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May 15, 1997

RE: DOE FEMP
COMMENTS: DRAFT FINAL
BRSR FOR THE ARP
APPROVAL: RAWP FOR ARP

Mr. Johnny Reising
U.S. Department of Energy, Fernald Area Office
P.O. Box 538705
Cincinnati, OH 45253-8705

Dear Mr. Reising:

This letter provides as an attachment Ohio Environmental Protection Agency comments on the draft final Baseline Remedial Strategy Report for the Aquifer Restoration Project. This letter also serves as Ohio EPA approval of the Remedial Action Work Plan for the Aquifer Restoration Project.

If you have any questions, please contact Tom Ontko or me.

Sincerely,

Tom Ontko

for Thomas A. Schneider
Fernald Project Manager
Office of Federal Facilities Oversight

cc: Jim Saric, U.S. EPA
Terry Hagen, FERMCO
Ruth Vandergrift, ODH
Mike Proffitt, DD&GW
Bob Geiger, PRC
Manager, TPSS/DERR, CO
Dave Ward, GeoTrans

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Ohio Environmental Protection Agency Comments on the draft final
Baseline Remedial Strategy Report for the Aquifer Restoration Project

General Comments

- 1) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section#: Pg. #: Line #: Code: C
Comment: The chemical processes active at the site are more complicated than can be described through a Kd approach, which assumes a linear isotherm and equilibrium. It is very likely that neither of these assumptions are met. Using the Kd approach to provide a retardation mechanism for modeling the migration of a plume from a source is commonly done. However, the applicability of this approach for evaluating removal of contamination is very questionable, because of the different modes of occurrence of a contaminant in the solid phase. The contaminant may be present as a precipitate, sorbed to several different substrates, or through different bonding mechanisms. It may also be present in the aqueous phase, but in low-permeability material. Its removal from the system would then be controlled by aqueous diffusion rather than through advection. For these reasons, we consider that use of the model to support the present decision to pursue a more active remediation of the system is appropriate, but that other potential uses of the model would require a reanalysis of the appropriateness of the model.
- 2) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section#: Pg. #: Line #: Code: C
Comment: The data on the behavior of the system during the remediation process should be collected to support future refinement of the model if modeling is to be used to support future decisions. It may be appropriate to designate a portion of the system for detailed data collection. Data on both contaminants and general inorganic chemistry need to be collected. Monitor wells at several points within the flow field should be installed to avoid the ambiguities that will result from mixing of waters of differing chemistries in extraction wells.
- 3) Commenting Organization: OEPA Commentor: OFFO
Section#: 3.1 Pg. #: 3-1 Line #: 24 Code: C
Comment: The Ohio EPA agrees that the Operable Unit 5 ROD requires that remediation of the GMA is to continue until groundwater concentrations are below the FRLs although we believe that it is premature to mention a technical impracticability waiver. Considering the difficult and lengthy discussions held in regards to the soil certification process, we do not feel that it is too early to begin thinking through the process that will be used to verify the attainment of aquifer FRLs. We would like to begin the discussions now with some initial thoughts that will need to be considered.
- The OU 5 ROD states that the remedy will "extract[ion] of contaminated groundwater until such time as final remedial levels are attained at all points in the impacted areas of the Great Miami Aquifer." This implies the development of a network of "attainment

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verification" monitoring wells that would be used in conjunction with the system of extraction wells to evaluate the attainment of the FRLs. The use of the phrase "at *all* points" (emphasis added) is unambiguous but for practical reasons only a limited number of verification points will be possible.

- A "toolbox" of statistical methods to evaluate the data and a set of statistical confidence intervals that both give the regulators confidence in the attainment while at the same time being realistically attainable for DOE.
- Provisions to monitor for rebound effects for a period of years after pumping has stopped in a given module. The costs associated with this monitoring and also the costs associated with keeping the pump and treat infrastructure in place while waiting to evaluate whether rebound is occurring should be considered. Some of the literature indicates that five years is necessary to confidently eliminate rebound as a concern.

