EPA COMMENTS ON ROCKY FLATS PLANT
REMEDIAL INVESTIGATION REPORT
881 HILLSIDE AREA
SUBMITTED 1 MARCH 1988

General Comments

The Rocky Flats Plant 881 Hillside Area Remedial Investigation as resubmitted on March 1, 1988, does not satisfactorily characterizing the nature and extent of contamination at the 881 Hillside. This deficiency is a result of inadequate background determination for metals and radionuclides, inappropriate and unjustified interpretation of analytical results for organics, metals and radionuclides and instances of poor source characterization for some of the SWMUs associated with the hillside.

The inadequacy of the remedial investigation results in incomplete alternative identification, incomplete ARAR identification, and potentially inappropriate remedy selection in the feasibility study.

The purpose of the remedial investigation is to determine the nature and extent of the contamination associated with the 881 Hillside. Judgement and opinion should not be presented. When presenting data that is inconclusive, no conclusions should be drawn and conservative use of the data should be effected. Indefensible, subjective, qualitative comments and conclusions are not appropriate. If questions are not answered during the course of the remedial investigation, then the method to derive the data should be determined and instituted and the alternatives selected for study as remedial options should not be affected by the lack of said data.

Specific Comments

Section 1.0: Executive Summary

1. The statement is made that no evidence of Solid Waste Management Unit (SWMU) 104 was found in review of historical photos or in the field investigations. The soil gas survey for tetrachloroethene proved positive for an area north of SWMU 130 and east of building 881. SWMU 104 is indicated in the Rocky Flats RCRA Post-Closure Care permit application and in Appendix I, 3004(u) Waste Management Units, as being north of borehole BH7-87 and within 100 feet. The PCE soil gas positive results were within this distance. No boreholes were drilled in this area and no wells are present to characterize contamination at this location. DOE and Rockwell must define plans for further characterization of this area to ensure that the proposed remediation will address contaminants associated with this SWMU.

2. Even though SWMU 177 will eventually be closed under interim status, it can not be excluded from investigation. This unit should be evaluated in context with 881 Hillside.

3. The postulation of natural causes for the elevated levels of TDS, nickel, selenium, strontium and uranium is unsubstantiated and is not pertinent. The denial of bedrock ground water quality impact is not substantiated by the data. The bedrock well west of the plant that was logged, 54-86, is completed in the Laramie formation. Wells 46-86 and 52-86 do not show borehole logs, so that the formation of completion for these wells is in doubt, but is also likely to be the Laramie. The bedrock wells at the 881 Hillside are completed in the Arapahoe formation. When compared to the average levels found in background wells 52-86 and 54-86, the detection of Sr89,90 in bedrock wells 62-86, 59-86, 8-87, 5-87 and 3-87 in conjunction with the levels of U238,234 detected in the bedrock wells of the 881 Hillside, may indicate radioactive contamination of the bedrock.

4. The relative elevation of TDS for bedrock wells 5-87, 59-86 and 8-87 when compared to the wells west of the plant and to wells 62-86, 45-87 and 3-87 may indicate bedrock groundwater impacts.

5. The detection of 1,2 DCA in bedrock well 5-87 and the detection of methylene chloride, acetone, chloroform and toluene in bedrock wells 45-87, 5-87, 59-86, 3-87 may be an indication of bedrock groundwater impact.

6. The detection of elevated nickel, selenium, strontium, sodium, calcium and magnesium in the bedrock wells associated

with the 881 Hillside may indicate impact to the bedrock groundwater at the hillside.

7. The determination of bedrock contamination utilizing the data presented in the remedial investigation is speculation and presently not justified or defensible and should not be denied in the executive summary of the remedial investigation.

8. Volatile organics were detected in low concentrations in the Woman Creek drainage downstream of 881 Hillside. The conclusion that there is no surface water contamination associated with the 881 Hillside is unsubstantiated by data. The implications associated with the quality of the laboratory data do not allow definitive statements concerning surface water contamination to be made.

9. The inability of the present data to support statements concerning the quality of the surface water may invalidate the determination of potential public health impacts associated with the 881 Hillside.

Section 2.0: Introduction

1. Although analysis of samples from alluvial wells 64-86 and 65-86 have not indicated detection of volatile organic constituents, well 64-86 analysis was limited to nine constituents excluding some of the more mobile constituents which have been found at the hillside. Well 65-86 analysis for the volatile hazardous substance list was limited to two samples. Volatile organics have been detected in surface water samples of Woman Creek.

2. Analysis for wells 64-86 and 65-86 have indicated the presence of Sr89,90 which are not naturally occuring radioisotopes. These strontium isotopes are also detected in the alluvial wells located on 881 Hillside. Does this indicate that contaminants present at the Hillside have migrated as far as Woman Creek?

