg/ℓ contour as indicated at wells 43-87 and 4-87. The data indicated that a separate contaminant source lies south of SWMUs 130 and 119, or that contaminants are being concentrated in an area downgradient from the SWMUs.

The number of data points is inadequate to determine the extent of contaminant migration between wells 8-87 and 47-87. It is indicated, however, that contamination (nitrate) has migrated beyond the South Interceptor Ditch.

The TCE and PCE concentration maps (Figures 2-8 and 2-9, respectively) do not adequately project conditions through time. For example, well 48-87 was dry during second quarter 1989 but not during first quarter 1988. Trend analyses are necessary to understand the extent of ground-water contamination. This is especially important in this location as VOCs are detectable in the ppm range upgradient from Woman Creek.

On Figure 2-12, it is not clear why two isopleths cross each other. The highest selenium values occur in or adjacent to SWMU 119.1, an area of high VOC contamination. Is selenium a parameter in the waste? Strontium, nickel, and zinc values also are high near SWMU 119.1. It is possible that the high VOCs leach the metals from their matrix. If this is the case, this can be an indicator and provide supporting evidence for the extent of contamination.

Figure 2-16 indicates that the source of uranium is not necessarily localized but dispersed at this time. Thus the higher concentrations near wells 43-87 and 6-87. It is not clear why the 53 pCi/ℓ contour lies outside the 35 pCi/ℓ contour.

The text lacks a discussion on plutonium occurrence in this area.

Response:

Elevated plutonium in surface soils is not confined to areas southeast of the 903 Pad (prevailing wind condition).

There are insufficient trends with depth for uranium, cesium, and tritium values to prepare cross sections.

See our response to EPA comments on Section 2.3.2.3.

There was no 1770 mg/ℓ TDS contour. Well 10-74 is within the 1500 mg/ℓ TDS contour as shown on Figure 2-10. The 1770 mg/ℓ concentration corresponds to well 43-87. The map of TDS values in the revised work plan shows second quarter 1989 data for the purposes of comparison to available background data. Determination of potential sources for ground water is an objective for the Phase III work plan.

The extent of nitrate contamination will be better defined by the Phase III RFI/RI results.

Trend analysis will be performed for the RI report. Preliminary evaluation of the existing data (provided in the appendix of the revised plan) indicate fluctuations rather than unambiguous trends of the parameters over time.

Inspection of Figure 2-12 does not show that the selenium isopleths cross over each other. Indeed, metals including selenium may be leached from the soil matrix and may be good indicators of contamination. The Phase III results will help in this evaluation. The revised figures of trace element distribution do not include contours because they do not aid interpretations of the available data.

Figure 2-16 is somewhat confusing in terms of identifying contour concentrations versus well concentrations. The 53 pCi/ℓ concentration is for well 6-87 which lies within the 30 pCi/ℓ isopleth. The revised Figure 2-16, modified to include any second quarter 1989 data, does not include contours. The area of high uranium concentrations is readily apparent without the contours, and the data do not justify a more detailed portrayal.

The only occurrences of plutonium in ground water at the 881 Hillside were at well 69-86 (0.014± 0.009 pCi/l) and well 2-87 (0.211± 0.074 pCi/l).

Comment:

3.3.3 Summary of Extent of Contamination

The text indicates that contaminants have not migrated an appreciable extent. However, the data and figures indicate that contamination may have migrated to, and possibly from, the South Interceptor Ditch.

Response:

"Appreciable" is a term whose meaning may have broad interpretation, and it has been removed from Section 3.3.3. The summary now more clearly indicates that the volatile organic contamination and the inorganic contamination to a less certain degree, are confined to OU1 and its proximity. Areas of highest organic contamination are associated with source SWMUs. Numerous portions of the work plan refer to uncertainties regarding the extent of lower concentrations of contaminants and Section 3.3.3 is consistent with the recognized need for further investigation.

Comment:

2.3.4 Surface Water

It is not understandable or acceptable why surface water data have not been received for dissolved and total radiochemistry analyses given that the investigation begin in 1987.