Specific Comments

- 4) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 1.3.2 Pg. #:1-8 Line #: 1-3 Code: C
 Comment: Only linear, equilibrium sorption has been evaluated rigorously in the sensitivity analysis using the newly delineated plume. Effects of hydraulic properties of the aquifer and other geochemical processes (ionic effects, etc.) have not been quantified for the most recent model runs; wording in this section should reflect that.
- 5) Commenting Organization: Ohio EPA Commentor: DDAGW
 Section #: 3.1.5, 5.2.1.3 Pg #: 3-4, 5-13 Line #: 24-25, 24-28 Code:
 Original Comment #: 32
 Comment: It is important to acknowledge that resource damage liabilities are an issue, however, it is not appropriate to interpret the State of Ohio groundwater antidegradation requirements in this document. This legal issue will have to be worked out between the appropriate representatives from US EPA, Ohio EPA and DOE in the future. Ohio EPA is not willing to accept DOE's interpretations at this time without the involvement of all appropriate parties. Lines 24-28, page 5-13, section 5.2.1.3 should be removed from the document.
- 6) Commenting Organization: Ohio EPA Commentor: DDAGW
 Section #: 3.2 Pg #: 3-6 Line #: 14-17 Code:
 Original Comment #: 35
 Comment: "Incorporate lessons learned through the operation of the South Plume Extraction System..." is very vague. DOE needs to specify that they will actively investigate alternative well/system designs, then implement these changes.

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- 7) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 3.3.2 Pg. #:3-7 Line #: 23-24 Code: C
 Comment: The reduction in iron content due to proposed treatment processes should be quantified. This may be particularly important in describing the long-term efficiency of injecting water into the aquifer and the impact of iron bacteria.
- 8) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 3.4.4 Pg. #:3-11 Line #: 6-28 Code: C
 Comment: The conceptual model of sorption/desorption processes described in this section and in Appendix A needs to be reflective of the current understanding of these processes. Further, this description mixes up the concepts of nonlinear sorption and time-dependent sorption. DOE has correctly identified that simple linear isotherm models typically do not fit observed contaminant behavior in aquifer systems (Line # 11). However, the issue of reversibility of sorption with time is not pertinent to the site conditions; the kinetics of uranium desorption may likely be faster than groundwater flow rate pas the aquifer media. It may be safe to assume that the contaminants have been in the aquifer system long enough to have established an equilibrium over the years.

The anticipated change in desorption behavior of uranium during remediation would actually be concentration-dependent, and not exactly time-dependent (time dependency in only secondary since concentration is decreasing with time). The approach adopted by DOE deals with this change in desorption behavior as separate linear isotherms in two time segments: (a) an early phase with high contaminant concentrations in water and relatively weak sorption ($K_d=1.78$ L/kg), and (b) a later phase with low contaminant concentrations in water and strong sorption ($K_d=17.8$ L/kg). These two phases are schematically shown as linear segments in Figure 1. However, the concentration-dependent sorption behavior is continuously changing with reducing uranium concentration. (also see comments on Appendix A)

A mathematically rigorous approach for modeling continuously changing sorption behavior is to use a nonlinear isotherm, such as the Freundlich isotherm (Freeze and Cherry, 1979; Schwarzenbach, 1993). Instead of using the two sorption regimes (represented by the two K_d values corresponding to only two points on a curve), a continuous mathematical function describes the entire range of sorption behavior expected during the plume recovery, as shown in Figure 1. Available groundwater flow and transport models (e.g., SWIFT, FTWORK) provide the capability of utilizing the Freundlich isotherm. The two parameters required for the Freundlich isotherm (K, n) can be estimated from the Feasibility Study batch sorption data (DOE, 1995). Alternatively, these parameter values for a wide range of contaminants are available in the literature.

