10899

ANNOTATED TABLE OF CONTENTS
FOR
DRAFT RESPONSES TO EPA COMMENTS
ON THE DRAFT 881 HILLSIDE FS REPORT

SECTION 1.0: INTRODUCTION

SECTION 2.0: SCREENING OF REMEDIAL ACTION TECHNOLOGIES

SECTION 3.0: SCREENING OF REMEDIAL ALTERNATIVES

SECTION 4.0: DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

APPENDIX 1: RISK ASSESSMENT

APPENDIX 2: ARARs

ACTION SPECIFIC ARARs ANALYSIS

LOCATION SPECIFIC ARARs ANALYSIS

DRAFT RESPONSES TO EPA COMMENTS
881 HILLSIDE FS REPORT
DATED 3/1/88

SPECIFIC COMMENTS

SECTION 1.0: INTRODUCTION

Section 1.0, Comment 1

The assessment of the feasibility study (FS) proposed alternatives should also consider short term effectiveness, long term effectiveness and permanence, community acceptance, state acceptance and reduction of toxicity, mobility or volume. These elements of the remedial alternative assessment should be included and be addressed to each alternative in addition to the five elements proposed on page 1-3 of the FS.

Response to Section 1.0, Comment 1

Short term effectiveness, long term effectiveness and permanence, community acceptance, state acceptance, and toxicity, mobility or volume reduction are criteria developed pursuant to SARA and documented in the March 1988 Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Draft). The guidance was not available at the time of report preparation; however, with the exception of state acceptance, community acceptance, and short term effectiveness, these criteria are delineated in Section 3.1 of the FS. Although all of these criteria should have been delineated in the introduction for completeness, we note that consideration of these criteria was a factor in the selection of the preferred alternative.

CRITERIA	ACTION ADDRESSING CRITERIA
Short term effectiveness	pumping well 9-74
Long term effectiveness	collection of all contaminated groundwater
Community Acceptance	using UV/Peroxide vs. stripping w/o off-gas controls; identifying public opposition
State Acceptance	clean-up will meet or exceed ARARs
Reduction in Toxicity, Mobility, Volume	using UV/Peroxide

In revising the FS, these criteria will be specifically addressed in the detailed evaluation of alternatives.

Section 1.0, Comment 2

The data presented in the RI do not support the statement made in Section 1.2.1 that groundwater in the bedrock appears non-impacted by the activities at the SWMUs of 881 Hillside. The division of 881 Hillside into two general areas of contamination may not be appropriate in light of the poor characterization of SWMU 104, 130, 119.2. The statement made in Section 1.2.3 that SWMUs other than 103, 106, 107 and 119.1 are not contaminating groundwater is doubtful.

Response to Section 1.0, Comment 2

SWMUs 103, 106, 107, and 119 appear to be potential sources of groundwater contamination based on concentrations of volatiles in soil gas and/or soils. Bedrock groundwater contamination is discussed in response to Comments 21, 23, 24, 25, 29, and 34 in Section 5.0 of the RI comment responses.

The division of contamination into two general areas is primarily a means of presenting analytical results with regard to the geographic grouping of SWMUs (RI pp 5-50), and for addressing remediation in the FS. If results from future sampling efforts demonstrate that contamination is not similarly grouped, such observations will be reported accordingly.

The preferred alternative of using a french drain will effectively collect all shallow groundwater from the 881 Hillside. Therefore, the design of the FS addresses remediation of all SWMUs regardless of their potential contribution to groundwater contamination.

We still feel it is appropriate to divide the alluvial groundwater contamination into two areas on the basis of migration pathways and risks because 1) the footing drain discharges contaminated water to surface water, 2) the most highly contaminated groundwater is in the vicinity of well 9-74, and 3) other sources of groundwater contamination are contained by the french drain.

Section 1.0, Comment 3

The statements made in Section 1.2.1.1 concerning the chemical conditions south of Building 881 are qualitative and do not reflect the reality of the data presented in the RI. The different geochemical environment postulated as the cause for elevated selenium is probably a result of the past waste management practices at the hillside. The statements concerning elevated volatiles and uranium levels are unsupported by the data presented in the RI. If other sources are responsible for elevated constituents, then these sources should be characterized. If background data for the colluvium systems mantling the 881 Hillside have not been characterized, then no conclusions can be made concerning the characterization of the contamination of the hillside and the FS becomes unsupportable.

Response to Section 1.0, Comment 3

Due to time limitations imposed by the Compliance Agreement with the Colorado Department of Health, field work leading to revisions of the July 1987 Draft RI Report and preparation of the March 1988 Draft RI and FS reports were conducted concurrently.

As a result, background characterization was inadequate at the time of the FS preparation. Rockwell International is currently involved in the development and implementation of a comprehensive program for background characterization of both soil and groundwater. Additional soils data are expected to be available in four to six months from program authorization. Additional reliable and meaningful groundwater data will not be available for six to nine months from program authorization.

Although there may be elevated inorganic constituents above chemical specific ARARs that, as yet, cannot be conclusively determined to be contaminants, greater that 99 percent of the risk to the public health posed by the site is attributable to organic contamination. Organic contamination is well characterized; therefore, the FS is supported in this respect by the RI.

Section 1.0, Comment 4

The statements made in Section 1.2.1.2 concerning the chemical conditions in the vicinity of SWMU 119.1 are qualitative and unsupported by the data presented in the RI. Differing chemical makeup of groundwater in different geologic formations can be a result of the differences in the mineral content of the different formations and does not necessarily reflect poor connection between groundwater systems. The designation of geochemical environment as being responsible for the elevated strontium and uranium is subjective and unsupported by the data. The conclusion that volatile compounds were non-detectable in the most shallow permeable zone in the bedrock, does not allow the conclusion that bedrock groundwater is uncontaminated.

Response to Section 1.0, Comment 4

The statements in Section 1.2.1.2 must be revised in accordance with the responses to comments on the RI. Those responses provide the details which support the following remarks:

As summarized in the Response to Section 5.0, Comment 39 of the Remedial Investigation, there is groundwater degradation south of SWMU 119.1. The major ion chemistry does suggest communication between alluvial and shallow bedrock groundwater; however, until background chemical conditions are well characterized, elevated major ion concentrations cannot be conclusively attributed to contamination. Based on the limited background characterization, the potential metal contamination is less compelling. The data do not indicate organic contamination of the bedrock, with the exception of limited shallow contamination in the vicinity of wells 43-87 and 9-74.

We concur that the differing chemical compositions of groundwater in different formations does not prove poor connection between groundwater systems. It does indicate limited mixing. As Response to Comment 32, Section 5.0 states, it is agreed that different major ion characteristics from bedrock and alluvial wells may reflect inherent geochemical differences in the water quality. However, a poor connection between units is also implied by the difference in water quality.

The data do not prove that elevated strontium and uranium are due to natural geochemical variations. Contamination could be responsible for those contaminants in alluvial and shallow bedrock wells at the site.

The text of the FS (pp 1-29) did not intentionally state that the absence of volatile compounds in shallow, permeable bedrock proves that there is no bedrock contamination of any sort. Rather, that absence represents compelling evidence that the bedrock is not contaminated with volatile organics.

Section 1.0, Comment 5

The disregard of the organics detected at surface water stations south of the 881 Hillside is inappropriate. DOE / Rockwell must provide quantitative evidence that the surface water is not affected by organic contamination prior to discounting the data. The data presented in the RI to eliminate the 881 Hillside as the source of the elevated uranium in the surface water are inconclusive. The data presented in the RI indicate that the sediments have elevated tritium, plutonium and uranium levels. Since the risk assessment attached as an appendix to the FS does not address the surface water transport of contaminants, it is unclear how it was determined that chemical conditions of the surface water do not pose a hazard to public health or the environment.

Response to Section 1.0, Comment 5

We agree that the detection of toluene, carbon tetrachloride, and TCE in SW-41 or SW-32 should not be presently dismissed; however, it seems very strange that the only observed "hits" of volatile organics occur between sample dates 11/10/87 and 11/17/87 except for 10 ug/l of TCE at SW-41 on 07/29/87. Perhaps an instantaneous release occurred during that week. However, these elevated analytes take place over an extensive surface area, and every sample that was taken during this time period showed elevated values. In conclusion, either an instantaneous release took place during that time period, or these values are the result of laboratory artifact. There are no laboratory blank data to verify the hypothesis of laboratory contamination. See Response to Comment 1, Section 2.0 of the RI.

Upon comparing spring 1988 surface water U-238 and U-234 analyses at various locations along the South Interceptor (Table 18), it is noted that the values are elevated above background at upgradient location SW-36 (35 ± 1.93 pCi/l and 6.90 ± 0.863 pCi/l, respectively). SW-35, located directly upgradient of the 881 Hillside, showed near background levels of U-238 and U-234 (0.835 ± 0.478 pCi/l and 1.5 ± 5.22 pCi.l, respectively). Directly below the 881 Hillside, SW-66 analysis show elevated values of 2.74 ± 0.301 pCi/l and 2.12 ± 0.259 pCi/l, respectively. Uranium 233, 234, 238, tritium, and plutonium cannot be considered elevated in sediments downgradient of the 881 Hillside due to the overlap of the error between upstream and downstream values. Further sampling is required to draw a firm conclusion.

The South Interceptor Ditch (SID), located between the 881 Hillside and Woman Creek, extends from the old landfill to Pond C-2 in the Woman Creek drainage, but not in Woman Creek itself. The SID isolates runoff from the south side of the Plant (including the 881 Hillside) from Woman Creek, as it was designed to do. Surface water flowing in an easterly direction along the SID is collected in Pond C-2. A diversion structure,

located upstream of Pond C-2, diverts flow in Woman Creek around Pond C-2 and into the Woman Creek channel downstream of Pond C-2. The discharge from Pond C-2 is strictly monitored in accordance with the Plant NPDES permit designated 007. The Plant would be unable to release water from Pond C-2 if the water quality was not up to the rigid NPDES standards. The maximum concentration of radionuclides reported for the NPDES discharge 007 from Pond C-2 are consistent with the interpretation that U-238 is being diluted or attenuated downstream in the South Interceptor Ditch and in Pond C-2.

Section 1.0, Comment 6

The statement that contamination does not extend to the Woman Creek Alluvium is unsupported. What is meant by the statement that groundwater contamination does not extend into the permeable horizons of the bedrock? The Arapahoe formation is permeable. Drawdown recovery tests of the weathered claystone indicate hydraulic conductivities in the 10^{-6} range. Groundwater contained in the Arapahoe will migrate, possibly into deeper, more productive aquifers of the Arapahoe.

Response to Section 1.0, Comment 6

Well 64-86, completed in Woman Creek alluvium downgradient from 881 Hillside, did exhibit elevated chloride, sulfate, Ca, Mg, Na, and TDS in some samplings (see Table 8, Appendix to RI responses). Table 11 records instances of Al, Ni, Se, and Sr above estimated background. It contained no volatile organics.

Although well 64-86 does not exceed background by as much as other alluvial wells which are closer to waste sources, the data do suggest some contamination. The diagram of major ions for 64-86 (See Figure 1) shows that the well is not calcium carbonate-dominated as is typical of the alluvial wells which are likely to be uncontaminated or diluted (55-86, 68-86, 66-86). The additional background study proposed for Fall 88 / Spring 89 will provide more definitive assessment of the Woman Creek alluvial groundwater status.