Response:

The revised draft includes a discussion of all available data, not just first quarter 1989 data. Some radiochemical data were missing at the time the draft work plan was prepared.

Comment:

2.3.5 Sediments

The sediment station locations must be indicated on a map with analytical results. Although acetone is not a likely sediment contaminant at the SED-30 sample location, its presence at a concentration of 200 mg/kg indicates significant problems with sampling and/or analytical techniques. The area requires resampling for verification of results.

Response:

The locations of previously sampled stations are described in the revised work plan. They are all up or downstream of OU1 so they are not shown on Figure 2-17. However, their distances from surface water stations shown in Figure 2-17 are provided in the text. The relationship of above-background constituents at the sediment stations to releases from OU1 is unclear because of the potential impacts from other sources at the Plant and the preliminary nature of the background characterization. Graphical presentation of the data thus has not been provided. Concerns at the 881 Hillside Area will be more appropriately addressed by the establishment of new sediment sampling stations that are more clearly associated with OU1. The plan for Phase III work includes such stations.

Comment:

2.4. Applicable or Relevant and Appropriate Requirements

Table 2-11 lists 1,1,-dichloroethane as a RCRA Appendix VIII constituent. The background value for this constituent is therefore relevant and appropriate. (See EPA comments of February 14, 1990, on the Draft Phase RFI/RI workplan for OU2).

Table 2-11, page 2-71 and page 2-75, the units for ARARs must be mg/ℓ and pCi/ℓ, respectively.

The standards for metals and organics must be changed to include most recent Colorado standards reclassification (Notice of Final Adoption of February 15, 1990). Table 1 of the new standards lists the TCE standard as 0.8 based on fish ingestion which is more restrictive than the standard based on carcinogen water supply.

Response:

The solvent 1,1-dichloroethane is an Appendix VIII constituent (ethylidene dichloride) and RCRA Subpart F is relevant and appropriate. However, Subpart F ground-water protection standards for Appendix VIII constituents are background or an alternate concentration limit (ACL) that is protective of the public health. The latter is more in keeping with Superfund policy. In the absence of an ACL at this time, we are proposing background as TBC. The entire section has also been rewritten to reflect the new NCP regulations (March 1990).

The typographical errors for the units in Table 2-11 have been corrected in the revised draft.

The February 15, 1990 standards are considered ARARs.

Comment:

2.5 Sampling and Analysis Requirements for Remedial Alternatives Evaluation

EPA comments on Section 2.5 of the Draft Phase II RI/FS Workplan (alluvial) for OU2 must also be considered in this report.

Response:

Bioreclamation and vitrification have been added to the technologies associated with in-situ contaminated soils treatment. Data needs for these technologies have been provided. It is noted in Table 2-13 that analysis for a full suite of organic constituents is necessary in order to evaluate soil and ground-water bioreclamation as well as UV-peroxide oxidation, air stripping, and in-situ aeration.

Comment:

3.1. Phase I and II RI Conclusions

Conclusion (7), the radionuclide contamination at SWMU 130 was not adequately evaluated in the Phase I RI report to conclude that plutonium was not detected.

Response:

Section 3.1 does not conclude that plutonium is absent in the soils at SWMU 130, and the deficiencies of the soil compositing strategy of the Phase I RI for detecting radionuclide contamination are recognized.

Comment:

3.2 Site Specific Phase III RI Objectives and Data Needs

CDH comments of February 15, 1990, on Section 3.2 of the Draft Phase II RI/FS Workplan for OU2 apply to Section 3.2 of this report also. These comments are cited below.

Comment:

Characterize Site Physical Features

The hydraulic interconnection between the surficial deposits and bedrock must be determined through hydraulic testing. Sandstone lenses in the Arapahoe Formation must be delineated in order to evaluate the fate and transport of contaminants. Delineation can be achieved through drilling and seismic studies.

The hydraulic properties of the underlying bedrock must also be determined through aquifer testing.