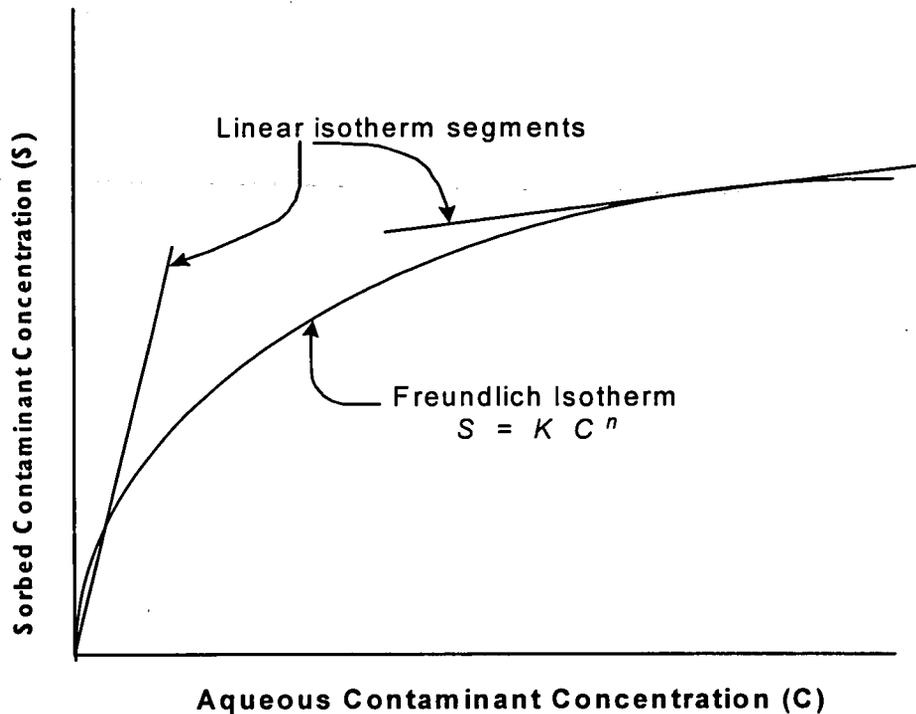


Figure 1. Concepts of contaminant sorption onto aquifer media.

Because the effect of sorption on duration of cleanup to FRL has been shown to be very significant, DOE should consider using Freundlich isotherm for more realistic predictions. This approach will simplify the modeling procedures used in the BRSR (Appendix A) and reduce overall uncertainty, particularly the uncertainty associated with guessing the appropriate time for switching from one K_d regime to another.

- 9) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 4.1.2 Pg. #:4-3 Line #: 1-7 Code: C
 Comment: The discussion on geochemical processes should also focus on nonlinear sorption parameters (see comments on Section 3.4.4)
- 10) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 4.2.1 Pg. #:4-4 Line #: 27-31 Code: C
 Comment: The K_d transition results in a sudden decrease in aqueous concentrations of uranium in model predictions, resulting in a duration for cleanup to FRL of about one year after the transition. The duration for overall cleanup may be significantly different when a nonlinear sorption behavior is modeled.

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- 11) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 4.2.3.3 Pg. #:4-12 Line #: 10-16 Code: C
 Comment: A comparison of uranium mass removal in Tables 4-2, 4-4, 4-6, and 4-8 shows that mass removal becomes asymptotic only after a 10-yr operation in the 15-year scenario. All other scenarios show that uranium removal is still significant at completion of the scenario. This has implications for efficiency of each scenario in achieving FRL, and therefore, the relative mass removal under each scenario should be discussed as a subsection in Section 4.3. Further, the implications for a recurrence of concentrations above FRL should also be evaluated.
- 12) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4 Pg. #: 4-26 Line #: 31 Code: E
 Comment: The sentence referenced in the indicated text is incomplete.
- 13) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4 Pg. #: 4-28 Line #: 2 Code: E
 Comment: The referenced text is out of order; it appears to be a continuation of the sentence starting on Line 31 of Page 4-26.
- 14) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4 Pg. #: 4-33 Line #: 23 Code: C
 Comment: The attainment of the intended capture zones during remediation should be verified with water level data collected from the site monitoring well network. A figure should be provided showing the wells used for this purpose and the predicted capture zone.
- 15) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 5.1.1 Pg. #:5-2 Line #: 20-26 Code: C
 Comment: Because significant differences were observed between the maximum plume and currently-measured plume, the same plume (i.e., the most recent plume) should have been used in all simulations. The only exception may be the simulation runs performed for particle tracking purposes.
- 16) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 5.1.1 Pg. #:5-3 Figure #: 5-1 Code: C
 Comment: The figure is very hard to comprehend in terms of separately visualizing the kriged plume and the synthetic maximum plume. A better presentation should be presented.

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- 17) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 5.2.1 Pg. #:5-9 Line #: 4 Code: C
 Comment: Off-property cleanup times may change for the different scenarios when nonlinear sorption is used.
- 18) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 5.2.1.3 Pg. #:5-13 Line #: 30-35 Code: C
 Comment: Because the property owner has agreed to locating wells 1, 2N and 3N along the property boundary, and since such well locations have shown promising results, the discussion of RCRA regulations does not appear pertinent.
- 19) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 5 Pg. #: 5-38 Line #: Code: C
 Comment: The text indicates that adjustments to extraction and injection well pumping rates may be required through the course of the remediation because of wastewater plant treatment capacity reductions resulting from temporary storm water influxes and remediation wastewater needs. What is the anticipated duration of reduced capacity? The text also indicates that computer modeling will be used to determine the optimal pumping rates to meet the reduced flow requirement. Please provide additional detail regarding the implementation of this process. Will the model runs be conducted a priori for anticipated flow reductions or when the actual amount of the reduction is known?
- 20) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 5 Pg. #: 5-38 Line #: Code: C
 Comment: A comparison of the maximum sampling depth at each geoprobe location to the estimated top of bedrock should be provided for each geoprobe location. The comparison of these two depths will enable the assessment of the thickness of unsampled aquifer at each geoprobe location.
- 21) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: 5.4.4.3 Pg. #:5-39 Line #: 12-18 Code: C
 Comment: Model simulations using the Insufficient Treatment Performance Mode should be performed to estimate its potential effect on duration for complete remediation. Such simulations should be a part of the sensitivity analysis in Appendix F.
- 22) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 5 Pg. #: 5-40 Line #: 12 Code: C
 Comment: A summary of data collection during operation of the groundwater remedy should