The statement the groundwater contamination does not extend into the permeable horizons of the bedrock should have been "organic contamination . . . into the more permeable horizons in the deeper bedrock." In other words, the Arapahoe units, with the exception of very shallow sandstone near well 43-87, are not contaminated by organics.

Contaminants could migrate to deeper portions of the Arapahoe Formation from shallow, weathered claystones. The weathered claystones are typically separated from deeper, more productive aquifers by substantial thicknesses of unweathered claystone, and are therefore expected to be poor conduits for extensive bedrock contamination. However, Response 39 in Section 5.0 of the RI suggests that this barrier is not impenetrable.

Section 1.0, Comment 7

The conclusions presented concerning the location of volatile soil contamination are incorrect and unsubstantiated. Volatile and semi-volatile organic contamination is widespread and generally not attributable to laboratory artifact.

Response to Section 1.0, Comment 7

The FS does report PCE at BH11-87 and TCE and 1,1,1-TCA at BH57-87 in the vicinity of Building 881 and SWMU 119.1, and the common occurrence of semi-volatile BEHP and other phthalates.

The apparent items of dispute involve possible laboratory contamination and the interpretation of soil gas measurements. Responses 10 through 21 on Section 4.0 of the RI reevaluate the specific results in question in light of laboratory QA/QC data which did not accompany the Draft RI. CLP data validation protocols, reiterated in Response 10, governed the data interpretation in the RI and in the Responses.

Many of the "positive" readings at soil gas points were less than 1,000 counts and are therefore considered unreliable in accord with recommendations by the soil gas contractor and Bisque (1984) (see response to Section 4.0, Comment 14 of the RI).

In each case in which it is not possible to rule out contamination, the Responses also consider the hazard indices of potential contaminants at the reported levels. Therefore it is possible to assess the implications of disputed conclusions for FS remediation recommendations.

The conclusions of Responses 10 to 21 in Section 4.0 of the RI are summarized below:

- Acetone, butanone, methylene chloride: In many instances these compounds are present at much less than ten times the laboratory blank, and cannot be considered valid contaminants in such cases. However some occurrences are at reportable concentrations and cannot be discounted.

- The hazard evaluations for the three compounds suggest inconsequential risk.

- BEHP: BEHP does occur at reportable levels and is a suspected waste at 881 Hillside. Its carcinogenic risk is at the lower end of the allowable range, and its hazard index for non-carcinogenic risk is also very low (0.01).

- TCE, PCE: The PCE count at soil gas point 76 is significant. The readings at soil gas point 120 do not reliably indicate TCE or PCE contamination, and the associated boreholes do not show detectable TCE and PCE.

- Phenanthrene, fluoranthrene, pyrene: The presence of these compounds in BH62-87 was acknowledged in the RI, but they were reported below detection limit.

- Other contaminants: Evaluation of the blank data which were not available with the Draft RI demonstrates that several volatile and semi-volatiles must be considered contaminants at SWMU 119.1: methylene chloride, acetone, 1,1-DCE, 1,2-DCA, 2-butanone, 1,1,1-TCA, TCE, 1,1,2-TCA, PCE, toluene, diethyl phthalate, n-nitrosodiphenylamine, phenanthrene, anthracene, di-n-butyl phthalate, fluoranthrene, pyrene BEHP, chrysene, and di-n-octyl phthalate. The status of these compounds at SWMU 119.2 is evaluated as well (Response 20). Typically, they occur below detection limits. Di-n-butyl phthalate did occur at 650 ug/kg in BH58-86 at the four-foot bedrock level. There are no associated laboratory blank data.

Section 1.0, Comment 8

The major ion levels detected in pond C-2 are elevated with respect to SW-35. The levels of radioactive constituents, metals and inorganics detected in pond C-2 are elevated with respect to station SW-42. The statements made in Section 1.2.5 are dubious.

Response to Section 1.0, Comment 8

The only major ion greater in Pond C-2 than SW-35 is sodium. The other major ions in Pond C-2 are less than or nearly equal the value analyzed for SW-35.

	$HCO_3^=$	Cl^-	$SO4^=$	TDS	Ca^{++}	Mg^{++}	Na^+
C-2							
08/18/86	NR	31	67	240	20.6	10.3	33.9
SW-35							
07/29/87	162	33.6	74.0	307	65	15.9	26.9

NR = Analyte Not Reported
All analyte concentrations reported in mg/l.

It is true that many constituents are elevated in Pond C-2 when compared with SW-42 (e.g., barium, beryllium, ± calcium, chromium, magnesium, sodium, strontium, chloride, sulfate, TDS, gross alpha and uranium (-233, -234 and -238). However, many analytes are elevated at SW-42 with respect to Pond C-2 (e.g., silver, aluminum, cesium, iron, mercury, potassium, manganese, molybdenum, nickel, antimony, selenium, vanadium and zinc. It should also be noted that water from SW-42 never flows into Pond C-2 and many of these constituents are elevated in the South Interceptor Ditch upgradient from the 881 Hillside. When comparing SW-36, the highest upgradient station on the South Interceptor Ditch, with Pond C-2, all of the analyte are elevated in SW-36.

Section 1.0, Comment 9

The detection of PCE in the air cannot be attributed to Building 952, as this building is a gas cylinder storage unit. No solvents are supposed to be stored at this unit.

Response to Section 1.0, Comment 9

We mistakenly identified Building 952 as the potential source. We meant to identify Building 885, a permitted RCRA drum storage area, as the potential source of the PCE.

Section 1.0, Comment 10

The air and biota section should present and reference important sections of the reports conducted by CSU which were directed towards identifying the impacts posed by RFP on the

biota. DOE and Rockwell should review the CSU studies and consider developing a document which would be available for review and would be referenced in the RI/FS documents for Rocky Flats. Such a document should be reviewed and approved by the Colorado Division of Wildlife, and U.S. Fish and Wildlife Service (contact John Spinks Jr., Deputy Regional Director).

Response to Section 1.0, Comment 10

NEED ROCKWELL INPUT HERE

Section 1.0, Comment 11

The assessment of public health impact must be based on the facts presented in the RI, not on conjecture and unsubstantiated conclusions regarding the presence or non-presence of contamination at the 881 Hillside. The results of the risk assessment indicate that there is potential for risk associated with this site.

Response to Section 1.0, Comment 11

We agree the public health impact must be based on facts. The risk assessment concluded there were unacceptable risks posed to the public for the no action alternative if there were no institutional controls, and a potential risk to the public in the future from off-site contaminant migration. This assessment was based on facts. The FS statement that "there is no imminent threat to the public health and environment at the 881 Hillside Area" is a valid remark based on the institutional controls currently in place and the absence of off-site contamination attributable to the 881 Hillside at this time. Furthermore, as stated in the FS, pursuant to the results of the risk assessment, "this feasibility study was undertaken to select an appropriate action".

Section 1.0, Comment 12

The discussion of state ARARs correctly indicates that state advisories, guidance, or other non-binding policies, as well as standards that are not of general application, cannot be treated as requirements under CERCLA. However, they may fall into the "to be considered" category, and cannot be summarily excluded. (A separate review of the ARARs screened in Appendix 2 is presented as an attachment to this document.)

Response to Section 1.0, Comment 12

A good example of how we did not summarily exclude state advisories, guidance or other non-binding policies is presented in the Screening of Chemical Specific ARARs tables found in Appendix 2. CDH proposed standards for organics in surface water and groundwater were presented and identified as "To Be Considered". EPA guidance on the development of ARARs states that "To Be Considered" unenforceable, non-promulgated federal and state criteria, guidance or standards may be considered (but are not ARAR) when no other health based enforceable standards exist for the chemical of concern.

Section 1.0, Comment 13

Although institutional control is inappropriate as the sole 881 remedy, the discussion of institutional control will be predicated on resolution of future land use issues. DOE and Rockwell may be required to resolve future land use issues regarding the plant and buffer zone with the U.S. Department of the Interior. Discussion of this matter and initial contact with the Department of the Interior should be made as soon as possible.

Response to Section 1.0, Comment 13

The selected remedy was developed so that no institutional controls would be necessary to guarantee adequate protection of human health and the environment. This includes sensitive future land use scenarios where revised zoning ordinances could permit residential development within existing plant boundaries. NEEDS ADDITIONAL INPUT FROM ROCKWELL AND DOE ON ARRANGEMENTS MADE WITH DOI OR ANY OTHER PARTIES INVOLVED IN DECISIONS ON FUTURE LAND USE FOR RFP..

SECTION 2.0: SCREENING OF REMEDIAL ACTION TECHNOLOGIES

Section 2.0, Comment 1

The initial selection and screening of remedial technologies is to be based on the developed remedial action objectives, which in turn are based on nature and extent of contamination, risk assessment and ARARs identification. Subsequent to the RI and the ARAR and risk assessment evaluation presented in Appendix 2, the remedial action objectives should be stated in Section 2.0 of the FS, specifying the contaminants and media of interest, exposure pathways and remediation goals so that the basis for initial selection and screening of remedial technologies is identified. The general remedial technologies to be screened and further refined are selected for each medium of interest which will satisfy the remedial action objectives. This means that the volume of media to be addressed must be defined and presented in the FS subsequent to the ARAR and risk assessment so that the remedial action objectives can be defined.

Response to Section 2.0, Comment 1

The selection and screening of remedial technologies was based on the nature and extent of contamination (Sections 1.2.3 - 1.2.6), ARARs (Appendix 2 as referenced in Section 1.3), and the risk assessment (Appendix 1 as referenced in Sections 1.2.7 and 2.2.2.1). For clarity, the revised FS will devote a section to the basis for selection of remedial technologies.

Section 2.0, Comment 2

The second phase of the screening process evaluates the response technology types in light of medium specific technical implementability. Contaminant types and concentrations and on-site characteristics such as depth to bedrock, degree of fracture and aquifers (alluvial and/or bedrock) affected are examples of the information which should be used to make these determinations.

If the elevated metals, inorganics and radionuclides found in the hillside groundwater are above ARAR or impart unacceptable risk, then the process options to address these contaminants must be discussed. This again requires that the FS define the media and contaminants of concern, so that the basis for proposal of response technology types can be understood. The ARAR evaluation and risk assessment should address the bedrock groundwater contamination at the hillside in order to assess the implementability of the technology types proposed.

The resulting technology types are refined to more specific process options within each technology type. The process options within potential technology types are evaluated in greater detail prior to selecting one process to represent the technology type. Process options are evaluated using the implementability, effectiveness and cost criteria. In general, Rockwell and DOE did not follow the basic procedures for screening of remedial action technologies as it is described above.

Response to Section 2.0, Comment 2

Screening of technologies was based on medium and contaminant specific technical implementability. Examples include elimination of sheet piling because of coarse grained soils (pg 2-9), elimination of bottom sealing because of the absence of subcropping sandstones at the two areas of contamination (pg 2-10), consideration of anaerobic biodegradation because the contaminants are aliphatic halogenated compounds (pg 2-25), consideration of air stripping because contaminants are volatile (pg 2-47), etc. Remediation of bedrock groundwater is not addressed because of the absence of organic contamination. Inorganic bedrock groundwater contamination is inconclusive at this time.