3. Elevated uranium and strontium concentrations and volatile organics (TCE) have been detected in the south interceptor ditch. This ditch is an integral part of the Woman Creek drainage as it eventually directs drainage back into Woman Creek. The interceptor ditch actually may be diverting contaminants around alluvial wells 64-86 and 65-86. Further investigation should be conducted prior to denying contamination of Woman Creek.

Section 4.0: Waste Sources Characterization

1. An accurate determination of background levels is crucial to defining the extent and nature of contamination, augments establishment of ARARs and cleanup levels and provides the basis for the risk assessment. If a one-time sampling is not considered a complete characterization of background alluvial and bedrock materials, then the RI should determine what is necessary to completely characterize the background conditions and justify decisions in the FS.

2. Comparison of analytical results from soil samples composited over depths greater than the 1 foot interval used for the background sampling is dubious. The comparison of 881 Hillside bedrock soil samples to the surface soil samples collected west of the west spray field is inappropriate. Given the potential of wind dispersal of radionuclides previously released to the environment as a result of past waste management practices at the facility, the establishment of accurate background levels in soils for radionuclides is of particular concern.

3. A SWMU by SWMU analysis of soil characterization with respect to metals and radionuclides is missing from the RI.

4. Because the metals found to be elevated with respect to background soils are not known to be components of past waste disposal activities does not provide a reason for concluding that metal concentrations are of little environmental significance. The significance of presenting the soil samples where the metal concentration is in excess of three times background is unclear.

5. The alluvial groundwater data indicates that past disposal practices at 881 Hillside may in fact affect the metal concentrations in the groundwater. Metals which are naturally present in the soils may become elevated in the groundwater due to changes in the groundwater chemistry of the hillside as a result of the past waste disposal practices. Since alluvial wells 61-86 and 68-86 are very close to the background ranges presented for the alluvial groundwater for all metals, while most of the 881 Hillside downgradient alluvial wells indicate elevated sodium, calcium, strontium and magnesium with occasional elevated levels of selenium, lithium and nickel, 881 Hillside alluvial groundwater should be considered elevated for metals. The environmental significance must be determined through ARAR analysis and environmental risk assessment.

6. If the same logic is applied to the background measurements for radionuclides as is being applied to the analytical results for the samples analyzed in the RI, then the background concentration for plutonium and tritium should be 0.0

pCi/gm (or pCi/ml), as the error terms for these isotopes are greater than the measured value.

7. When considering data where the measured value minus the error term is less than the background range plus the associated error term, it is unclear whether this has been considered to be elevated or within the range of background for determination of radioactive contamination.

8. There should be data for soil background for Sr89,90, Cs137 and U235. There should be analyses for U235 for all of the borehole soil samples. The exclusion of U235 from the analyses makes the subjective denial of uranium contamination presented in the RI dubious. To compound the uranium contamination determination with the inclusion of a factor of two times the 95% confidence interval for the background concentrations is completely subjective. From the data presented in the RI, it cannot be concluded that there is "no likely" uranium contamination. Contrarily, it would appear that when analyzed in conjunction with the groundwater data, there are elevated uranium levels associated with the 881 Hillside. If background concentrations for uranium are not well characterized, then no conclusions should be drawn and further investigation is warranted.

9. What were the <u>average</u> radionuclide concentrations found in the background soil samples? The RI does not indicate whether the background ranges presented for radionuclides are normally distributed or whether there were "outliers" skewing the ranges presented for background. This information would allow greater insight into the evaluation of the radionuclide contamination at the 881 Hillside. For example, plutonium and americium ranges presented vary over an order of magnitude. Is the average closer to the high end of the range or to the low end of the range?

10. Inspection of the soil organic sample data indicates that although methylene chloride (MeCl) was at times present at low or estimated concentrations, it was more often detected above detection limit and was generally either not found in the blanks or found at levels at least an order of magnitude above the levels detected in the blanks. Furthermore, a great many of the samples collected in 1987 are not presented with blank analytical data and there is some question as to the existence of analytical data for blanks for these samples. The data do not allow a conclusion that MeCl is present solely as laboratory artifact.

11. Although acetone was detected in some of the laboratory blanks, the levels detected in the blanks were generally much lower than the levels detected in the borehole samples. In many samples, the blank levels detected for acetone were more than two orders of magnitude less than the levels found in the borehole samples. Again, data for blanks is either not presented or

nonexistant for a great many of the more recent borehole samples and further confuses the interpretation of this data. Acetone is a constituent of a known contaminant at the 881 Hillside. The information presented does not allow elimination of acetone as a contaminant for further consideration at the hillside.