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be provided. The statistical approach for evaluating these data should also be summarized. The text should also refer the reader to a detailed discussion of the statistical approach that should be provided in the Integrated Environmental Monitoring Plan (IEMP).

- 23) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: A.2.0 Pg. #:A-2 Line #: 19-21 Code: C
 Comment: The alternative view provided by Freundlich-type isotherm concept is that as contaminant concentration (and mass) in the system decreases, desorption becomes relatively more "difficult." (See comments on Section 3.4.4)
- 24) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.2.0, A.4.0 Pg.#: A-2, A-4 Line #: 9-18, 32-12 Code: C
 Comment: The authors' theoretical arguments that: (1) the adsorption process is dominated by physical sorption, (2) desorption process is dominated by chemisorption, and (3) that a transition from physical sorption to chemisorption occurs upon aging is not supported by data at the site. The only reference to the scientific literature is to an early paper by Lasaga (1981), which only addressed physical sorption and chemisorption on general terms, and those on sorption mechanism of organic molecules. In light of the lack of any work, at the site or somewhere else, on uranium sorption mechanisms, these theoretical arguments are speculative. The discussion gives a misleading impression that an understanding of uranium sorption mechanism at the molecular level is reached. This part of the report should clearly acknowledge the lack of understanding of uranium sorption mechanism.
- 25) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.2.0, A.4.0 Pg.#: A-2, A-4 Line #: 9-18, 32-12 Code: C
 Comment: The authors also believe that uranium desorption is kinetically more inhibited than adsorption. Although this general concept is shared by some, from their experiences of bulk property measurements (Kd measurements) and field work, this concept is nevertheless unproven for the site. The comparison of adsorption Kd with desorption Kd cited in the report is not a good evidence for slow desorption kinetics. The "adsorption" Kd of 1.78 ml/g is a fitting parameter from the calibration of past uranium transport that resulted in the present plumes and/or from the lower end of the range of Kds calculated from paired soil and water samples. The "desorption" Kd of 17.8 ml/g was determined from linear regression of solid phase and liquid phase concentrations of uranium from the batch experiments in the laboratory. It should be noted that laboratory Kds seldom agree with field-based Kds. Typically, laboratory-measured Kds are higher than field-measured Kds. Differences such as soil-to-water ratios can result in Kd values that are different by

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orders of magnitudes. Therefore, the differences in the values of the two types of Kd may well be artifacts. It should be noted that a wide range of Kd values was determined in the batch experiments (from 7 to 1307).

The results of the sequential batch experiments on acid leaching of contaminated top soils are not good evidence for Kd transition either. These experimental conditions are significantly different from the conditions in the GMA on many fronts. In short, slower desorption kinetics is a reasonable, but unproven assumption.

- 26) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.3.2 Pg. #: A-4 Line #: 9-18 Code: C
 Comment: A discussion of FTWORK should also be included in "Simplified Models".
 Further, a comparative discussion of linear versus nonlinear sorption models is warranted, which should focus on implications of using these modeling approaches for predicting duration of remediation.
- 27) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.4.0 Pg. #: A-5-A-6 Line #: 26-23 Code: C
 Comment: With the assumption that adsorption and desorption kinetics are different at the site, the use of the "Kd transition" approach to modeling the different kinetics of adsorption and desorption processes is inherently inadequate, although it is understood that the modelers are limited by the modeling tools (SWIFT) available to them. The report should make clear that a Kd approach does not address the kinetics issue, and the "Kd transition" approach is a simplification of the chemical system that may be adequate for some purpose but not others. This distinction is made clearer in the BRSR report than in Appendix A. The weaknesses of the Kd transition approach is obvious. For example, these can include: (1) the assumption of instantaneous equilibrium between soil particles and groundwater, which contradicts with the underlying kinetic argument for desorption; (2) the abrupt redistribution of the mass at the transition; (3) the timing of the transition; and (4) the problems, which the authors discussed deftly in the Introduction, of using a Kd approach whether or not a transition occurs. As discussed elsewhere, the use of a nonlinear isotherm may be a better approach, but one that would still ignore kinetics.
- 28) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.4.2 Pg. #: A-7 Line #: 1-16 Code: C
 Comment: The value of 17.8 ml/g for the desorption Kd should not be regarded as a firm number. First, Kd is only a conditional parameter. It is a measurement of bulk properties under a set of specific laboratory conditions, which may well be different to field conditions. For example, the water-rock ratios, pH, and grain sizes can be different in

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laboratory and field.