The refining of technologies into more specific process options and selecting a process option to represent the technology type follows March 1988 RI/FS guidance not available at the time of the FS report preparation. However, Rockwell did, in effect, use this process. For example, a soil bentonite slurry wall was chosen over a cement bentonite slurry wall, diaphragm wall, grout curtain, sheet piling, and bottom sealing to represent subsurface barriers. Soil flushing was retained rather than vitrification, in situ aeration, biodegradation, and carbon adsorption to represent in situ treatment/immobilization. Process options were evaluated on the basis of implementability, effectiveness, and cost. Cost was used if the process option was first considered implementable and effective.

Section 2.0, Comment 3

The "conclusion" presented in the RI, and referenced in Section 2.2.2.2, that radionuclide concentrations in soils are at or near background levels is questionable. Prior to determination that the soils need not be disposed of at a mixed waste facility, a more thorough determination of radiation level of the soils impacted must be made or the soils would have to be disposed of at a mixed waste disposal facility.

Response to Section 2.0, Comment 3

Rockwell is in the process of implementing a background hydrogeochemical characterization plan to resolve current questions pertaining to the existence of contamination at the site and facilitate determination of contamination in future investigations. We nevertheless feel that radionuclide concentrations in soils presented in the RI are at or near background levels based on review of all existing soils data at the facility. We agree that our statement that "disposal at a RCRA mixed waste treatment, storage, and disposal facility will not be required" is to conclusive at this time.

Section 2.0, Comment 4

The screening of technology types, specifically well arrays as presented in Section 2.2.3.1, is to be based on technical implementability. The section indicates that pumping is most effective in homogeneous materials with relatively high intergranular hydraulic conductivities. This may not be appropriate for the contaminated groundwater in the SS1 Hillside alluvial and weathered claystone bedrock.

Response to Section 2.0, Comment 4

We agree with the comment that a well array may be inappropriate for the alluvium, and addressed this in Section 3.3.2.2. The unsaturated conditions encountered in borehole 7-87BRA and the unconfined conditions in well 5-87BR indicate insignificant flow of groundwater in the weathered bedrock. This appears to be an insignificant migration pathway.

Section 2.0, Comment 5

The technical implementability of subsurface drains and barriers is dependent on the depth of affected groundwater. The FS must address the contaminated groundwater in the weathered horizons of the bedrock prior to determining whether these technology types are implementable at the hillside.

What hydrologic impact would result from utilization of a subsurface barrier on the hillside? Upgradient mounding and flow net changes should be considered when evaluating this technology type.

Response to Section 2.0, Comment 5

The significance of contaminant migration in the weathered claystone bedrock is addressed in our response to Comment 4 above.

Subsurface barriers were used in Alternative 5, Total Encapsulation. Although not stated in the FS, mounding is not expected to be a problem because of the substantial depth to groundwater, and the potential for groundwater to flow around the slurry wall. This will be addressed in the technology and alternative screening sections of the revised FS.

Section 2.0, Comment 6

It is unclear why capping is being considered and retained as a technology type when it has been stated that the leaching of contaminants from the soils is not anticipated to be a problem, and the soils themselves have been determined in the risk assessment not to pose significant hazards. The reduction of infiltration will not reduce the concentration of contaminants in the groundwater.

Response to Section 2.0, Comment 6

Although not stated in Section 2, capping was considered because it is an integral part of total encapsulation (Alternative 5 in Section 3) where reduction in infiltration is important to maintain hydraulic gradient into the encapsulated material. This will be identified in the revised FS. Additionally, our analysis of action specific ARARs indicated that closure with waste in place makes RCRA closure standards relevant and appropriate.

Section 2.0, Comment 7

The initial screening of technology types is to be based on implementability. The feasibility of vitrification, lack of commercial availability and limited previous applications are not the screening elements to be used at this stage in the FS. Also if soils are not of concern and vitrification would most likely volatilize the organics, why is this technology type being considered?

Response to Section 2.0, Comment 7

As stated in Section 2.2.5, "...treatment technologies are considered only as methods to expedite the remediation of groundwater at the 881 Hillside". As stated in the Guidance on Feasibility Studies under CERCLA (EPA/540/G-85/003), technologies may be eliminated if they rely on unproven technology or are not fully demonstrated.

Section 2.0, Comment 8

If soils do not pose a significant health hazard, as determined in the risk assessment, and leaching of soils will not significantly affect the groundwater concentrations of contaminants, then why is soil flushing being considered and retained? The leachability of the soils and/or the distribution of contaminants between soil and groundwater should be evaluated in order to verify the low significance of leaching of contaminants from the soil. The permeability and clay content of the soils in conjunction with the hardness of the groundwater would indicate that this technology type may not be implementable at the 881 Hillside.

Response to Section 2.0, Comment 8

As stated on page 3-20, paragraph 1, soil flushing provides additional hydraulic drive to displace contaminated groundwater. The hydraulic conductivity of the alluvium was considered sufficient to prepare a conceptual design for the FS. Hardness of the water may affect the implementability of this technology should calcium carbonate precipitate, however, as stated on page 6-3, last paragraph, this technology will only be used to expedite groundwater remediation. Infiltration testing would likely be conducted before preparing a detailed design for a soil flushing system.

Section 2.0, Comment 9

The FS should state the reasons that in situ aeration is not implementable at the 881 Hillside. Application of the geologic information developed in the RI should provide the information needed to assess this technology type.

Response to Section 2.0, Comment 9

As stated on page 2-24, last paragraph, soils containing a high percentage clay distribution, as is the case at the 881 Hillside, are less amenable to the process.

Section 2.0, Comment 10

The FS should state why in situ anaerobic conditions would be difficult to maintain at the 881 Hillside. The absence of conclusive demonstrations of the effectiveness of this technology for treating soils and groundwater contaminated with organics is not a valid reason for dismissing this technology type.

Response to Section 2.0, Comment 10

Flooding of the soils and containment of the groundwater, or addition of readily biodegradable organics may induce the low redox potential (anaerobic conditions) required for biodegradation. However, these methods or other methods have not been demonstrated (EPA, 1985). We have not applied the geologic information developed in the RI to assess this technology further because, as stated in the FS, "there are no known conclusive demonstrations of the effectiveness of this technology for treating soils and groundwater contaminated with these organics."

Section 2.0, Comment 11

The fact that in situ carbon adsorption is in the research and development stage is not a valid reason to dismiss this technology type. The initial screening process evaluates implementability of the technology type. The hydraulic impact of implementation of this technology should be discussed.

Response to Section 2.0, Comment 11

Again, as stated in the Guidance on Feasibility Studies under CERCLA (EPA/540/G-85/003), technologies may be eliminated if they rely on unproven technology or are not fully demonstrated. It is our opinion that unproven or not fully demonstrated technologies would be difficult to implement. The in situ carbon system would necessarily have to have a permeability equal to or greater than the permeability of the surrounding surficial material to prevent an 'end around run' of contaminants'. Therefore, there should be no adverse hydraulic impacts of implementing the system.

Section 2.0, Comment 12

The complete oxidation of 1,1,1-trichloroethane results in the production of carbon dioxide and hydrogen chloride. The dismissal of wet air oxidation and supercritical water based solely on costs is not consistent with the NCP. Costs are to be considered only after it is determined that adequate protection of public health, welfare and the environment will be achieved. The initial screening of technology types is to be based on implementability, not on cost. Only after alternatives comprising process options have been developed should the costs be considered and then costs can only be considered after it is determined that the alternative provides the adequate level of protectiveness.

Response to Section 2.0, Comment 12

You state in comment 2 of Section 2 "process options are evaluated using the implementability, effectiveness, and cost criteria", which is consistent with the March

1988 Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. The screening of these technologies, and the subsequent detailed evaluation of the three most implementable and effective water treatment technologies was "to determine the cost effective reliable treatment system for inclusion with the alternatives requiring water treatment" (see page 2-66). The purpose of this strategy was to eliminate unnecessary permutations of water treatment technologies and other remedial technologies in formulating remedial action alternatives. This is consistent with the intent of the new guidance.

Section 2.0, Comment 13

The chemicals associated with 881 Hillside should be analyzed for compatibility with the reverse osmosis membrane in order to dismiss this technology as not implementable. It seems that the volume of the concentrate would be low for wastes treated by reverse osmosis considering the concentration of the contaminants in the groundwater.

Response to Section 2.0, Comment 13

If it were not for the aggregate of disadvantages of reverse osmosis (bio-fouling, possible reactivity with the membrane, precipitation of metal salts, and large quantity of concentrate requiring treatment), Rockwell would have performed a more exhaustive literature search on the compatibility of the various contaminants with the reverse osmosis membrane. The effluent standard defines the maximum concentration gradient that can exist across the membrane. The lower the effluent standard, the lower the concentration gradient needs to be to control migration of contaminants into the effluent. The flow of concentrate would be a process variable that controls this concentration gradient. The effluent standard is non-detectable concentrations suggesting a need for low concentration gradients and thus high concentrate flows. Without treatability study data, the flow of concentrate cannot be exactly determined. The EPA estimates the typical concentrate flow to be 10 to 25 percent of the influent flow (EPA, 1985). Treatment of this waste adds a significant additional capital and operating cost to this technology.

Section 2.0, Comment 14

Chemical oxidation should be evaluated for implementability as a technology prior to evaluation of process options within this genre of treatment.

Response to Section 2.0, Comment 14

Wet air oxidation, supercritical water, and UV ozone/peroxide are all chemical oxidation technologies evaluated in this FS. For completeness, the revised FS will discuss the use of chlorine, permanganate, and other chemical oxidants.

Section 2.0, Comment 15

The dismissal of steam stripping only because of cost is inappropriate. The steam stripping and air stripping process options must first achieve the same level of effectiveness prior to consideration of costs.

Response to Section 2.0, Comment 15

The FS states on page 2-49 that there is minimal enhancement of system efficiency for contaminant removal and significantly increased costs in the use of steam stripping in lieu of air stripping. For the organic contaminants identified in the groundwater, it is more accurate to state there is no enhancement of system efficiency in the use of steam stripping relative to a properly designed air stripper.

SECTION 3: SCREENING OF REMEDIAL ALTERNATIVES

Section 3.0, Comment 1

The remedial alternatives are to be analyzed in light of effectiveness, implementability and cost. Is acceptable engineering practice the same as implementability? Alternatives are to be further refined by quantifying the areas and volumes of media to be addressed and the sizes and capacities of the process options making up each remedial alternative. The media and pathways of exposure to be addressed are the same for all alternatives. The media and pathways of exposure to be addressed are considered during development of remedial action objectives. Effectiveness is evaluated based on protectiveness and reductions in toxicity, mobility or volume achieved.

After identifying the alternatives to be analyzed in detail, treatability testing should be initiated if necessary and additional site characterization should be conducted as appropriate, in order to support the detailed analysis of remedial alternatives.

Response to Section 3.0, Comment 1

Screening on the basis of implementability, effectiveness, and cost is from the March 1988 draft RI/FS guidance not available at the time the FS was prepared. Acceptable engineering practice is a term from the NCP (40 CFR 300.68 (g)(2)) which, if we are not mistaken, has not been revised since November 20, 1985. It is our opinion that acceptable engineering practices is the same as implementability as defined in the March 1988 draft guidance. We otherwise agree with the statements of this comment and believe the FS is responsive on all accounts.