During drilling, logging and other site characterization activities, a geologic oversite program must be implemented that emphasizes consistency in geologic mapping and core logging.

Response:

Plans for hydraulic testing to assess the bedrock-alluvium connection and bedrock properties are described in Section 5.1.1.3 of the revised work plan. The high resolution seismic study and further drilling will provide additional information on the occurrence of sandstone in the Arapahoe Formation.

Field audits are part of an ongoing quality assurance program that will help ensure consistency in geologic mapping and core logging.

Comment:

Characterize Contaminant Sources

Installation of wells may not necessarily be restricted to the alluvium. The impact of releases on the uppermost aquifer must be determined.

Response:

Planned well installation for Phase III will include the uppermost bedrock unit beneath the alluvium.

Comment:

Characterization of the Nature and Extent of Contamination

The vertical and horizontal extent of contamination due to radionuclides, VOCs, and inorganics in the uppermost aquifer and surface water must be determined. Ground-water monitoring wells must be *installed into all hydraulically interconnected geologic units. As nitrates were detected south of the 881 Hillside, nitrate analyses must be included.*

Response:

Phase III activities will include determination of the vertical and horizontal extent of radionuclide, inorganic (including nitrates), and volatile organic compound contamination; monitoring of all hydraulically connected units; and tracking of contaminant plumes through time.

Comment:

<u>Provide a Baseline Risk Assessment</u>

The migration pathways and receptors must be identified as part of the baseline risk assessment. Identify the migration pathways, receptors, toxicity and quantity of contaminants.

Response:

Section 4.1.6 includes these aspects of a baseline risk assessment.

Comment:

<u>Addition of New Categories</u>

- *Identify appropriate IM/IRAs for OU1 if necessary.*
- *Identify and implement data management procedures.*
- *Identify the necessary upgrades to the air monitoring program for detection of possible releases during RI/FS activities.*

Response:

These items have been identified in Section 4.1.3 of the revised Phase III work plan.

Comment:

Table 3-2, Comparison of Chemical-Specific ARARs and TBCs to Analytical Detection Limits of the Draft Phase II Workplan for OU2 must also be included in Section 3.2 of this report. The table must be revised to address EPA's comments on the previous document. That is, detection limits must be modified for all analyses where detection limits are greater than the ARAR standard.

Response:

Table 3-2 is not included in this plan because it contains redundant information that is presented in Table 2-11. This table has also been revised to reflect both EPA's comments on the previous document as well as regulations in the new NCP. Detection limits will be equal to or less than chemical-specific ARARs to the extent practical.

Comment:

4.1 Remedial Investigation Tasks

4.1.1 Task 1 - Project Planning

The current seismic reflection program will help in the evaluating hydrogeologic conditions at OU1. Results of the study should be used in scoping further investigation at OU1.

Response:

The preliminary results of the ongoing high resolution seismic reflection program were reviewed in preparation of this document (see Section 2.2.1.2). This is noted in Section 4.1.1 in the revised draft work plan.

Comment:

4.1.2 Task 2 - Community Relations

The final workplan must mention the interim community relations plan.

Response:

The interim community relations plan has been explained in Section 4.1.2.

Comment:

4.1.3 Task 3 - Field Investigation

Many of the comments provided by CDH and EPA on the Draft Phase II RI for OU2 regarding Section 4.1.3 apply to this report.

Response:

The text now notes that the field investigation must be designed to meet the objectives outlined in Section 3. Boreholes will be placed within and around the SWMUs to assess maximum contaminant concentrations and to approximate the vertical and horizontal extent of contamination within the estimated SWMU boundaries.

Comment:

4.1.5 Task 5 - Data Evaluation

Data evaluation must also be used to determine the rate of ground-water flow and contaminant migration.

Data collected from the seismic study, drilling, water level measurements, and any other characterization activities must be evaluated and used to construct detailed cross sections and plan maps depicting site-specific geology, hydrology, and nature and extent of contamination. Cross sections are necessary to illustrate the vertical extent of contamination and to identify data gaps. Results of the Background Geochemical Characterization Report must be incorporated into the characterization study of OU1.