12. Although 2-butanone was present at low levels, this compound was only detected in one of the laboratory blanks and was found in the blank at a significantly lower level than the level found in the borehole sample. 2-butanone was found at significant levels with no detection of 2-butanone in the corresponding laboratory blank. 2-butanone is also a common contaminant of acetone, so that the acknowledgement of acetone as a likely contaminant at the hillside might also be indicative of contamination by 2-butanone. The data does not support elimination of 2-butanone from further consideration as a contaminant at the hillside.

13. The detection of bis(2-ethylhexyl)phthalate (BEHP) in borehole samples was, in general, at levels at least three times the levels detected in the blanks. BEHP was found in many borehole samples where no BEHP was detected in the blank above detection limits. The acknowledgement of BEHP as a component of vacuum pump oil in conjunction with the detection of BEHP is evidence of contamination at the hillside. BEHP cannot be eliminated from further consideration as a contaminant at 881 Hillside.

14. SWMU 102. Trichloroethene was detected in the soil gas in the vicinity of SWMU 102 at soil gas point 120, in addition to the PCE detected at soil gas point 106. The detected levels of acetone are present in boreholes BH5-87 and BH6-87 at levels 10 times the level reported for the blank for these samples. The blank sample reported in the original 881 Hillside RI detects no methylene chloride. This data would indicate that both acetone and methylene chloride should be considered as contaminants at SWMU 102. The detected level of BEHP found in the blank was 2 g/kg for all BH5-87 and BH6-87 samples analyzed. The levels of BEHP detected in the BH5-87 and BH6-87 samples were close to 1000 g/kg. This data indicates that BEHP is a significant contaminant at the 881 Hillside.

15. SWMU 103. Trichloroethane was detected in the soil gas in the vicinity of SWMU 103 at soil gas point 76, in addition to the PCE detected at soil gas points 97 and 88. The blank sample analyzed for BH4-87 indicated methylene chloride at 1 g/kg, acetone at 8 g/kg and 2-butanone at 7 g/kg. The levels of these compounds detected in the blank sample are at least an order of magnitude below the levels detected for methylene chloride in BH4-87, two orders of magnitude below the levels detected for acetone in BH4-87 and greater than two orders of magnitude below the levels detected in BH4-87 for 2-butanone.

The RI should not speculate as to the significance of the detection of 4-methyl-2-pentanone in BH4-87. MeCl, acetone and 2-butanone must be considered as contaminants at SWMU 103.

Since no blank was run for BNA organic samples of BH4-87, the significance of the detection of phenanthrene, fluoranthene, pyrene and BEHP cannot be discounted at SWMU 103.

The RI does not present the laboratory data resultant to the analysis of blank samples for BH63-87. Therefore, the significance of the detection of TCE cannot be discounted for BH63-87. The data presented for BH63-87 indicates that neither methylene chloride nor acetone were detected in the blank for this batch. Thus the statement discounting methylene chloride and acetone as laboratory artifact is unsubstantiated.

Analytical data for the BNA blank samples of BH63-87 are not presented. BEHP was detected in BH63-87, in addition to N-Nitrosodiphenylamine, Anthracene and di-n-butylphthalate. The data indicates that the blank sample did not contain N-Nitrosodiphenylamine or di-n-butylphthalate. The significance of these detections cannot be discounted without presenting the analytical data for the blank samples associated with BH63-87 BNA analysis. The statement that no volatile or semivolatile compounds were elevated in BH63-87 is unsubstanitated and possibly incorrect.

16. SWMU 105. Methylene chloride and TCE were detected in all five samples from BH62-87. Acetone was not detected in BH62-87. The analytical data for blanks associated with the BH62-87 analysis are not presented in the RI. The statement that no contaminants were identified above background levels cannot be verified. Di-n-butylphthalate, N-Nitrosodiphenylamine and BEHP were detected in samples from BH62-87. The significance of these detections cannot be evaluated without analysis of the lab blanks associated with analysis of BH62-87 samples.

17. SWMU 106. If PCE was detected in soil gas at sampling point 110, why were PCE volatile organic analyses not reported for three of the five borehole samples taken? The semi-volatile compounds di-n-butylphthalate and BEHP were not found in the blanks. The highest concentration of semi-volatile compounds was found in the weathered bedrock at the 18-foot level of BH2-87.

18. SWMU 107. Methylene chloride and TCE were detected in all five samples from BH62-87. Acetone was not detected in BH62-87. The analytical data for blanks associated with the BH62-87 analysis are not presented in the RI. The statement that no contaminants were identified above background levels cannot be verified. Di-n-butylphthalate, N-Nitrosodiphenylamine and BEHP were detected in samples from BH62-87. The significance of these detections cannot be evaluated without analysis of the lab blanks associated with analysis of BH62-87 samples. BEHP was also estimated below detection limits in the 10-foot sample of

BH1-87. If the detection limit for methylene chloride is 5ppb, methylene chloride was detected in BH3-87 above laboratory contaminant levels and above detection limits for three out of the four samples taken. Acetone was also detected above a 10ppb detection limit for two out of the four samples from BH3-87 and is possibly elevated with respect to the laboratory blanks associated with BH3-87. 2-butanone was not detected in the laboratory blank for three of the four samples and was detected above the detection limit for two of the four samples. The statement that no volatile organics were detected in BH3-87 above detection limits or laboratory contaminant levels is incorrect. The semivolatile laboratory blank levels for the four samples for BH3-87 were estimated at 2ppb, not 550ppb as indicated.