Section 3.0, Comment 2

The dismissal of treatment for contaminants other than the volatile organics must be based on the ARAR evaluation and/or the risk assessment. This must be explicitly stated so that the basis for the proposed remedial alternatives can be understood. Otherwise, incorporating reinjection of groundwater or discharging to the surface water after only treating the organics is possibly unacceptable.

Response to Section 3.0, Comment 2

The inorganics (and organics) exceeding ARARs are identified in Table 4-6, page 4-40. The table indicates that manganese, selenium, gross alpha, gross beta, and total dissolved solids are at concentrations exceeding ARARs. As discussed on page 4-39, the selected treatment alternative will be unable to meet ARARs for these inorganic constituents. Because the RI and FS were required to be completed at the same time, there was insufficient time to screen technologies for removal of these inorganics once it was recognized that they exceeded ARARs. Furthermore, it is unclear whether these inorganics are contaminants without a thorough characterization of background chemical conditions. The revised FS will "up front" identify the results of the background characterization, risk assessment, and ARAR analysis to allow selection and screening of

technologies and alternatives. The revised FS will include technology screening of treatment processes that remove the inorganic contaminants above ARAR, if appropriate.

Section 3.0, Comment 3

No Action. The hazard posed by SWMU 107 has not been evaluated separately. Groundwater downgradient of SWMU 107 has been degraded. The hazard posed by SWMU 119.1 has not been separately evaluated. The determination of extent of contamination resultant to SWMU 119.1 has not been accurately presented in the RI. Borehole soil samples indicate that VOCs are present in the weathered horizons of the claystone bedrock. VOCs have been detected in the surface waters of the South Interceptor Ditch and Woman Creek. Thus the monitoring program proposed will only detect changes to the present contaminated conditions of the groundwater of 881 Hillside. The ability of the soils to naturally attenuate contaminant plumes should be substantiated. Attenuative processes may reach some capacity level, which could allow further migration of the plume.

Response to Section 3.0, Comment 3

The risk assessment evaluates risk posed by both contaminated groundwater and surface water. We see no reason to assess the hazard posed by SWMU 107 and SWMU 119.1 separately. Concerns regarding the extent of contamination resulting from SWMU 119.1 are addressed in our response to question Response 19, Section 4. Concerns regarding VOC contamination of weathered claystone and surface water are addressed in our responses to Comments 34, 36 and 39 of Section 5, and Comments 2, 4 and 7 of Section 6, respectively. The wells and surface water stations selected for monitoring were based on the extent of VOC contamination in alluvial groundwater and surface water as presented in the RI. Other downgradient wells and surface water stations may be added to the monitoring system pending the results of the background characterization, revised ARAR analysis, and risk assessment. It is our opinion that volatilization and adsorption explain, in part, the lack of contaminant migration observed to date. It was discussed in a qualitative manner in view of this observation. We see no reason to substantiate attenuative mechanisms since we recognize (as stated in the first paragraph of page 3-7) that the no action alternative "will not improve site conditions, minimize generation of contaminants, or mitigate any potential long term risks". It is not the preferred alternative, and we believe the discussion of the effectiveness of the alternative is an accurate description of the current conditions and hazards.

Section 3.0, Comment 4

Line of Wells with Treatment. The depth of the groundwater wells proposed in the FS must be predicated on the risk assessment and ARAR review for contaminants in the bedrock groundwater. A more prudent treatment alternative would pump the 8 gpm to Building 374 post treatment in the new treatment facility. See comment number 2 above. The location of 165 wells located on 10 foot centers will have to be verified for ability to intercept groundwater. The number and placement of wells should assure that overlapping cones of depression provide complete cut-off of groundwater flow. The FS must evaluate the depth requirements to meet ARAR and/or acceptable risk levels for remediation of groundwater. This will have to be done prior to elimination of well placement as an alternative. The french drain system is constrained to shallow remediation, and may not provide the level of protection required if bedrock groundwater must be considered. The location of these wells must also be

evaluated in light of the extent of contamination. The location of these wells must be based on quantitative information. Risk isopleths would allow proper determination of well placement. Sampling the influent and effluent on a monthly basis may not provide adequate information to assess the performance of this unit. These sampling events must also be coordinated. The statements regarding effectiveness and meeting of ARARs are poorly justified.

Response to Section 3.0, Comment 4

The depth of the wells was based on capturing contaminated alluvial groundwater because it was concluded in the RI that bedrock groundwater contamination did not exist. This has been reevaluated (see response to Comments 24 and 39 of Section 5), and it is suggested now that bedrock groundwater simply be monitored. We do not understand why treatment in Building 374 with post treatment in the new facility is more prudent. For example, the effluent from Building 374 comprises many sources of influent water. Furthermore there is insufficient capacity at Building 374 to handle the additional flow. The location of the well array was determined to be at a line downgradient of the 881 Hillside where organic contamination did not exist, and therefore, there were no risks attributable to the organics. If the background characterization and revised ARAR analysis indicate inorganic contaminants exceed ARARs downgradient of the hillside, the well array will be relocated to a location where acceptable risks are posed. The spacing of the wells was calculated based on an average hydraulic conductivity, but since the alternative was eliminated because of subsurface heterogeneities in favor of a subsurface drain, we see no reason to further verify their spacing to assure complete cut off of the groundwater flow. We feel influent and effluent monitoring on a monthly basis is adequate to assess the performance of the system once the system has been thoroughly tested initially. It is certainly adequate for establishing a cost for monitoring for the FS. In light of our focus on remediation of organic contaminated alluvial groundwater, we do not see our statements regarding effectiveness and meeting ARARs as poorly justified.

Section 3.0, Comment 5

French Drain. Comments made above are applicable to this alternative. (i.e. depth of trench, location on the hillside, feasibility determinations, extent of contamination and contaminants to treat, etc.) The soils which will be excavated will have to be tested to determine whether they can be used as backfill materials in light of land disposal restrictions. The soils will also have to be evaluated to ensure that subsurface structures will be geotechnically stable. Capital costs for this alternative should include the costs of the above tests. The statements regarding effectiveness are poorly justified.

Response to Section 3.0, Comment 5

Our response to comment 4 above applies to this comment with respect to depth of the trench, location on the hillside, feasibility determinations, extent of contamination, contaminants to treat, and effectiveness. Testing of soils for volatiles before use as backfill material is unwarranted in that risk assessment based acceptable concentrations and maximum concentrations for land disposal restriction are in the part per million range. Testing is also unnecessary because land disposal restrictions are not triggered unless the waste is moved from one area or unit of contamination to another, or if the movement constitutes an act of disposal (See Section 2.5.2 Draft CERCLA Compliance With Other Laws Manual, Volume I, June 1987). Concentrations in soils in contaminated areas at the hillside are in the low part per billion range. We agree testing

will be required for backfill material to ensure that subsurface structures are geotechnically stable.

Section 3.0, Comment 6

French Drain with Soil Flushing. The reason for considering soil flushing should be stated in section 2 as it is in section 3. The design discharge for soil flushing of 0.8 gpm should be presented based on effective porosity, surface area and depth of the drain field. The evaluation of effectiveness and acceptable engineering practice is poorly justified. The additional cost for soil flushing is estimated at about $52,000. Soil flushing will considerably shorten the remedial process at a relatively small initial cost increase, if effective. Use of innovative technologies is encouraged by SARA. This process option should be further evaluated to see if the hardness of the groundwater and/or the subsurface conditions will allow effective use of this technology.

Response to Section 3.0, Comment 6

We agree the reason for considering soil flushing should be stated in Section 2 as it is stated in Section 3. This will be done for the revised FS. As stated in the FS, the design discharge is based on hydraulic conductivity, effective porosity, and surface area. Depth of the drain field is not a factor unless it is near the alluvial groundwater table which is not the case for the 881 Hillside. The reader is referred to our response to comment 4 regarding the poor justification of effectiveness. Our discussion of acceptable engineering practice is based on a thorough literature search of soil flushing. Although the discussion does not provide definitive conclusions on the implementability or effectiveness of soil flushing (and does not claim to), we feel it is adequate considering how it is intended to be used in the preferred alternative. See response to comment 8 (Section 2) regarding further investigation of this alternative. We feel use of UV peroxide treatment is an innovative technology as encouraged by SARA.

Section 3.0, Comment 7

Total Encapsulation. The alternative does not totally encapsulate the 881 Hillside. No discussion of the existing treatment process is presented. The encapsulation will not address the geochemical changes in groundwater resultant to the past waste disposal practices at 881 Hillside. The statements concerning dilution and attenuation of contaminated groundwater not encapsulated is unsupported. Dilution is prohibited as a substitute for treatment and release of contaminants above background will degrade water quality. This solution may not meet ARARs.

Response to Section 3.0, Comment 7

We do not claim that the alternative totally encapsulates the 881 Hillside but rather it encapsulates "the contaminant sources near SWMU 107 and SWMU 119.1" as stated on page 3-27. This was done to make the alternative reasonable, i.e., minimizing cost while maximizing it's effectiveness, since the alternative was considered largely to comply with SARA (consideration of an alternative that represents waste containment with little or no treatment). The existing treatment process is the flash evaporator in Building 374 which can handle the small volume of contaminated water anticipated with this alternative. This will be identified in the revised FS. None of the alternatives address the

geochemical changes in groundwater resultant to the past waste disposal practices at the 881 Hillside for reasons which are discussed in our response to comment 2 of Section 3. The risk assessment quantifies dilution of contaminants entering the valley fill alluvium of Woman Creek. Attenuation is not quantified, but volatilization, an attenuative mechanism, is likely to be significant especially considering the unsaturated conditions that exist in the alluvium at times during the year. Dilution is a consideration in the establishment of ACLs under RCRA. We state on page 3-30, last paragraph, this alternative will not meet ARARs.

Section 3.0, Comment 8

Treat Source Well and Footing Drain Flow. The RI has not characterized the sources in sufficient detail to allow conclusions to be made that treatment of the footing drain flow and 9-74 source well will significantly minimize any threats to public health. The RI never determined that the footing drain collected all the VOCs in the area adjacent to the 881 building. Will pumping at a steady flow of only 0.04 gpm provide a cone of contaminated groundwater from migrating or even to collect the contaminants which are present in the area? The reasons presented for retention of this alternative have no support in the document.

Response to Section 3.0, Comment 8

Regardless of how issues of soil contamination, bedrock groundwater contamination, or inorganic contamination of alluvial groundwater are resolved, it seems clear that discharge of contaminated water to surface water and the presence of tens-of-thousands ug/l concentrations of VOCs in groundwater present the greatest potential threat to the public health. Whether the footing drain collects all the VOCs in the vicinity of Building 881 is irrelevant to any statement made in the FS concerning Alternative 7. By the time a steady flow of 0.04 gpm is achieved, most of the contaminated water will be removed which is the intent of this alternative. The above discussion provides the reasons for retaining this alternative for further consideration.

Section 3.0, Comment 9

French Drain with Soil Removal. This alternative must address the same considerations as presented in comments 4 and 5 above. The FS does not present justification for the dimensions and volume of soil to be removed. The FS does not consider the possibility that the excavated soils will have to be treated to meet Land Disposal Restrictions.

Response to Section 3.0, Comment 9

Our response to comment 4 is applicable to this comment. The volume of soil was estimated by assuming all alluvial material would be removed, the areal extent of which determined by the presence of volatiles in soil samples from the boreholes. This will be

included in the revised FS after presentation of the results of the ARAR analysis and risk assessment. See our response to comment 5 regarding land disposal restrictions.