Second, a wide range of Kds was measured from the experiments. The linear regression that generated the number of 17.8 ml/g shows a poor correlation among the data (a R² of 0.411). Third, there are some possible experimental flaws that might affect the results. During experiments, CO₂ may be degassed if the atmosphere was not controlled to maintain the CO₂ pressure. Groundwater taken from GMA has a partial CO₂ pressure of 10^{-1.7} atm (IT, 1996), which is significantly higher than the atmospheric CO₂ pressure of 10^{-3.5} atm. If degassing occurs, the solution pH would drift to higher values. Lower carbonate/bicarbonate concentrations and higher pH can both change uranium sorption behaviors. Research showed that uranium sorption onto clay and silica minerals is very sensitive to solution pH and carbonate contents (e.g., Lupkowski and Pabalan, 1994).

- 29) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.4.0 Pg.#: A-6 Line #: 4-12 Code: C
 Comment: The lack of kinetic considerations of the uranium transport in the model is a major omission of the transport model. Metal concentration rebound is commonly observed in many pump-and-treat systems. If desorption is kinetically inhibited, uranium can continue to be released from the soil surfaces after active remediation ceases, causing an increase in dissolved uranium concentrations. Rebound issues should be addressed prior to decision to end active remediation.
- 30) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.4.1 Pg.#: A-6 Line #: 25-35 Code: C
 Comment: Using a Kd of 1.78 ml/g to establish the solid phase inventory may lead to an underestimate of the inventory.
- 31) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.4.3 Pg.#: A-7 Line #: 18-27 Code: C
 Comment: The timing of the Kd transition, as the authors acknowledged, is highly uncertain. An area that may be worth more detailed work is the effects of changing the geochemical environment when pore waters are replaced with injected water of different chemistry. Studies have shown that uranium sorption onto clay minerals is strongly dependent on the solution pH, carbonate concentrations, and effective surface areas. The replacement of pore water by injection may change uranium sorption behavior so that "Kd transition" can occur but for different reasons. It may not be due to "aging".
- 32) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: A.4.2 Pg. #:A-7 Line #: 9-23 Code: C

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Comment: This discussion should be replaced by that for parameters of Freundlich isotherm, K and n .

- 33) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: A.5.0 Pg. #:A-8 Line #: 26-28 Code: C
 Comment: The modeling approach will be simplified considerably as a result of using a nonlinear isotherm. The two-stage approach adopted in BRSR will not be required and Steps 2 through 6 will be eliminated. It should be pointed out that this will also reduce the uncertainty associated with describing each individual plume, assigning the appropriate K_d value and guessing the time for transition from the first K_d regime to the second.
- 34) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: A.6.0 Pg. #: A-10 Line #: 7-19 Code: C
 Comment: Post-remediation rebound can also be a result of heterogeneity of the aquifer. The GMA is composed of glacial sand and gravel deposits. The diffusion of uranium from less permeable parts of the aquifer to more permeable parts of the aquifer, or out of limestone clasts, may contribute to the re-emergence of a contamination plume.
- 35) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: E.1.3 Pg. #:E-2 Line #: 17-19 Code: C
 Comment: The five simulations performed using DMEPP plume should be revised using the most current, grided plume to reflect a more realistic depiction of site conditions.
- 36) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: E.2.2 Pg. #:E-4 Line #: 38-42 Code: C
 Comment: The modeling results for Plume Expansion and Efficiency may be significantly different if the most current plume were used, because concentrations and spatial extent are greater for the new plume delineation.
- 37) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: E.3.2 Pg. #:E-6 Line #: 34-35 Code: C
 Comment: A more detailed discussion should be provided regarding the probable causes for the downward plume expansion when injection is performed at lower levels.
- 38) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: E.4.2 Pg. #:E-12 Line #: 3-5 Code: C
 Comment: The comment about "minor differences" does not sound reasonable considering the significant differences in plume shape as well as the highest concentration within

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plume segments.