Response:

The introductory paragraph to Section 4.1.5 now mentions evaluation of ground-water flow and velocity, and Section 4.1.5.3 discusses contaminant migration rates in ground water and the interaction of surface and ground water as it pertains to contaminant migration.

The remainder of this comment is acknowledged. However, the text of Section 4.1.5 appears to adequately cover these elements of data evaluation.

Comment:

4.1.6 Task 6 - Baseline Risk Assessment

CDH comments on the Draft Workplan for OU2 are to be considered in this report also.

4.1.6.1 Public Health Evaluation

Contaminant Identification

Contaminants occurring at OU1 must be considered in the risk assessment regardless of the frequency of contaminant occurrence.

Toxicity Assessment

In order to assess the risks from a site, the projected concentrations of all constituents analyzed must be compared to ARARs to judge the degree and extent of risk.

A summary of toxicological studies performed must include an evaluation of all constituents found in concentrations greater than ARARs.

CDH must also be consulted regarding the appropriateness of the data and methodologies to be used in deriving reference values.

Response:

Frequency is no longer a criterion in determination of site contaminants. Site contaminants are now defined as all chemicals exceeding background using the statistical techniques presented in the draft Background Geochemical Characterization Report. Thus, comparison to ARARs and toxicological summaries will be completed for these site contaminants and not just to indicators or target compounds as previously stated. The text now stipulates consultation with CDH for deriving reference values.

Comment:

4.1.7 Task 7 - Treatability Studies/Pilot Testing

See additional attached comments.

It is a possibility that soil contamination is present at boreholes 1-87, 57-87 and 58-87. Therefore, a section on soil decontamination is necessary.

Response:

This section has been modified to discuss planned treatability studies presented in the draft Site-Wide Treatability Study Plan. These studies include soil remediation. The "additional comments" referenced above were not received from CDH.

Comment:

4.1.8 Task 8 - Remedial Investigation Report

The report must also discuss the rate of contaminant migration and include all data from quarterly ground water and all surface water sampling events.

Response:

The rate of contaminant migration and the use of the ground-water and surface water data are now noted in Section 4.1.8.

Comment:

Section 5.1 Sampling Location and Frequency

All wells must be sampled on a quarterly basis at a minimum. A higher sampling frequency during wetter seasons may be necessary to determine if contamination is moving in slugs.

Wells must be completed to a depth below their vertical extent of contamination.

Response:

The text now notes that ground-water monitoring wells will be sampled quarterly at a minimum until it is determined that the ground-water quality is sufficiently characterized.

Alluvial and bedrock wells are completed at the base of surficial materials and sandstone, respectively. This permits sampling of potentially contaminated ground water in the respective units.

Comment:

5.1.1.3 Liquid Dumping Site (SWMU Ref. No. 104)

For complete investigation of this area, one borehole must be completed as a monitoring well. If contamination of ground water is found, installation of additional wells will be necessary to determine the extent of the plume.

Response:

Considering the existence of this SWMU is unlikely, the data from the proposed boreholes at this SWMU, together with ground-water quality data from nearby proposed wells, will be adequate to address SWMU 104 as a potential source of contamination.

Comment:

5.1.1.5 Outfall Site (SWMU Ref. No. 106)

If contamination at the outfall is found, other monitoring wells and boreholes up and downgradient of the pipe may be necessary. Upgradient locations would be necessary to locate possible leaks in the pipe.

Response:

If high levels of contamination are found, additional boreholes and wells may be required to better define the extent of contamination for remediation. Otherwise the boreholes and wells proposed at SWMU 106 and in the vicinity, as well as existing wells, will provide adequate data to address this SWMU.

Comment:

5.1.1.6 Hillside Oil Leak Site (SWMU Ref. No. 107)

It is not clear where ground-water samples will be collected within SWMU 107. No new monitoring well locations are shown on Figure 5-1.