19. SWMU 119.1. Boreholes BH8-87, BH9-87 and BH13-87 are not downgradient of the contaminated soils at SWMU 119.1 and do not assess the extent of the soil contamination at SWMU 119.1. In addition to the PCE found at SWMU 119.1, BH12-87 2-butanone levels were detected above the detection limit of 10 ppb, acetone levels of 85ppb and 66ppb are between 7 and 10 times the levels found in the blank for BH12-87 and methylene chloride levels detected in BH12-87 are 25 times the levels found in the blank. The PCE level detected in BH12-87 is above the detection limit of 5ppb. No data are presented regarding the analysis of laboratory blanks for BH14-87. The data that are presented indicate that no blanks were run for analyses associated with BH14-87. The data do not support any statements concerning the significance of the acetone levels detected in samples from BH14-87.

No data are presented concerning the laboratory blank analyses associated with BH57-87. Methylene chloride was detected above laboratory blank levels in BH12-87 and BH14-87. Acetone is estimated below detection limit in samples from BH57-87 to a depth of 28 feet. The volatile organic contamination definitely extends into the weathered claystone bedrock of the Arapahoe formation. No laboratory blank data were submitted with the RI for semi-volatile samples associated with the analysis of BH57-87 or BH14-87. The significance of semi-volatile detections in samples from BH14-87 and BH57-87 cannot be determined without analysis of the laboratory blanks for these data. Although BEHP and di-n-butylphthalate were the only semivolatiles detected above detection limit, phenanthrene, pyrene, fluoranthene, benzo(a)anthracene, Chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, diethylphthalate and N-Nitrosodiphenylamine were estimated below detection limits. The detected levels of methylene chloride, acetone and 2-butanone for samples of BH8-87 are greater than the levels detected in the laboratory blanks by factors between 5 and 30 and are not resultant to laboratory artifact. Methylene chloride and acetone were elevated above laboratory contamination levels in all four samples from BH9-87. 2-butanone was not detected in the zero to ten-foot composite and

the 11-foot contact sample, but was detected at the 14-foot bedrock sample and the 6-foot water table sample for BH9-87. 2-butanone was not detected in blanks associated with the analysis of BH9-87. Methylene chloride was estimated at levels above the levels detected in the blank associated with BH13-87 for the zero to ten-foot composite and the 14-foot bedrock sample. No blank was presented which is associated with the 11-foot contact sample for BH13-87. Acetone was detected in the 11-foot contact sample for which no blank is presented in addition to the detection of acetone in the 14-foot bedrock sample.

Methylene chloride must be considered a contaminant at SWMU 119.1, in addition to PCE, 1,1,1 TCA, TCE, acetone, 2-butanone, 1,1,2 TCA, di-n-butyl phthalate and BEHP. The presence of the other semi-volatiles at levels below detection limit cannot be discounted without the analysis of blank samples associated with these findings.

20. SWMU 119.2. TCE was detected at soil gas point 183 in addition to the PCE, TCA and DCE associated with soil gas sampling of SWMU 119.2. In addition to the methylene chloride and BEHP detected above laboratory contaminant levels at BH16-87, acetone is present significantly above laboratory blank levels. In addition to the acetone, 2-butanone and BEHP detected above laboratory contaminant levels, methylene chloride was detected in BH17-87. Phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, di-n-octylphthalate and benzo(b)fluoranthene are estimated below detection limits in samples from BH17-87. No laboratory blank information was presented in the RI to evaluate or substantiate the claims made concerning BH58-87 and BH59-87. N-Nitrosodiphenylamine and di-n-butyl phthalate were estimated below detection limit in samples from BH58-87, with one sample from the 4-foot bedrock level indicating di-n-butyl phthalate at significant levels. Samples from BH59-87 indicated estimated levels of N-Nitrosodiphenylamine in addition to the levels of BEHP detected. To state that BEHP is the only organic detected above laboratory blank levels for BH59-87 is presently unsubstantiated. No blank information was submitted. Methylene chloride, TCA, TCE, N-Nitrosodiphenylamine, di-n-butyl phthalate and BEHP were estimated at levels below detection limit for BH61-87. No evaluation of the significance of these detections can be made without analysis of the blank data associated with analyses of BH61-87.