Section 3.0, Comment 10

Summary of Screening Results. Total encapsulation should not be retained. Soil flushing options should be further evaluated to determine effectiveness at the 881 Hillside. Soil removal should be retained, as until the effectiveness of each retained option is more thoroughly evaluated, soil removal may provide the greatest level of protection to human health and the environment. The pump source well and collect footing drain flow option does not provide the same level of protection as the other options under consideration.

Response to Section 3.0, Comment 10

We believe total encapsulation should be retained based on reduction in risks and low cost. We agree soil flushing should be further investigated when it appears prudent to implement. The risk assessment performed for this response to comments still shows that contaminated soils per se do not pose unacceptable risk. It is our opinion that the retained alternatives offer similar levels of protection to human health and the environment as the soil removal alternative, but are considerably more cost effective. We agree the pump source well and collect footing drain flow alternative does not provide the same level of protection as the other alternatives, but then we do not claim otherwise in the FS. If the implication of this comment is that the alternative should not be retained for detailed evaluation, we do not understand the basis for this claim. The March 1988 RI/FS guidance suggest that the alternatives retained after screening adequately preserve the range of remedies.

SECTION 4: DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

Section 4.0, Comment 1

Before performing the detailed evaluation of remedial alternatives, post-screening investigations should be conducted to ensure that the post-screen remedial alternatives can meet the remedial action objectives. These studies may include the collection of additional site characterization data, treatability studies, and/or bench scale testing.

Response to Section 4.0, Comment 1

This comment is directly from the March 1988 RI/FS guidance which was not available at the time the FS was prepared. Furthermore, the schedule imposed on preparing the RI/FS completely eliminated consideration for additional site investigations. We did manage to conduct activated carbon and UV peroxide treatability studies in the limited time available.

Section 4.0, Comment 2

The specific CERCLA requirements to be supported in the FS include protection of human health and the environment, ARAR attainment, cost-effectiveness, permanence and use of innovative technologies as practicable and satisfaction of the preference for treatment which reduces toxicity, mobility or volume. In addition, CERCLA places emphasis on consideration of the long term uncertainties associated with land disposal, the requirements of the Solid Waste Disposal Act, the characteristics of the hazardous substances and their tendency to bioaccumulate, short and long term health effects from human exposure, long term maintenance costs, failure of proposed remediation and the threat to human health and welfare associated with excavation and redisposal. The criteria to be used to address these requirements and considerations are short term effectiveness, long term effectiveness and permanence, reduction of toxicity, mobility and volume, implementability, cost, compliance with ARARs, protection of human health and the environment, state acceptance and community acceptance. These evaluation criteria should be used as opposed to the criteria proposed in section 4.1 of the FS.

Response to Section 4.0, Comment 2

See first line of comment 1 above. The revised FS will consider, more specifically than it currently does, the new criteria for detailed analysis of alternatives.

Section 4.0, Comment 3

The groundwater treatment section focuses only on treating organics in the groundwater. The RI and FS must address the other elevated constituents, namely the elevated radionuclides, inorganics and metals. If these constituents must be addressed by the remedial alternative, as determined through ARAR and risk assessment, then the FS must propose remedial alternatives which will meet the requirements.

Response to Section 4.0, Comment 3

Our response to Comment 2 (Section 3) addresses this comment.

Section 4.0, Comment 4

The FS should evaluate the specific efficiencies of treatment for each contaminant of concern.

Response to Section 4.0, Comment 4

UV peroxide, activated carbon, and air stripping technologies can be designed to achieve the efficiencies required for removal of the organic contaminants to meet ARARs for discharge of the effluent. The conceptual designs and the associated cost for implementation reflect achieving these removal efficiencies.

Section 4.0, Comment 5

Implementability of carbon adsorption may be affected by the potential problems associated with radionuclides in the groundwater. The effects, safety problems and disposal implications of the radionuclides should be determined in this section before the technology can be evaluated.

Response to Section 4.0, Comment 5

Treatability studies are underway to evaluate the adsorption of radionuclides on activated carbon. Even if radionuclide adsorption is determined not to be significant, UV peroxide is still the preferred technology because it destroys contaminants directly in the water and therefore obviates the need for treatment or disposal of secondary waste streams. Favorable results from the treatability study may suggest use of activated carbon as a back up system to UV peroxide.

Section 4.0, Comment 6

The data resulting from the bench scale testing of 881 Hillside groundwater should be presented in the section discussing the UV/peroxide treatment system. The production of hydrogen chloride in the offgas post treatment with UV/peroxide should be addressed technically.

Response to Section 4.0, Comment 6

The revised FS will present the treatability study data for UV peroxide. The oxidation of trichloroethane produces three moles of hydrogen chloride per mole of trichloroethane. Given a typical feed concentration of 1mg/l chlorinated VOC's (~0.01 mM), 0.03mM hydrogen chloride will be produced, which will produce a 1.5 mg/l (as calcium carbonate) reduction in alkalinity. This reduction in alkalinity will have an insignificant impact on pH. Even at ten times this concentration the impact on pH will be small. There should be no degassing of hydrogen chloride. The solubility of hydrogen chloride is 820,000 mg/l. This discussion will be added to the FS.

Section 4.0, Comment 7

The expectation that a french drain will be highly effective in containing and collecting contaminated groundwater at the 881 Hillside needs to be substantiated. The determination of extent of contamination into bedrock and the risks associated with this contamination is prerequisite to evaluating this alternative. The implementability of this type of structure to depths greater than 10 feet is at issue. How is it known that the footing drain at Building 881 has not clogged partially? What is the life expectancy of the low permeability barrier to be placed on the downgradient side of the trench? What will this material be? The alternative as proposed does not address the contaminated groundwater in the weathered horizons of the claystone bedrock.

Response to Section 4.0, Comment 7

Based on the RI conclusion that bedrock groundwater is not contaminated, the french drain will be highly effective in containing and collecting contaminated groundwater. We do not foresee implementability to be a problem. Dewatering is expected to be minimal, and there are new techniques for cost effective shoring should soil stability be a problem. We do not know if the footing drain is partially clogged but its continued effectiveness for over 30 years without cleaning nevertheless supports the contention of the long useful life of the french drain. The low permeability barrier will be a synthetic membrane (page 3-13, second paragraph). The material will be HDPE. The life of synthetic membranes is at least 20 years based on observed service to date of such membranes. Our response to comment 4, Section 2, addresses weathered bedrock contamination.

Section 4.0, Comment 8

The underlying weathered claystone may adversely affect the performance of the total encapsulation alternative. It is unclear how the internal sump system incorporated in this alternative would be expected to maintain an inward gradient, especially given the slope of the hillside. The expectations that the compacted soil walls will provide performance equal to the slurry wall needs to be substantiated. The statement that the released contaminants will not pose a hazard to public health or the environment is unsupported. Dilution is prohibited from being substituted for treatment. Contaminated groundwater must be mitigated prior to release. The statement that soil excavated must be returned to the area from which it was removed in order to avoid triggering the land disposal restrictions is incorrect. Contaminated soil can not be used for backfill material.

Response to Section 4.0, Comment 8

Our response to Comment 4, Section 2, addresses weathered bedrock conditions. The internal sump system would be located at the lowest elevation within the encapsulated area in order to effectively dewater the contained volume and thus maintain an inward gradient. The compacted clay barrier can be installed to achieve a hydraulic conductivity of 10^{-7} cm/sec. Although soil-bentonite slurry walls can achieve hydraulic conductivities of 10^{-8} cm/sec, the higher hydraulic conductivity for the compacted clay barrier is standard practice for underlying soil liners in RCRA multi-layer caps. See our response to comment 7, Section 3, regarding contaminants outside the encapsulated material. Moving or consolidating waste within the same unit or area of contamination does not

constitute disposal and thus does not trigger land disposal restrictions (EPA, 1987), therefore our statement regarding land disposal restrictions stands. We see no reason why contaminated soil cannot be used for backfill if the risk assessment indicates this material does not pose an unacceptable risk to the public health.

Section 4.0, Comment 9

The source well and footing drain option will not address the risks associated with the plume downgradient of these two sources.

Response to Section 4.0, Comment 9

As stated in Table 5-1, page 5-3, "there is insufficient data to reliably conclude that there will not be public exposure to contaminants off-site at some point in the future." This is primary reason the alternative was not chosen as the preferred alternative.

Section 4.0, Comment 10

If the treatment technologies will not meet ARARs for manganese, selenium, total dissolved solids, alpha and beta then the FS should address technologies which will meet these requirements. The action specific ARARs should address the offgas emissions from the treatment of the groundwater.

Response to Section 4.0, Comment 10

Our response to comment 2, Section 3, addresses this comment. The revised ARAR analysis will include action specific ARARs for off-gas emission. These will include the applicable CDH air pollution regulations.

Section 4.0, Comment 11

The calculations presented in Appendix 3 are inconsistent with the narrative discussion of Appendix 3. Table A3-2 includes a lump sum cost for the UV/peroxide treatment system. Table A3-3, page 1 is titled UV/peroxide, while all subsequent pages are titled carbon adsorption and the total cost is estimated at 780,000, not $291,000. This may significantly affect the evaluation of cost/benefit and present worth calculations.

Response to Section 4.0, Comment 11

The lump sum cost for UV-peroxide in Appendix 3 , Table A3-2 is for equipment purchase and installation only. Equipment purchase and installation costs are adequate for cost comparisons in the selection of a water treatment system. The additional cost identified in Table A3-3 are for electrical design and instrumentation as well as contingency. These costs should be reasonably constant for all water treatment technologies.

APPENDIX 1: RISK ASSESSMENT

Appendix 1, Comment 1

The method utilized to evaluate risk associated with the 881 Hillside is appropriate and good information is derived from this study. However, statements made in the text of the report are inconsistent with the data and the appendix should be edited accordingly. The majority of the comments concerning this risk evaluation are directed towards these inconsistencies.

Response to Appendix 1, Comment 1

We will comply with this statement and revise the future risk assessment accordingly.

Appendix 1, Comment 2

Although the risk assessment does not seem to be predicated on this basis, the statement is made that constituents will be eliminated from selection as an indicator chemical because there is insufficient evidence that the constituent originated from prior disposal practices. There is evidence that past waste management activities at 881 Hillside may have altered the groundwater chemistry of the hillside. This is not addressed by the RI. The data suggest that the elevated metals, inorganics and radionuclides at the hillside may be symptomatic of a problem at the hillside. No effort is made to understand the problem and the symptoms are written off as attributable to geochemical variability. This is unacceptable, as the proposed remedy cannot be evaluated as to effectivenss in solving the problem, if the problem is not understood.

Response to Appendix 1, Comment 2

The risk assessment did cover constituents which were not definitely known to be the direct result of post-disposal practices.

We agree that the data suggest that elevated major elements, and possibly elevated trace elements, may be symptomatic of waste-related problems at the hillside. However, these issues cannot be resolved until background chemical conditions are characterized. The observed groundwater compositions are probably the result of a combination of mobilization of natural host rock constituents (e.g., via complexation of Se in alkaline solutions, degradation of clays by organics), and the addition of waste-derived ions (e.g. chloride). In lieu of the limited background characterization, we are currently unable to properly categorize the anomalously high metal and major ion concentrations as discussed in Response to Comment 24, Section 5.0 of the RI.