Response:

The revised work plan proposes that MW17 be installed just downgradient of SWMU 107 to monitor ground-water quality there. Note that the well numbers greater than or equal to MW17 have been changed from the February 1990 draft of the work plan (EG&G, 1990c) because of the addition of some new proposed wells.

Comment:

5.1.1.7 Multiple Solvent Spill Sites (SWMU Ref. Nos. 119.1 and 119.2)

<u>SWMU 119.1</u>

Additional ground-water monitoring wells are needed to confirm hydrogeologic conditions and to trace the extent of ground-water contamination. Suggested locations are: at the southwestern end of SWMU 119.2 and south of the road but north of the dry wells 50-87, 62-86, and 63-86.

Response:

There are numerous existing and proposed wells downgradient of SWMU 119.2, including well 50-87, 62-86, 63-86 (existing) and MW11, MW13 and MW23 (proposed). These six wells within a relatively small area, together with the further downgradient well MW29, will provide the information required to characterize the hydrogeologic conditions and any contamination emanating from SWMU 119.2.

Comment:

5.1.2 Sample Analysis

Explain how the results of the experiment designed to determine the source of phthalate contamination will be presented to CDH and EPA.

Response:

Although the details of the investigation have not yet been defined, the study will likely look at the contribution of phthalates from all forms of plastic that comes in contact with the soil by using phthalate-free control soils. The results will be presented in a technical memorandum to CDH and EPA in the RI report. If the investigation does indicate that sample handling with surgical gloves causes phthalate contamination, an alternative sample handling procedure will be used.

Comment:

Nature and Extent of Contamination

5.2.1.1 Monitor Well Locations

SWMUs 119.1 and 119.2

It is important to evaluate the data from the seismic study to determine the location of sandstones and hence the location of the monitoring wells.

Response:

The seismic study is now referenced in determining the location of bedrock wells (Section 5.2.1.1).

Comment:

5.2.1.2 Chemical Analysis of Ground-water Samples

Prior to reducing the parameter list for analyses, DOE must receive approval from CDH and EPA.

Response:

The need for EPA and CDH approval is noted in the revised draft.

Comment:

5.2.1.3 Hydraulic Testing

Pumping and Tracer Tests in Woman Creek Valley Alluvium

The locations of the pumping and tracer test locations must also be illustrated on a smaller scale to show their geographical relationships with SWMUs.

Pumping Test

The references for the hydraulic conductivity, storage coefficient and saturated thickness must be given. Calculations showing how the sustained discharge was determined and the drawdown values from the pumping site must be provided. All calculations must be provided.

The need for specific hydrogeologic data to determine fate and transport conditions of contaminants is recognized. Explain why the more detailed pumping tests are only proposed for Woman Creek alluvium.

Response:

Figure 5-2 portrays the location of the pumping and tracer tests. These locations are all south of the South Interceptor Ditch and the boundary of OU1 is coincident with the security area boundary as shown on the figure.

All calculations will be provided for the pumping test results. The revised Section 5.2.1.3 lists the methods which will be used to analyze the hydraulic testing data:

Slug tests	Bouwer and Rice (1976)
Bail-down/Recovery Tests	Theis (1935), Thiem (1906) or Cooper et al (1967)
Single Hole Pumping Tests	Theis (1935), Cooper and Jacob (1964)
Multi-well Pumping Tests	Theis (1935), Cooper and Jacob (1964)
Tracer injection tests	Ogata (1970)

Comment:

5.3 Evaluation of Proposed Interim Remedial Action

5.3.1 Borehole Location

Additional monitoring wells and/or piezometers are necessary south of the french drain and west of the cluster P201 through P204.

Response:

Proposed and existing monitoring wells for ground-water quality monitoring should be adequate to evaluate ground-water flow in this vicinity of the french drain.

Comment:

5.3.2 Chemical Analysis of Soil Samples

A sample must be taken if contamination is suspected by staining, discoloration or odor.

Response:

Samples will be collected if staining, discoloration or odor is observed during the investigation.

SECTION 4

REFERENCES

SECTION 4

REFERENCES

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