21. SWMU 130. BH7-87 is drilled through the estimated location of SWMU 130. Methylene chloride, acetone and 2-butanone were detected at levels significantly above detection limits and laboratory contamination levels. BEHP was also detected at significant levels in samples from BH7-87. In addition to the methylene chloride and BEHP detected in BH10-87 and BH11-87, significantly elevated levels of acetone were detected in both boreholes. The comparison of soil composites sampled in both

alluvial and bedrock soils over varying depths to a "background" sampling of alluvial soils composited over one foot, may preclude characterization of the soils for metal and radioactive contamination. The non-reporting of U235 and the presence of Cs137 and Sr89,90 in some soil samples does not support determinations made in the RI regarding radionuclide contamination.

Section 5.0: Site Hydrogeology

1. Appendix E does not contain geologic logs of all boreholes and wells. Of particular significance are the missing borehole/well logs for the bedrock background wells 46-86 and 52-86.

2. The RI does not present justification for the distinction that the lignite layers found in bedrock wells 3-87 and 8-87 are actually different lignite layers. The RI does not address the impact organic rich sediments and lignites have on the groundwater geochemistry and/or transport of contaminants within the saturated lignite layers. The RI does not address the effect geologic horizons at 881 Hillside may have on the mobility of the contaminants.

3. Event sampling of the springs and seeps on the 881 Hillside would provide data as to the significance of these surface water pathways with respect to contaminant transport.

4. Considering the intimate contact between the valley fill alluvium and the surface flow of Woman Creek, speculation that contaminants would stay in the valley fill alluvium and travel the 10,000 feet to the facility boundary in approximately 80 years is unrealistic. The contaminant would more likely take 1 to 4 years to travel down the hillside to Woman Creek valley fill alluvium and then be carried to the facility boundary at the velocity and travel time dictated by Woman Creek surface flow. This would be especially true for areas where there was no saturated thickness of valley fill alluvium, and/or Woman Creek was underlain by bedrock. Hurr (1976) estimates that the groundwater in valley fill alluvium flows at a velocity between 5400 and 9100 feet per year. Why are the estimates of between 250 and 740 feet per year presented in the RI for groundwater flow in valley fill alluvium so low compared to Hurr's estimates? Hurr's estimates of pore velocity would dramatically decrease the amount of time that would be required for a contaminant to travel to the facility boundary. The use of an hydraulic gradient based on topography in conjunction with the estimated effective porosity and mean hydraulic conductivity does not allow an assumption that ground water would only flow at the estimated velocity for half of the year. What would change to allow this

assumption? The topographically derived gradient is constant as is the effective porosity and hydraulic conductivity.

5. Section 5.4.2.2 does not substantiate the statement that the gravel lenses in the colluvium are not continuous and in fact refutes this statement. After traveling the length of the colluvium, a dissolved constituent might not have to travel the entire length of the valley fill alluvium if the groundwater emerges as a seep or Woman Creek is a gaining stream at certain times of the year.

6. High vertical gradients in continuously saturated subsurface material does not necessarily indicate the presence of intervening low conductivity material. A high vertical gradient means only that there is high potential to flow. The vertical gradient information presented in Table 5-3 is incorrect for well pair 69-86 and 59-86. The elevation of the ground and potentiometric surface for well 69-86 as presented in Table 5-3 are not as presented in the well construction summary and log of boring for well 69-86. The high vertical gradient for well pairs 69-86 and 59-86 could be environmentally significant in that there is a great potential to flow between the colluvium and the sandstone of the Arapahoe formation. The vertical gradient calculated for well pairs 8-87Br and 59-86Br of 0.29 means that there is not such a great tendency to flow between the weathered claystone and the first permeable sandstone and may indicate that the weathered bedrock found between the colluvium and first permeable sandstone is close to saturated. This finding may be in direct conflict with the findings associated with well pair 59-86 and 69-86. The vertical gradient estimated for well pairs 8-87Br and 69-86 is approximately 0.53. What significance does this have in light of the vertical gradients for the other two well pairs of the triplet? The calculated vertical gradient for well pairs 2-87 and 3-87Br of 0.45 might indicate hydraulic connection, when considering that 3-87Br is completed in unweathered claystone and 2-87 is finished in weathered claystone. However, the calculation of a vertical gradient for well pairs which are separated to such an extent vertically, (approximately 100 feet), might systematically decrease the vertical gradient. The vertical gradient estimated for well pair 44-87 and 45-87Br is aproximately 1.04. This again indicates a strong potential to flow between the colluvium and the first permeable sandstone of the Arapahoe formation.

7. Table 5-2 should be reworked to eliminate the ambiguity in Table numbering (ie. is it Table 5-2 or Table 5-4?). Table 5-2 data for the packer test of well 8-87Br seem to be in conflict with the data presented in Table 5-1 for well 8-87Br.