Appendix 1, Comment 3

Tables 2-10 through 2-12 identifying radionuclide levels in alluvial and bedrock wells and surface waters should identify what the minimum detectable activity is for each radioisotope

below minimum detectable activity. Why have only 3 beta/gamma emitting fission products Cs137, Sr89,90 been selected for monitoring in the groundwater? Do the surface water concentrations refer to total or dissolved only? The data may be more explainable if both total and dissolved activities were presented.

Response to Appendix 1, Comment 3

Minimum detectable activities for samples analyzed before 11/19/87 by Rockwell were 30 pCi/l for gross alpha, and 80 pCi/l for gross beta. After this date, the MDA was 15 pCi/l for alpha and 25 pCi/l for beta. No information was given for MDAs for the other analytes. The MDA for samples analyzed for americium, plutonium, and uranium after 10/1/87 had the following range. 0.12 - 1.6 pCi/l for $Pu^{239,240}$, 0.21-3.3 pCi/l for Am^{241}, 0.16-6.7 pCi/l for the uranium isotopes. In the future when values are below the MDA the MDA will be provided. These fission products were chosen because they would be the most indicative of a criticality incident at the facility. There has never been a criticality at the facility and there is no need to continue analyzing for fission products. The surface water concentrations are total values. Beginning this year, surface water samples were filtered in the field to obtain total and dissolved concentrations.

Appendix 1, Comment 4

In the identification of indicator chemicals, the significance of the chemicals which ranked in the upper 50% for carcinogenic and non-carcinogenic effects is not understood. EPA guidance does not offer this as an alternative and evaluation of risk associated with all elevated constituents is advantageous to the determination of risk and remedial action objectives. For constituents where toxicity constants are not available, EPA recognizes, as acceptable, the use of lowest observable effects numbers or numbers derived from these numbers.

Response to Appendix 1, Comment 4

The screening process used to identify indicator chemicals was based on EPA methodology (U.S. EPA, 1986, Chapter 3). Furthermore, the Risk Assessment Team re-evaluated the potential risk of all suspected contaminants on the 881 Hillside. Comparing the new results with the results using the previous selected indicator chemicals showed a less than one percent change in total risk thus indicating our selection process worked.

Appendix 1, Comment 5

The exclusion of the downgradient surface water stations other than SW-31 and SW-32 is not justified by postulating that other areas of RFP may be impacting the South Interceptor Ditch downgradient of SW-31 and SW-32. Conservative estimation of risk associated with the 881 Hillside should assume that the constituents found in the South Interceptor Ditch are a result of 881 Hillside past waste disposal activities. Further studies of the 903 Pad and old landfill may better identify the sources of impact associated with the South Interceptor Ditch.

Response to Appendix 1, Comment 5

Because Pond C-2 appears uncontaminated, it is not necessary to attribute surface water quality degradation downgradient of SW-31 and SW-32 to the 881 Hillside as a conservative measure, especially considering other sources are likely contributors.

Appendix 1, Comment 6

Why is it unlikely that the PCE detections in ambient air east of the 881 Hillside are related to past disposal activities at 881 Hillside? PCE was widely detected in soils at the 881 Hillside. Composite soil samples may dilute the peak concentrations found in soils. Building 952 is a storage facility for gas cylinders, mostly empty, not solvents.

Response to Appendix 1, Comment 6

As noted in Response 9, Section 1.0 of the FS, we mistakenly identified Building 952 as the potential source of PCE in the air. We meant to identify Building 885, a permitted RCRA drum storage area, as the potential source of the PCE.

Although volatile and semi-volatile organics were measured in on-site soil of the 881 Hillside, it is not expected that the volatilization of these chemicals would result in ambient air concentrations high enough to be of human health concern for the following reasons: 1) the analysis of soil samples revealed that organics were not widely distributed nor present at high concentrations in the soil and 2) limited ambient air sampling conducted on-site did not indicate the presence of organics in the ambient air at concentrations above detection limits (i.e., ppm range). See response 11 of this Section for related discussion.

Appendix 1, Comment 7

Why are there instances where background ranges are presented as single numbers?

Response to Appendix 1, Comment 7

In these instances, the constituent was undetected except for the value shown. The detection limit will be used to show the range in the final version.

Appendix 1, Comment 8

If the same analysis of radioactive contamination is utilized in the risk assessment as was offered in the RI, then possibly elevated radionuclides, Sr89,90, CS137 and Pu239,240 may be incorrectly eliminated from the evaluation presented in the risk assessment. Detection limitations may preclude the accurate determination of elevation with respect to background for radionuclides. The background determination for all constituents at the site is subjective and does not allow accurate evaluation of elevation with respect to background (see comments on RI). How are Sr89,90 and Cs137 eliminated from consideration when no background data exist? How are Pu239,240 and Am241 eliminated from being considered as elevated in bedrock and alluvial groundwater when background is below detectable activity?

Response to Appendix 1, Comment 8

The risk assessment was performed with data of limited value because of the high detection limits associated with the analyses and sampling methods which were not designed to adequately detect surficially deposited radionuclides. The new method of sampling the top 1 cm of soil, and 5 cm increments below it to a total depth of 30 cm

should provide good data for soil contamination profiles if contamination does exist. The risk assessment will be revised as required in light of the new data.

Appendix 1, Comment 9

The statement made in Section 3.2.2 that none of the organic indicator chemicals were detected above detection limits in surface water samples downgradient of the hillside is incorrect. Carbon tetrachloride was detected at surface water stations SW-32, 29 and 30. Tetrachloroethane was detected at surface water station SW-45. Trichloroethene was detected in surface water at SW-32, 29, 45 and 64.

The ranges presented for strontium concentrations do not correlate with the data presented in the RI. Surface water station SW-42 samples contained undetectable concentrations of strontium. Downstream samples from surface water stations SW-27, 28, 30, 31, 62, 64, 32 and 34 were all elevated with respect to background, some of which are considerably higher than the range presented in this section. Where was the background for sediment concentration of strontium determined? It is not presented in the data of the RI. The comparison to a referenced "usual" level of strontium in the sediment is irrelevant.

The U238 concentrations decrease from surface water station SW-36 to SW-35 to SW-44. No analysis of U235 is presented for SW-36, but U235 concentrations decrease from SW-35 to SW-44. U235 and U238 concentrations increase from station SW-44 to SW-31. Trends for U233,234 are hard to recognize given the data. Uranium levels may increase at SW-30 and this may be due to the SWMUs north of this station, however the conservative determination of risk associated with 881 Hillside should not assume that these constituents are the result of some other source. Ponds C-1 and C-2 are elevated with respect to surface water sampled at SW-32 and SW-42. The data presented could indicate 881 Hillside impacts the South Interceptor Ditch.

Response to Appendix 1, Comment 9

Please note Response 1 to Section 2.0 in the RI for a discussion of organic contamination in Woman Creek and the South Interceptor Ditch (SID). The conclusion drawn from that discussion suggests elevated organics in SW-29, -30, -32, and -45 during 11/87 is the result of laboratory artifact. Further sampling is necessary to verify this conclusion.

However, trichloroethene and tetrachloroethene were above detection in SW-45 on 05/26/88 (14 ug/l and 128 ug/l, respectively) and trichloroethene was above detection in SW-64 on 07/22/87 (20 ug/l). SW-45's organic contamination is directly attributed to past practices on the 881 Hillside. However, SW-64 is located immediately downgradient of the 903 Pad/East Trenches in a secondary ditch adjacent to the South Interceptor Ditch. Contamination observed at SW-64 is probably not related to the 881 Hillside past disposal practices.

As shown below, strontium concentrations in the surface water are highly variable and could be attributed to background variations. Further background characterization of both the soils and the surface water will be necessary to completely evaluate this question.

STRONTIUM VALUES IN SOUTH INTERCEPTOR DITCH AND WOMAN CREEK SURFACE WATER

South Interceptor Ditch		Woman Creek	
SW-36	.68	SW-42	Not Detected
SW-35	.4	SW-33	.3
SW-44	.6	SW-34	.2
SW-31	.4	SW-32	.28
SW-30	.4	Pond C-1	.7
SW-54	.36	SW-29	.143
SW-27	.52	SW-28	.46
Pond C-2	.23	SW-62	.97

It should be noted that: 1) SW-42 never flows into the South Interceptor Ditch, 2) SW-62 may be influenced by the South Interceptor Ditch and 3) SW-64 is downgradient from the 903 Pad and in a ditch adjacent to the SID.

Uranium concentrations, as you mentioned, are difficult to interpret. U-238 concentrations do not increase from station SW-44 to SW-31. The data presented does indicate that the 881 Hillside impacts the South Interceptor Ditch, however the old landfill and the 903 Pad may also be contributors.

URANIUM CONCENTRATIONS (PC:/l) IN SURFACE WATERS OF SOUTH INTERCEPTOR DITCH AND WOMAN CREEK (06/88)

	U-233 U-234		U-235		U-238	
SID	Total	Dissolved	Total	Dissolved	Total	Dissolved
SW-36	7.18 ±0.898	6.91 ±0.863	NR	NR	28.4 ±1.42	35 ±1.93
SW-35	1.20 ±0.218	1.51 ±0.522	.49±.48[3]	NR	1.83 ±0.293	0.835±0.478
SW-44	4.22 ±0.242	4.59 ±0.340	.27±.50[3]	NR	3.61 ±0.334	3.77 ±0.327
SW-31	2.41 ±0.423	2.42 ±0.225	.46±.45[3]	NR	2.71 ±0.476	2.76 ±0.257
SW-30	2.32 ±0.227	1.69 ±0.335	.84±.62[3]	NR	2.88 ±0.259	2.99 ±0.450
Pond C-2[1]	1.5 ±0.4	NA	NR	NA	2.6 ±0.6	NA
Woman Creek						
SW-42[2]	0.13 ±0.09	NA	NR	NA	0.06 ±0.06	NA
SW-32	0.455±0.116	0.470±0.136	0.07±.50[3]	NR	0.426±0.133	0.283±0.145
Pond C-1[1]	1.8 ±0.3	NA	NR	NA	1.5 ±0.3	NA

NR - Analyte Not Reported
NA - Not Analyzed
1 08/18/86
2 08/07/86
3 05/26/87

Appendix 1, Comment 10

The facts that ponds C-1 and C-2 contain elevated levels of uranium with respect to proposed background ranges and both ponds are elevated for inorganics with respect to SW-42 indicate that surface transport of contaminants is probable. The reasons for discounting this pathway must be related to concentration of constituents and not because it will not transport contaminants.

Response to Appendix 1, Comment 10

Uranium variation in surface waters is discussed in the previous response (Response 9). It should be noted that water initiating at SW-42 never enters Pond C-2.

Inorganics are elevated in Pond C-1 with respect to SW-42; however inorganics in Pond C-2 are not elevated with respect to upgradient surface water in the South Interceptor Ditch.

INORGANIC CONCENTRATIONS (mg/l) IN SURFACE WATER
(08/86)

SID	Cl^-	SO4=	Cyanide	TDS
SW-36	39	64	ND	320
SW-35[1]	33.6	74.0	ND	307
Pond C-2	31	67	ND	340
Woman Creek				
SW-42	2.0	3	0.0016	31
Pond C-1	22	38	ND	190

1 - 07/87
ND - Not Detected

Appendix 1, Comment 11

The borehole analyses as presented in the RI do not allow determination that volatile organics were not widely distributed. Ambient air sampling did detect PCE above detection limits. Soil gas sampling detected PCE above detection limits throughout the 881 Hillside. Although the risks associated with the air migration pathway are likely to be low, the reasons presented for discounting this pathway are incorrect.