- 39) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: E.4.3.1 Pg. #:E-15 Line #: 28-29 Code: C
 Comment: The conclusion about cleanup by FY 2004 may change when nonlinear sorption processes are used in model simulations.
- 40) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: E.4.3.3 Pg. #:E-17 Line #: 38 Code: C
 Comment: It is not obvious how the uranium plume was "very conservative", because it was based on actual GeoProbe data.
- 41) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section#: F.2.2 Pg. #:F-6 Line #: 26-29 Code: C
 Comment: This discussion of hydraulic parameters not significantly affecting cleanup time should be reflected in Section 1.3.2. It is obvious that only one parameter was evaluated in sensitivity analyses.
- 42) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: G Pg. #: G-2 Line #: 32 Code: C
 Comment: The highest Phase I uranium concentration was measured at 12192 (331 ug/L). Additional geoprobe sampling should be conducted east of this point or the text should include a discussion of any existing documenting the position of the plume's leading edge in this direction.
- 43) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: G Pg. #: G-3 Line #: 21-26 Code: E
 Comment: Geoprobe location identifiers should be made consistent with Figure G-1. For example, 1231, 1232, 1233, 1234, and 1230 should be revised to 12231, 12232, 12233, 12234, and 12230.
- 44) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: G Pg. #: G-4 Line #: 1 Code: E
 Comment: Revise location identifier 1231 to 12231.
- 45) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: G Pg. #: G-4 Line #: 14-24 Code: C
 Comment: Additional geoprobe sampling should be conducted to define the extent of the plume east of 12234 and 12235.

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- 46) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: G Pg. #: G-5 Line #: 32 Code: C
 Comment: Hydropunch data is used to define the leading edge of the plume at some locations. When was the hydropunch data collected and what justification exists that these data are reflective of current plume conditions?
- 47) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: G Pg. #: G-7 Line #: 7 Code: E
 Comment: The referenced text should be revised to read: "the cross section illustrates how the total uranium plume appears to be migrating..."
- 48) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: G Pg. #: G-8 Line #: 21 Code: C
 Comment: Homeowner well pumpage is stated to be impacting plume movement near well 12228. The maximum concentration at this point is 70 ug/L. Is the residential well used for potable supply? If so, does the threat of exposure to uranium contamination exist?
- 49) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4.2.5.1 Wellfield Pattern Page #: 4-22 Line #: 6 Code: C
 Comment: The 7.5 year scenario is described as including three horizontal wells in the south plume area installed using the Ranney method. However in Table 4-7 and Figure 4-4, only two horizontal wells are present in the south plume area. The costs seem to include the third well. What is the correct configuration? Were two or three wells included in the model used to calculate the cleanup period? Please address the discrepancy.
- 50) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4.3.2 Implementation Risk and Uncertainty Page #: 4-30 Code: M
 Comment: In this section, DOE has addressed uncertainty of success, or the causes of uncertainty for the groundwater remediation scenarios for OU5. This section needs to include a discussion of the uncertainty in the prediction of cleanup times for each given remediation scenario. What impact will this uncertainty have on the final selection? It should be noted that the shorter time frame scenarios are loaded with capital costs up front, and O&M costs are reduced due to the shortened operation time frame. What happens to the cost if the remediation is not complete in the predicted time frame of the remediation scenario? Two tables showing the costs of possible scenarios for the extension of the 10-year and 25-year scenarios are listed below.

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10-Year Scenario Cost Estimate Extended to 20-Year - 2.8%							
	Interest	2.8%					
	Cost Unit	\$500,000					
Capital Costs							
Item	Year	P/F	Relative Costs	Units	Cost Units	Costs	
Off-Property Vertical Extraction Well	3	0.92	2	4	7	\$3,681,973	
On-Property Vertical Extraction Well	3	0.92	1	9	8	\$4,142,220	
On-Property Vertical Extraction Well	8	0.802	1	21	17	\$8,418,687	
Vertical Injection Well	3	0.92	0.75	10	7	\$3,451,850	
Horizontal Extraction Well		1	5.25		0	\$0	
Ranney Well		1	8.75		0	\$0	
Ranney Well Add-On Section		1	5		0	\$0	
Capital Well Total					39	\$19,694,731	
Groundwater Treatment Expansion	3	0.92	7.5	1	7	\$3,451,850	
250-gpm Mobile Treatment		1	3		0	\$0	
Capital Treatment Total					7	\$3,451,850	
O&M Costs							
Item	From Year	To Year	P/A	Relative Cost	Units	Cost Units	Costs
O&M Vertical Extraction Well		0			0		
	0	2	1.919	0.07	4	1	\$268,664
	3	7	4.358	0.07	15	5	\$2,288,205
	8	10	2.34	0.07	32	5	\$2,621,269
	11	20	6.538	0.1	9	6	\$2,942,284
O&M Horizontal Extraction Well		0					
	0	2	1.919	0.14		0	\$0
	3	7	4.358	0.14		0	\$0
	8	10	2.34	0.14		0	\$0
O&M Vertical Injection Well		0					
	0	2	1.919	0.035		0	\$0
	3	7	4.358	0.035	5	1	\$381,367
	8	10	2.34	0.035	13	1	\$532,445
Well O&M Total						18	\$9,034,234
Groundwater Treatment	0	10	8.618	6	1	52	\$25,853,802
	11	20	6.538	8	1	52	\$26,153,632
Treatment Total						104	\$52,007,434
Groundwater Monitoring	0	10	8.618	2	1	17	\$8,617,934
	11	20	6.538	3	1	20	\$9,807,612
Monitoring Total						37	\$18,425,546
Grand Total						205	\$102,613,795