8. The clay cuttings from drilling the wells would affect the draw-down recovery tests in the same manner as they are presumed to affect the packer tests. This negates any

conclusions concerning the validity of the packer tests or the draw-down recovery tests.

9. The aquifer test results presented in Appendix E do not include test data or results for most of the 86 series wells located on the 881 Hillside and presented in Table 5-2.

10. The fact that the RI has found only few correlations along dip for lateral continuity of sandstone in the Arapahoe formation does not allow determination that the sandstone formations of the Arapahoe are not continuous along dip. Cross-sections C-C' and H-H' may indicate lateral continuity along the dip.

11. The exclusion of volatile organics which have been detected in soils (acetone, methylene chloride, 2-butanone, toluene) from groundwater analysis is dubious.

12. The data derived from sampling alluvial wells 49-86, 50-86 and 56-86 should not be considered as representative of background as these wells seem to have elevated inorganics, possibly elevated radionuclides and elevated metals when compared to wells 47-86, 51-86, and 55-86. Well 47-86 appears to be impacted by elevated uranium. The non-reporting of U235 for many of the groundwater samples from submitted background wells does not allow conclusions to be made concerning the levels to be expected in background. The non-reporting of Cs137 and the finding of Sr89,90 in the submitted alluvial background wells makes determination of background for radionuclides difficult.

13. The presentation of ranges for background in alluvial wells would also benefit from the inclusion of average concentrations of constituents for the wells which do not appear to be impacted by SWMUs west of the plant. No data presented in the RI indicates a level of 0.047 mg/l vanadium was ever detected for alluvial wells west of the plant. This value should not be used to specify the background range for vanadium. Why is the alluvial groundwater background range for carbonate presented as ND-130 after the acknowledgement that at pHs between 6.0 and 7.4 little carbonate would be expected?

14. The background determination is not advanced by the evaluation of wells which are known to be downgradient of SWMUs and subsequent subjective and inconsistent elimination of "outliers". This does not allow a conservative comparison of background to the conditions existing at the 881 Hillside.

15. To be consistent with the logic used to determine if elevated concentrations of radionuclides exist, the background concentrations for plutonium, americium, cesium 137, strontium 89,90 and uranium 235 in groundwater should be defined as zero. The fact that data developed in 1987 contain many more values

with associated uncertainties on the order of the value may be indicative of a laboratory problem and does not allow conclusion that the background range may increase as time goes on.

16. The fact that detection limit is on the same order of magnitude as the analysis itself can be remedied by increasing the counting time for isotopic analysis. The detection limit must be decreased in order to properly evaluate the data and determine whether radioactive constituents are present above background levels.

17. Bedrock well 54-86 west of the plant is completed in the Laramie formation. Boring logs for the other bedrock wells submitted as background wells are not present in any documents submitted to date. However, 52-86 can be presumed to be completed in the Laramie formation and wells 46-86 and 48-86 are most likely completed in the Laramie formation. In addition to this problem, the wells 46-86 and 54-86 are shown as completed in a sandstone formation. No well construction summaries are presented for wells 48-86 and 52-86. The boring log for well 54-86 does not correlate with the well construction summary presented for the well. How can the bedrock groundwater data for wells presumably completed in sandstone formations of the Laramie be compared to bedrock wells completed in claystone of the Arapahoe on the 881 Hillside?

18. If wells 52-86 and 54-86 are assumed to be the good background bedrock wells, then the range for U234 would be 0-2.4(1.3) pCi/l and U238 would be 0-0.64(.127) pCi/l. This is significantly different than the background levels proposed.

19. What are the background levels for alpha, beta, tritium, strontium89,90 and cesium137 for both alluvial and bedrock groundwater?

20. No blank data are submitted with the RI for any of the groundwater samples associated with 881 Hillside. The blank data submitted with the original RI only present data for the 86 series wells. No data are submitted for alluvial well 44-87 and the alluvial wells 63-86 and 50-87 are dry, so that evaluation of the alluvial groundwater contamination at SWMU 119.2 is not possible. There are no groundwater wells completed within the estimated extent of SWMUs 130, 102 or 103. No data are presented for alluvial well 1-87, yet water has been detected in this well. Why weren't samples collected from well 1-87 when water was present in the well? The division of contamination into two general areas may not be warranted as characterization of the groundwater for all SWMUs at the hillside has not been completed.

21. Data presented in the RI indicate that bedrock groundwater is impacted by contamination at the 881 Hillside.

22. Hurr(1976) estimates the groundwater pore velocities for the Rocky Flats Alluvium and Valley Fill Alluvium to be 7 to 18 ft/d and 15 to 25 ft/d respectively. The hydraulic conductivities presented by Hurr are in conflict with the data presented in the RI. Prior to concluding that the flow of water in the surficial materials is probably slow and of small quantity, the discrepancy between these two estimates must be discussed.