Response to Appendix 1, Comment 11

The reevaluation of borehole contamination presented in RI responses 10 to 21, Section 4.0, and FS Response 7, Section 1.0, does corroborate the general statement that volatile organic contamination is not areally extensive. See Response 6 of this Section for a related discussion.

Most of the soil gas counts of PCE were less than 1,000, the amount designated as the minimum reliable reading.

The observation of PCE in air is not considered a significant risk primarily because of the low concentrations observed. The fact that the PCE was detected next to an active solvent collection area lend support to the assessment that the remediation of past disposal effects at 881 Hillside need not focus on PCE in air. We do not understand which reasons the Comment 11 refers to as incorrect.

APPENDIX 2: ARARs

Chemical Specific ARARs Analysis

Appendix 2, Comment 1

The use of geometric mean for averaging alluvial groundwater well contaminant concentration is incorrect. Since all SWMU/operable units at the 881 Hillside affect the same alluvial system, the ARAR evaluation should consider maximum concentration detected for each constituent considered. The FS should also utilize an acceptable range for background for each constituent and compare the high constituent concentration to this range. The background and data interpretation concerns expressed in this document extend into the development and analysis of ARARs presented in the FS. We are concerned that an adequate ARARs analysis cannot be done if the same subjective, and we believe arguable, interpretations of data are utilized in the ARAR analysis as are presented in the RI/FS.

Response to Appendix 2, Comment 1

The highest concentration of a given contaminant at any one location has no relevance when considered in the context of the overall remedial objective of collecting and treating a combined alluvial groundwater flow. Review of the alluvial groundwater data for the 881 Hillside reveals that wells completed in the alluvium exhibit a wide variety of contaminants and contaminant concentrations ranging from low ppb levels to ppm levels. In addition, the vast majority of alluvial wells were found to contain levels of volatile organics in the low ppb range, not the ppm range. Although it may be procedurally proper to compare the maximum concentrations found to ARARs, the use of these numbers would provide no insight into the levels of contaminants expected in the influent to the treatment facility. One of the purposes of the ARAR analysis is to provide a basis upon which to evaluate alternative remedial technologies. This could not have been done without some method of evaluating the wide range in concentrations found throughout the 881 hillside. The geometric mean of alluvial well concentrations was used for ARAR analysis because it more accurately reflects the expected contaminant concentrations associated with the remedial alternatives of groundwater collection and treatment en masse as opposed to collection and treatment of individual "hot spots".

Appendix 2, Comment 2

The ARAR review for soils is missing, as is an ARAR review of the bedrock groundwater. Bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, fluorene, phenanthrene, anthracene, fluroanthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluroanthene, benzo(k)fluoranthene, indono(1,2,3-cd) pyrene, benzo(g,h,i)perylene and diethylphthalate should be included with the volatiles detected for the soil ARAR analysis. Elevated metals, inorganics and radionuclides should also be evaluated in the soil ARAR analysis. All elevated constituents in the bedrock groundwater should be evaluated in an ARAR analysis.

Response to Appendix 2, Comment 2

Although not implicitly stated in the FS, the analysis of ARARs for soils at the 881 hillside was not completed because there are no existing standards, criteria or guidance that could be construed as chemical specific ARARs for soil remediation. The exceptions are the CDH standard for Permissible Levels of Radioactive Material in Uncontrolled Areas (Section 4.35.1 of Rules and Regulations Pertaining to Radiation Control, Colorado State Board of Health, April 1, 1978) of 2 dpm/gm of plutonium, or 2 dpm per square centimeter; and NRC's guidance on releases of radioactive materials to controlled areas.

Revisions to the FS will include a discussion of the potential ARARs associated with radionuclide contamination in soils.

In the absence of chemical specific soil ARARs, the approach taken in the FS was to perform a risk assessment using the most conservative scenarios of exposure to determine if concentrations of contaminants in the soil posed an unacceptable level of risk.

We concur that a separate analysis of chemical specific ARARs should be performed for the constituents found to be elevated in the bedrock groundwater.

Appendix 2, Comment 3

A "to be considered" column should be included in the FS presentation of the ARAR analysis. The health advisory level for t-1,2 dichloroethane is 70 microgram/liter lifetime intake for a 70 kg adult. The health advisory level for methyl ethyl ketone is 170 microgram/liter lifetime intake for a 70 kg adult, not 860 microgram/liter as stated in the report.

Response to Appendix 2, Comment 3

A "To Be Considered" column was not included in order to simplify the presentation of potential ARARs and to conserve space. However, consideration of "To Be Considered" criteria or health advisories were noted in the "ARAR" or "Comment" column in every case where there was a lack of promulgated or enforceable health-based ARAR, or where the promulgated or enforceable ARAR did not adequately address the protection of human health.

With respect to trans 1,2 dichloroethane, we believe you mean trans 1,2 dichloroethene. 1,2 dichloroethane does not exhibit geometric isomerism because of the lack of a double bond. The current EPA drinking water health advisory level for trans 1,2 dichloroethene is 100 ug/l and was obtained from personal communication with the Office of Drinking

Water, Health Effects Section. The level for methyl ethyl ketone of 860 ug/l for a lifetime intake for a 70 kg adult was found in USEPA, OERR, Superfund Public Health Evaluation Manual, OSWER Directive 9285.4-1, October 1986, Appendix 4-8. The current lifetime drinking water health advisory level for MEK is 200 ug/l. This level was also obtained from the Office of Drinking Water.

Appendix 2, Comment 4

It is unclear how the distinction between applicable and relevant and appropriate is made in the FS presentation of chemical specific ARARs in Appendix 3. For example, why are the SDWA MCLs for carbon tetrachloride, 1,2 dichloroethane, 1,1 dichloroethene, trichloroethene, 1,1,1 trichloroethane considered relevant and appropriate and not applicable? Also, since Rocky Flats Plant is a RCRA facility, the groundwater protection standards are applicable. The groundwater protection standards are background, MCLs (as specified in 40 CFR 264.94) or ACLs (alternate concentration limits) proposed by the facility. Since volatile organics are not listed in Table 1 of 40 CFR 264.94, the ARAR for organics should be background, i.e., 0.0 ppb. The ARAR for volatile organics would therefore not be met for any volatile compound detected in the groundwater. The FS presentation of chemical specific ARAR should utilize a column of RCRA background under the potential ARAR requirements. This would make the screening results more clear.

Response to Appendix 2, Comment 4

The SDWA MCLs were determined to be relevant and appropriate for certain volatile organics based on our interpretation that the alluvial groundwater on the 881 hillside is not used directly as a public drinking water source. It could be argued, based on RI data, that contaminated alluvial groundwater from the 881 hillside discharges to Woman Creek which in turn discharges to Standley Lake, and that this represents direct connection to a public drinking water source. However, our approach to the identification of ARARs was based on RI data that revealed that volatile organic contamination is not evident in Woman Creek and therefore does not directly impact Standley Lake. The fact that potential pathways exist for contamination of Standley Lake by volatile organics led us to conclude that the SDWA MCLs are not directly applicable, but are sufficiently similar, in this case, that their use is relevant and appropriate. The determination that the SDWA MCLs are relevant and appropriate instead of applicable does not affect the conclusion that SDWA MCLs are ARAR.

Because hazardous wastes were not received at the 881 Hillside after July 26, 1982, the SWMUs on the hillside are not regulated units and therefore are subject only to Subpart F Part 264.101. Based on this interpretation, the RCRA groundwater protection standards are not directly applicable to the 881 Hillside but the circumstances are such that their use would be relevant and appropriate. Note that we have set our performance goals for remediation as background concentrations for organics: and RCRA MCLs or background for metals pursuant to these ARARs.

We agree that a column that includes RCRA background would make the screening results more clear.

Appendix 2, Comment 5

All of the volatile organics detected in the groundwater should be evaluated in the chemical specific ARAR analysis. This includes 2-butanone and acetone in addition to the volatiles already evaluated. The SDWA MCL for chloroform is 100 ppb if no other trihalomethanes are present in significant concentrations in the groundwater.

Response to Appendix 2, Comment 5

Acetone and 2-butanone (also known as methyl ethyl ketone) are evaluated in the screening of chemical specific ARARs found in Appendix 2.

Appendix 2, Comment 6

Why is the ambient water quality criteria for t-1,2 dichloroethene not protective of human health? Are CDH agricultural groundwater standards published or proposed for organic chemicals, conventional pollutants and the radionuclides presented?

Response to Appendix 2, Comment 6

We were mistaken in stating that the Federal Ambient Water Quality Criteria are not protective of human health. However, because the criterion for t-1,2 dichloroethene of 11,000 ug/l is so much higher than the CDH proposed surface and groundwater standards of 0.033 and 0.03, respectively, we opted to use the CDH proposed standards as the potential ARAR.

CDH agricultural standards are published in the State's Basic Standards and Methodologies under 5 CCR 1002-8, Section 3.11.5. Standards are set for most of the conventional pollutants and radionuclides presented in the chemical specific screening tables. Standards are also set for organics listed in EPA's list of Primary Drinking Water Standards.

CDH has developed proposed standards for the volatile organic compounds listed in the organics section of the screening tables. These standards were prepared as amendments to the existing Basic Standards and Methodologies and were released for public comment in November, 1987. Because the proposed standards are all as stringent as, or more stringent than SDWA MCLs for these compounds, they were retained as "To be Considered" in the ARAR analysis.

Appendix 2, Comment 7

Section 121(d)(2)(a) of CERCLA states that MCLGs can be relevant and appropriate, and are not limited to being considered. DOE and Rockwell need to explain why MCLGs are relevant and appropriate "under the circumstances of the release or threatened release".

Response to Appendix 2, Comment 7

We concur with your assessment that the use of MCLGs may be relevant and appropriate under the circumstances existing at the 881 hillside. Section 121(d) of CERCLA as amended by SARA suggests that MCLGs may be appropriate under certain circumstances of the release or threatened release of hazardous substances. This is reinforced in EPA's document entitled, Draft CERCLA Compliance with Other Laws Manual, Volume II, June 1987, that identifies the special circumstances where MCLGs should be considered as ARAR. These circumstances are where there are multiple contaminants in groundwater, or where multiple pathways of exposure present extraordinary risks. According to the guidance document, the use of MCLGs should be determined on a site-specific basis in consultation with EPA headquarters.

Appendix 2, Comment 8

Comment number 2 above is applicable to the metals analysis of ARARs. The RCRA groundwater protection standards are applicable. Background would be the applicable RCRA requirement in the case that the contaminant MCL is not listed in Table 1 of 40 CFR 264.94 or background is higher than the MCL listed in Table 1. Thus unless the CDH groundwater standard, CDH water quality limited standard or MCLG is more stringent than the background requirement, the RCRA background requirements must be the level of protection for remediation in the case that an MCL listed in Table 1 is not applicable. The ARAR analysis should address the Federal ambient water quality criteria proposed and published for metals.