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25-Year Scenario Cost Estimate with Extended to 35-Year - 2.8%							
	Interest	2.8%					
	Cost Unit	\$500,000					
Capital Costs							
Item		Year	P/F	Relative	Units	Cost	Costs
				Costs		Units	
Off-Property Vertical Extraction Well		3	0.92	2	4	7	\$3,681,973
On-Property Vertical Extraction Well		3	0.92	1	9	8	\$4,142,220
On-Property Vertical Extraction Well		8	0.802	1	8	6	\$3,207,119
Vertical Injection Well		3	0.92	0.75	10	7	\$3,451,850
Horizontal Extraction Well			1	5.25		0	\$0
Ranney Well			1	8.75		0	\$0
Ranney Well Add-On Section			1	5		0	\$0
Capital Well Total						29	\$14,483,163
Groundwater Treatment Expansion		3	0.92	7.5	1	7	\$3,451,850
250-gpm Mobile Treatment		3	0.92	3	2	6	\$2,761,480
Capital Treatment Total						12	\$6,213,330
O&M Costs							
Item	From	To	P/A	Relative	Units	Cost	Costs
	Year	Year		Cost		Units	
O&M Vertical Extraction Well		0					
	0	2	1.919	0.07	4	1	\$268,664
	3	7	4.358	0.07	15	5	\$2,288,205
	8	10	2.34	0.07	23	4	\$1,884,037
	11	25	9.19	0.1	9	8	\$4,135,370
	26	35	4.321	0.1	2	1	\$432,091
O&M Horizontal Extraction Well		0					
	0	2	1.919	0.14		0	\$0
	3	7	4.358	0.14		0	\$0
	8	10	2.34	0.14		0	\$0
	11	25	9.19	0.2		0	\$0
	26	35	4.321	0.2		0	\$0
O&M Vertical Injection Well		0					
	0	2	1.919	0.035		0	\$0
	3	7	4.358	0.035	10	2	\$782,735
	8	10	2.34	0.035	10	1	\$409,573
	11	25	9.19	0.05	3	1	\$689,228
	26	35	4.321	0.05	2	0	\$216,046
Well O&M Total						22	\$11,085,950
Groundwater Treatment	0	10	8.618	6	1	52	\$25,853,802
	11	25	9.19	8	1	74	\$36,758,847
Treatment Total						125	\$62,612,649
Groundwater Monitoring	0	10	8.618	2	1	17	\$8,617,934
	11	35	13.51	3	1	41	\$20,265,934
Monitoring Total						58	\$28,883,868
Grand Total						247	\$123,278,959

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As can be seen on the tables, the total present worth cost of remediation if the 10-year scenario is extended by 10 years is essentially the cost of the 25-year scenario. The cost of extending the 25-year scenario by 10 years is only half that of extending the 10-year scenario by ten years. The object of this evaluation is to demonstrate that the cost advantage of the shorter term scenarios will diminish if the remediation is not completed within the estimated time frame. The uncertainty of the remediation time frame is important, and should be addressed in this section.