23. Differing major ion chemistry may reflect geochemical differences in the different completion zones for bedrock wells. The vertical gradient between wells 59-86 and 8-87Br is 0.29 which may imply that these wells are in fact not in communication due to a low potential to flow between the two bedrock zones. However, the similarity of major ion chemistry in well pairs 2-87/3-87 and 59-86/69-86, in conjunction with stronger vertical gradients, 0.45 and 4.6 respectively, may imply that the bedrock groundwaters are not distinct.

24. Metals elevated with respect to the proposed background ranges in alluvial groundwater include aluminum, lithium, zinc and nickel in addition to the elevated levels of selenium and strontium. Metals elevated with respect to the proposed background ranges in bedrock groundwater include nickel in addition to the elevated levels of strontium in bedrock groundwater. The "different geochemical environment" postulated as the reason for the elevated strontium concentrations may be the result of SWMU impacts on the chemistry of the groundwater.

25. Since no background data are submitted for tritium, Sr89,90 and Cs137, it cannot be determined whether elevated levels exist in groundwater at the 881 Hillside. Elevated levels of uranium are indicated in shallow groundwater at SWMU 119.1 in addition to the elevated levels detected south of building 881. Uranium levels in bedrock groundwater are elevated with respect to the proposed background levels at SWMU 119.1 and south of building 881. One of the groundwater samples from well 3-87Br does contain elevated uranium levels, so that any conclusions concerning the connection with overlying shallow groundwater may not be appropriate.

26. The detection limit for the uranium in groundwater analyses prevents discussions related to the U235 to U238 ratios.

27. The groundwater analysis for only 8 of the HSL volatile organics makes conclusions regarding groundwater contamination dubious, especially in light of the detection of organics other than those now analyzed for in the soil and groundwater and the non-presentation of blank data. Data for bedrock well 45-87 indicate the presence of methylene chloride,

acetone and chloroform. Bedrock well 5-87 contains 1,2 DCA, while bedrock well 8-87 contains DCE.

28. Volatile organics have been detected in alluvial wells 10-74, 2-87, 4-87, 43-87, 52-87, 53-8, 54-87, 59-86, 6-87 and 9-74.

29. Major ion levels are definitely elevated in the groundwater in both alluvial and bedrock groundwater with respect to the proposed background major ion levels.

30. The conclusions that uranium levels are of natural origin and that the elevated levels of major ions and metals are the result of a natural geochemical environment at the 881 Hillside are not supported by the data. The geochemical environment at the hillside may be different than the environment associated with the background wells, but this is probably due to the waste disposal activities at the 881 Hillside. If there are other sources in the general area responsible for the elevation above what would be expected as a result of the 881 footing drain, then the RI should characterize these sources.

31. The evidence supporting the contention that the gravel lenses are discontinous perpendicular to the slope and are pinched out along the slope should be summarized and presented in the RI.

32. The different major ion chemistry in samples from bedrock and alluvial wells at SWMU 119.1 may reflect inherent geochemical differences, not a poor connection of groundwater flow. Vertical gradients in and of themselves do not indicate a lack of continuous saturation. The high vertical gradient means only that there is a potential to flow to the bedrock.

33. The conclusion that uranium concentrations in shallow groundwater are in the range of background is incorrect. The bedrock well associated with SWMU 119.1 is also elevated with respect to the proposed background bedrock levels.

34. The delineation of shallow groundwater volatile organic contamination is not benefited by the limited number of samples taken from wells 48-87 and 47-87. The determination that volatile organic contamination does not exist in the bedrock groundwater is not facilitated by the analysis of only 8 volatile organics, which do not include organics which are contaminating the bedrock soils. The determination is also not facilitated by the non-presentation of blank data associated with these analyses. This conclusion is not substantiated and would appear to be in conflict with the soil data presented for bedrock.

35. Whether or not the selenium concentrations are consistent with a referenced finding is irrelevant in light of

the background proposed for the plant and 881 Hillside. Since the vertical gradient does not in itself reflect level of saturation between wells and geochemical variation between shallow and bedrock groundwater systems may only reflect inherent geochemical differences, the conclusion that shallow and bedrock systems are not connected is not supported. This seems especially evident in light of the soil contamination in the bedrock, the obviously elevated inorganics and metals in the bedrock groundwater and the similarity in bedrock and shallow TDS and major ion levels. Although the SWMUs at the hillside may in fact have increased the levels of natural uranium in the groundwater, the detection limits for uranium do not allow any conclusions to be made concerning isotopic ratios.

36. The decision to forego analysis of the groundwater for the HSL volatile organics limits the conclusions regarding extent and character of contamination and makes conclusions concerning the connection of the shallow and bedrock groundwater systems dubious in light of the soil findings. The conclusion that most of the chemical differences result from natural environmental conditions, rather than from the SWMU is unsupported.