Response to Appendix 2, Comment 8

The response to comment 4 addresses most of this comment. During preparation of the chemical specific ARARs screening table, it became evident that CDH water quality limited standards for metals are more stringent than Federal Ambient Water Quality Criteria. Revisions to the FS will contain a column for Federal Ambient Water Quality Criteria as aid in comparison between other potential ARARs.

Appendix 2, Comment 9

When the MCLs, etc., have not been exceeded, and the constituent is within or below the background range, then the remediation need not address the specific constituent, provided the concentration present does not pose an unacceptable risk.

Response to Appendix 2, Comment 9

This is also our understanding of the application of ARARs to CERCLA actions, and the objectives and scope of remedial actions.

Appendix 2, Comment 10

Why is the CDH water quality limited standard for cadmium not applicable? How was it determined that the CDH human health standard for chromium, lead, manganese, mercury, silver and copper is applicable and not the CDH water quality limited standard? Why is

strontium not considered in the chemical specific ARARs analysis? Why is background proposed as the GWPS for chromium VI when a RCRA MCL is applicable?

Response to Appendix 2, Comment 10

During the preparation of the FS the CDH water quality limited standards were not considered applicable for the metals indicated because the recommended remedial alternative did not involve direct discharge to surface water. Considering that 881 hillside alluvial groundwater discharges to Woman Creek, we agree that the more stringent water quality limited standards should be retained as the ARAR for the metals that have CDH water quality limited standards.

Appendix 2, Comment 11

The published lifetime health advisories for nickel, cadmium and lead are 0.150 mg/l, 0.005 mg/l, 0.020 mg/l, 10.0 mg/l and 1.0 mg/l respectively. These are less than the CDH groundwater standards for agriculture and human health, which are proposed in the FS as applicable.

Response to Appendix 2, Comment 11

These health advisories will be considered in the ARAR analysis but they would not be ARAR in the event a more stringent promulgated health based standard is available. Note the response to Comment 10 states that CDH groundwater standards for human health and agriculture were considered ARAR because the proposed remedial action involved direct discharge to groundwater. The more stringent CDH water quality limited standards will be incorporated into revisions of the FS and will likely be the ARARs selected.

Appendix 2, Comment 12

The November, 1985 proposed MCLGs for arsenic, chromium, lead, nitrate and nitrite are 0.05 mg/l, 0.12 mg/l, 0.020 mg/l, 10.0 mg/l and 1.0 mg/l respectively. It should be noted that these were proposed in November of 1985 and new proposals are anticipated.

Response to Appendix 2, Comment 12

These proposed MCLGs are noted and will be incorporated into FS revisions

Appendix 2, Comment 13

Are the CDH groundwater standards presented in the conventional pollutants analysis for human health or agriculture? There is a SDWA MCL for nitrate equal to 10 mg/l as nitrogen. Total coliform should be considered in the ARAR analysis as this is what the standard addresses. How will the analytes which have not been measured be evaluated, i.e., coliform, dissolved oxygen, ammonia, sulfide and free cyanide?

Response to Appendix 2, Comment 13

The CDH groundwater standards presented in the conventional pollutant analysis are either human health or agricultural standards. The parameters listed do not necessarily have both an agricultural standard and a human health standard. If the parameter has both an agricultural and a human health standard the more restrictive standard was presented as the potential ARAR. If the parameter has only one standard, that standard was presented as the potential ARAR.

We overlooked the nitrate SDWA MCL and will include this in the revised ARAR analysis. Note, however, that the CDH groundwater and water quality limited standard for nitrate is also 10 mg/l as nitrogen and would therefore not affect the results of the ARAR analysis.

Conventional pollutants that were not measured were included in the ARAR screening tables as a matter of completeness; however, we have no basis for concluding that these parameters are of concern at the 881 hillside. To determine if the potential ARARs (CDH water quality limited and groundwater standards) for these parameters are exceeded, analyses will be run on a one time basis.

Appendix 2, Comment 14

How will the proposed remedial alternative affect the temperature of the aquifer (i.e., will there be a temperature increase associated after reinjection)? Will pH be affected by the remediation? These considerations must be analyzed prior to dismissing the requirement in light of the proposed remedial alternative.

Response to Appendix 2, Comment 14

The mean values for pH and temperature for the alluvial groundwater do not exceed the acceptable ranges identified in the ARAR screening tables. The fact that these values do not exceed ARARs and were not identified as a concern does not imply that we are dismissing these parameters during remediation. pH and temperature controls will be maintained to monitor treatment processes, and will be mandatory under the substantive requirements of an UIC or NPDES permit.

Appendix 2, Comment 15

If the geometric mean for gross alpha measured at the 881 Hillside includes uranium and radon, then numbers cannot be compared to the SDWA MCL. Why is the SDWA MCL for gross beta relevant and appropriate and not applicable? The MCL indicated in the FS for gross beta is 50 pCi/l. This is incorrect. 40 CFR 141.16 establishes the MCL for beta particle and photon radioactivity from man-made radionuclides at a total annual dose not greater than 4 millirem/year. If two or more radionuclides are present, the sum of their annual dose equivalent to the body or to any organ shall not exceed 4 millirem/year.

Response to Appendix 2, Comment 15

Radon measurements will be incorporated into the analytical program. Together with

isotopic uranium analysis, this will allow calculation of a gross alpha level that can be compared to existing standards for gross alpha.

The SDWA MCL for gross beta was determined to be relevant and appropriate because the groundwater on the 881 hillside is not used directly as a drinking water source. As you correctly point out, in the final analysis this value is moot in light of the MCLs established under 40 CFR Part 141.16. To determine if the 4 mrem/yr annual dose equivalent limit is met, a ratio of the mean concentration of the man-made radionuclides to the MCL listed for that radionuclide is calculated. The sum of the ratios should be less than or equal to one. In this case, for Plutonium-239,240, Americium-241, Strontium-89,90, and tritium, the sum of the ratios of average concentrations to MCLs is:

$$0.44/40 + 0.46/4 + 122/90{,}000 + 1.64/8 = 0.33$$

The 4 mrem/yr annual dose equivalent limit is met. This analysis will be included in ARAR revisions.

Appendix 2, Comment 16

40 pCi/l can be considered an MCL for Pu239 only if Pu239 is the only beta/photon emitter present. This same comment is applicable to the Am241, tritium, Cs137 and strontium 90 SDWA MCLs. Why are Cs134, Ra226/Ra228 and Th230/Th232 addressed in the ARAR analysis? Should the radioactive analysis for groundwater at 881 Hillside include the entire "laundry list" of man-made radionuclides? Justification for the analyses proposed should be made. Again, the SDWA MCL for cesium is only appropriate if it is the only man-made beta/photon emitter present. The correct MCL is the total of combined Ra226 and Ra228 not to exceed 5 pCi/l. There is a 1983 health advisory for uranium setting a limit on chronic exposure to 10 pCi/l. The analysis of ARAR for beta/photon emitters at the 881 Hillside should consider the maximum concentrations detected and cumulatively evaluate the level in light of the 4 millirem/year dose equivalent. Why has the ARARs analysis not evaluated the CDH soil standard of 2 dpm/gm?

Response to Appendix 2, Comment 16

The response to the comment on the MCL for plutonium is addressed in the response to comment 15. The radioactive chemical specific ARARs analysis included cesium, radium and thorium isotopes as a matter of completeness and to present the CDH standards for these isotopes. Because there is no basis for including these elements in a evaluation of ARARs at the 881 hillside they will be excluded in the FS revisions.

Our response to comment 1 of this section addresses the comment relating to the use of the maximum concentrations of radionuclides detected when calculating the 4 mrem dose equivalent.

The 1983 health advisory level for uranium of 10 pCi/l will be included in the ARAR analysis in revisions to the FS.

The CDH soil standard of 2 dpm/gm will be addressed in the revised chemical specific and action-specific ARAR analysis.

ACTION SPECIFIC ARARs ANALYSIS

Comment 1

It would be helpful to separate the action specific ARARs analysis into those dealing with the soils and those dealing with groundwater.

Response to Comment 1

We agree that the preparation of action specific ARARs for both groundwater and soils would provide more clarity.

Comment 2

Considering the interconnection between the alluvial groundwater and the surface water flow in Woman Creek, direct groundwater discharge of treatment system effluent should be considered in the ARAR analysis. Which contaminants may not be controlled to levels required by in-stream standards due to limitations of Best Available Tcchnology?

Response to Comment 2

The action-specific ARARs associated with direct groundwater discharge of treatment system effluent are identified in the section on Underground Injection of Wastes and Treated Groundwater in Appendix 2. Many of the CDH water quality limited standards for metals are set at levels below those that would be achievable by Best Available Technologies (BAT).

Comment 3

Why are the RCRA requirements not applicable for hazardous waste injection wells (40 CFR 144.16)?

Response to Comment 3

The RCRA requirements for hazardous waste injection wells are not applicable because contaminated groundwater from the 881 hillside is not RCRA hazardous waste (SWMUs on the hillside are not regulated units). At best, the RCRA requirements are relevant and appropriate and should have been identified as such in the action specific ARAR analysis.

Comment 4

Why are the RCRA requirements for treatment of storage in tanks and storage in containers relevant and appropriate and not applicable?

Response to Comment 4

The RCRA requirements for storage and treatment of hazardous waste in containers and tanks is relevant and appropriate because contaminated groundwater from the 881 hillside is not hazardous waste (SWMUs are not regulated units).

Comment 5

EPA's off-site policy, codified in SARA section 121(d)(3), should be considered for off-site treatment, storage or disposal.

Response to Comment 5

EPA's off-site policy is addressed in the action specific ARARs screening table section of Appendix 2, entitled Off-Site Treatment, Storage or Disposal.

Comment 6

The RCRA disposal requirements are applicable for current disposal. The chart should state that the disposal requirements are both applicable and relevant and appropriate considering the past and present releases associated with the 881 Hillside. The detection monitoring program is applicable, but has been complied with.

Response to Comment 6

We don't understand your interpretation that RCRA disposal requirements are applicable in light of the fact that there is no current disposal of hazardous wastes at the 881 hillside, nor are there any activities that would constitute disposal proposed under the preferred remedial alternative. EPA's Draft CERCLA Compliance With Other Laws Manual, June 1987 is quite clear on the definition of activities that constitute disposal. The manual states: "EPA has determined that placement triggering the land disposal requirements occurs when disposal occurs. Thus, for placement to occur, the waste must be picked up and moved across the boundary of a unit or an area of contamination in which it was originally located."

The comment that the action-specific ARARs should indicate that the disposal requirements under RCRA are both applicable and relevant and appropriate considering the past and present releases associated with the 881 hillside is incorrect. Present releases from SWMUs should not be equated with current disposal of hazardous waste.

The only applicable RCRA requirements relating to releases from "non-regulated" SWMUs are found in 40 CFR Part 264.90 (a)(1),(2) and 264.101. We have considered the remaining Subpart F requirements to be relevant and appropriate considering the circumstances of the release. These requirements involve the initiation of a corrective action program and compliance and detection monitoring which are currently being implemented.

LOCATION SPECIFIC ARARs ANALYSIS

Comment 1

If the wastes associated with the 881 Hillside are hazardous and subsequently treated or disposed, then the siting requirements would be applicable, not relevant and appropriate.

Response to Comment 1

Siting requirements would be applicable if groundwater and soils are defined as hazardous waste.

REFERENCES

U.S. EPA, 1986. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, D.C.