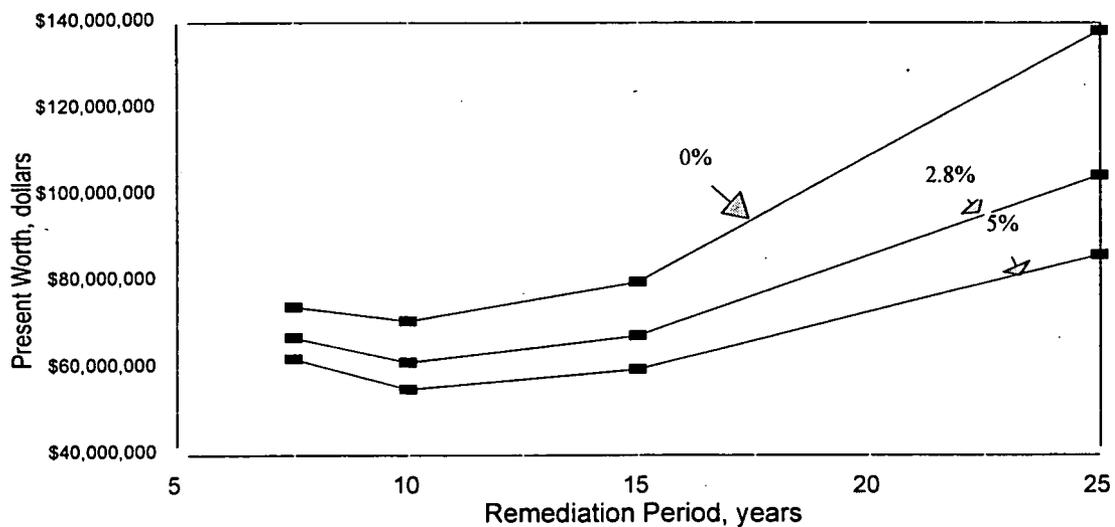
- 51) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4.3.1.2 Scenario-Specific Relative Cost Page #: 4-27 Line #: 4-6 Code: C
 Comment: When calculating the present worth cost of the four alternatives, the cost of wells installed in the future should be converted to present worth dollars. It appears the costs were assumed to be incurred at year 0. This does not change the outcome (10-year scenario is the most cost effective) of the cost comparison, however it does impact the long term scenarios more than the short term scenarios.
- 52) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4.3.2.2 Treatment Efficiency and Capacity Page #: 4-31 Code: C
 Comment: In costing the four remediation scenarios, it becomes apparent that the O&M costs of the groundwater treatment system are the largest cost items in all scenarios except for well installation in the 7.5-year scenario. The groundwater treatment system O&M costs account for 30% to 50% of the total present worth cost of the scenarios. Insufficient detail is given on how these cost estimates were made. The document should also contain or reference a discussion of the uncertainty of the O&M cost estimates.
- 53) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: 4.3.2.2 Treatment Efficiency and Capacity Page #: 4-31 Code: M
 Comment: The four remediation scenarios were evaluated with the intent of optimizing groundwater extraction and injection rates to determine the most cost effective scenario. To find the most cost effective alternative the groundwater treatment O&M costs (30% to 50% of the present worth cost of the alternatives) should also have been considered a variable to be optimized. It would seem that the assumption that groundwater treatment costs are independent of the flow rate is not appropriate. The cost estimate for each scenario should include an estimate of base cost items such as administration, labor, and facility maintenance, and then costs such as treatment chemicals and utilities calculated on a per unit flow rate

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basis. This level of detail is required to determine the most cost effective alternative.

- 54) Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
 Section #: Table 4-11 Summary of Present Worth Analysis Page #: 4-30 Code: C
 Comment: It would be better to present the data in Table 4-11 as a graph, similar to the one below. The data used in this graph are from the cost estimates we compiled using DOE's scenarios and unit costs, however we converted future costs to present

Comparison of Remediation Scenarios



costs for all wells installed in the future. From this graph, two things become apparent. The 10-year scenario is the most cost effective (as DOE has established) and secondly, the difference in present worth costs diminishes significantly as the discount rate changes from 0% to 5%. This should be discussed in the text.

Reference Cited

Department of Energy (1996) Phase II south field injection test report for operable unit 5.

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Appendix F Geochemical analysis and modeling of waters injected into the Great Miami Aquifer (IT, 1996).

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McBride, M.B. (1994) Environmental Chemistry and Soils. Oxford University Press, 406 p.

Sposito, G. (1990) Molecular models of ion adsorption on minerals surfaces. In Mineral-water interfaces geochemistry. M.F. Hochella, Jr. and A.F. White eds., Mineralogical Society of America, Washington, D.C., pp.61-279.

Stumm, W., and Morgan, J.J. (1996) Aquatic Chemistry --- Chemical equilibria and rates in natural waters. John Wiley & Sons, New York, 1022 p.

Thomas, K. (1987) Summary of sorption measurements performed with Yucca Mountain, Nevada, Tuff samples and water from J-13. Los Alamos National Laboratory, LA-10960-ms.