37. None of the wells used to characterize SWMU 119.2 are located within the estimated location of SWMU 119.2. Well 62-86Br is not located within the SWMU and is probably not downgradient of the SWMU. Chloroform is suspected as a laboratory contaminant but no data is presented to support the contention. The conclusion that SWMU 119.2 is not contaminating the groundwater is unfounded, as it is based on inadequate data.

38. The fact that the same elevated constituents are present in Woman Creek alluvium as are found at the hillside and these constituents are elevated with respect to the upgradient valley fill concentrations indicates that 881 Hillside is impacting Woman Creek valley fill alluvium and as a result is also impacting Woman Creek. The determination of health or environmental hazard must be evaluated in the risk assessment and an ARARs review. The contention that the differences may result from discharges of colluvial groundwater with naturally different chemistry is conjecture and unsupported.

39. The conclusions presented in section 5.5 are unsupported by the data presented in the RI.

Section 6.0: Surface Water

1. The South Interceptor Ditch (SID) does not isolate 881 Hillside runoff from Woman Creek.

2. The comparison of SW-36, sampled in August, 1986 to

SW-35, sampled in May, 1987 is dubious. May is generally a much wetter month and constituent concentrations would be expected to be lower than when sampled in August. What is the purpose of comparing SW-35 to SW-36 since they are both upgradient of 881 Hillside? Speculation about contamination at SW-35 is inapproriate, as no data are presented to support the contention that the organics present represent laboratory artifact.

3. Why is sodium considered a conservative tracer? Sodium is a commonly used element for cation exchange. The data presented in an attempt to relate the elevated uranium levels to sources other than 881 Hillside are inconclusive and may indicate that the SID only intercepts alluvial groundwater during hydrologic events.

4. It is important that detection of volatile organics at SW-30 and BNA compounds at SW-27 be given significance until data negates the significance of the detection.

5. The major ion levels detected in pond C-2 are elevated with respect to SW-35. No data are presented in the RI for SW-37. How do the levels at SW-37 compare to proposed background? This station may be impacted by the old landfill. The levels of radioactive constituents, inorganics and metals detected in pond C-2 are elevated with respect to SW-42.

6. Although the SID may in fact be impacted by sites upstream from 881 Hillside, the RI does not determine whether SWMUs associated with 881 impact the interceptor ditch.

7. The detection of toluene, carbon tetrachloride and TCE at SW-41 or SW-32 cannot presently be dismissed, as no data support such a conclusion. No radioactive data are presented for SW-33. The sample of SW-32, taken on May, 26 1987, is elevated with respect to the radioactive ranges presented in Table 6-8. The detection of carbon tetrachloride, TCE and toluene in a sample taken from station SW-29 cannot be discounted until there are data to support such a conclusion. The conclusions that 881 Hillside is not impacting the SID or Woman Creek with respect to radionuclides or volatile organics are dubious.

8. The RI does not present laboratory blanks with the sediment data. This is necessary in order to discount the detection of acetone and methylene chloride found in the sediments. The RI does not present the SED-15 data for inorganics and metals.

9. In addition to the elevated plutonium found in SED-1 and SED-2, U238 is elevated in SED-2, U233,234 is elevated in both SED-1 and SED-2 and tritium is elevated in both SED-1 and SED-2 with respect to the data for SED-15.

Section 9.0: Public Health and Environmental Concerns

1. The evaluations presented in this section are generally based on the acceptance of proposed background levels for constituents and the resulting qualitative conclusions concerning extent and nature of contamination. The interpretation of the raw data as presented in the RI and the conclusions associated with the interpretation of the raw data are unsupported. This prevents this section from adequately addressing public health and environmental concerns.

2. The evaluation of public health concerns should include an estimate of the population at risk from the groundwater pathway.

3. The ecological risk assessment is lacking in sufficient detail to determine the quality of the conclusions presented. Historical surveys of indigenous fauna are not described or referenced. The parameters of importance and the procedures for the determination of ecological stress are not presented.

Analytical Program, Quality Assurance and Data Management

1. The analytical program as presented does not provide the quantitative data quality that is needed to conduct the feasibility study. The generic QA/QC plan does not define site-specific data quality objectives (DQO). The laboratory QA/QC and data management do not allow adequate site characterization, which may require that additional samples be collected and analyzed using proper QA/QC methods and practices to verify or refine existing data. The required site-specific DQOs concerning analytical methods, detection limits and QA sampling and analysis must be developed to ensure that the produced data fulfill the intended purpose.

2. The frequency with which contaminant detections were attributed to laboratory contamination and the detection of contaminants in the laboratory blanks is problematic. The absence of the blank data from the RI is problematic.