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RESPONSES TO U.S. EPA AND OEPA COMMENTS ON THE DRAFT BASELINE REMEDIAL STRATEGY REPORT REMEDIAL DESIGN FOR AQUIFER RESTORATION (TASK 1) FOR OCTOBER 1996

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

APRIL 1997

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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RESPONSES TO U.S. EPA COMMENTS ON THE DRAFT BASELINE REMEDIAL STRATEGY REPORT REMEDIAL DESIGN FOR AQUIFER RESTORATION (TASK 1) (OCTOBER 1996)

1. Commenting Organization: U.S. EPA Commentor: Saric
Section#: Not applicable (NA) Pg.#: NA Line#: NA Code:
Original General Comment# 1

Comment: The report states in several places that additional treatment capacity above the volume described in the Operable Unit (OU) 5 record of decision (ROD) is not required. However no language in the ROD precludes additional treatment capacity above the 2,350 gallons per minute specified in the ROD. The report should be amended to not preclude the option for additional treatment capacity.

Response: DOE agrees with the commentor that there is no language in the ROD that excludes the option for additional treatment.

Action: Language in the BRSR will be revised so as not to preclude the option for additional treatment capacity as indicated below.

In Section 3, page 3-10: delete the sentence which begins on line 23 and ends on line 25.

In Section 4.1.2, page 4-2, line 28: delete "expanded ... ROD," replace with "planned AWWT expansion,"

In Section 4.2.2.3, page 4-5, line 30: delete "described ... ROD" replace with "planned for the AWWT facility expansion"

In Section 4.2.2.4, page 4-9, line 15-16: delete " capacity ... ROD." replace with "planned AWWT expansion."

In Section 4.3.2.2, page 4-29, line 32: Add new sentence: "Alternatively, additional treatment capacity would need to be provided."

2. Commenting Organization: U.S. EPA Commentor: Saric
Section#: NA Pg.#: NA Line#: NA Code:
Original General Comment# 2

Comment: The report proposes natural attenuation of contaminants in some areas of the Great Miami Aquifer (GMA). Natural attenuation is an acceptable aquifer restoration option. However, it appears that attenuation in the GMA would be enhanced through dilution. Attenuation through dilution may not meet the intent of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) or the OU 5 ROD. The effect of natural attenuation without groundwater injection or a change in the desorption coefficient (K_d) should be discussed in the report.

Response: The intended effect of the proposed groundwater injection is to push the uranium plume toward the downgradient extraction wells. Although some degree of dilution will occur due to dispersion as the plume is moving toward the extraction wells, benefits of groundwater injection as designed (such as elimination of groundwater stagnation zones and increasing the velocity of contaminant migration and therefore reducing the time required to clean the aquifer) far outweigh the limited dilution effect. As a matter of fact, results of a case with an additional off-property injection well, simulated per EPA's request and presented in the revised Appendix E (Scenario B-1), shows a higher uranium mass removal rate from the off-property area than other cases without this injection well.

During the FS, the DOE looked at modeling scenarios that simulated no injection and no K_d transition. The FS modeling scenarios though did not include the South Plume Optimization Wells. The October draft of the BRSR looked at a modeling scenario that did have the optimization wells without a K_d transition, but the effects of no injection were not modeled. No additional modeling without injection is planned. DOE has determined through the previous modeling that actual groundwater cleanup time may not be significantly shorter than 27 years if the proposed groundwater injection wells are not successfully operated and sufficiently maintained at the level that has been modeled for the aquifer remediation.

Action: The following text will be added Section F.4.1 of Appendix F.

It is also important to note that the cleanup time range discussed above assumes that the planned groundwater injection wells will be successfully operated and sufficiently maintained at the level simulated throughout the aquifer remediation. If this assumption does not materialize, the actual groundwater cleanup time may not be significantly shorter than the 27 years time frame estimated in the Operable Unit 5 FS. It is difficult to predict the possibility of long-term success for the groundwater injection operation. The full-scale Groundwater Injection Demonstration along the FEMP southern fence line to be conducted in 1998 will provide real data for re-evaluating long-term feasibility, operation and maintenance requirements, and effects of groundwater injection.

3. Commenting Organization: U.S. EPA Commentor: Saric
Section#: NA Pg.#: NA Line#: NA Code:
Original General Comment# 3

Comment: Section 4.3.1 of the report presents a comparison of the relative costs in terms of "cost units" for each of the four aquifer restoration scenarios. This type of cost comparison is typically conducted by completing a present worth analysis. A present worth analysis should be completed and presented in this report. The analysis should compare the two end-member components of the baseline groundwater remediation scenario; the minimum time which assume a change in K_d (from 7.8 to 17.8) and the maximum time that assumes no change in K_d (1.7 for the entire period) and the 27-year restoration scenario presented in the OU 5 feasibility study (FS) report.

Response: DOE agrees that the BRSR would be improved by the addition of a present worth analysis.

Action: DOE will add a present worth analysis to Section 4.3.1.2 of the BRSR. Table 4-11 will be a summary of the Present Worth Analysis for the 25 year, 15 year, 10 year and 7.5 years scenarios. Tables C-5 to C-7 in Appendix C will also provide present worth value information.

4. Commenting Organization: U.S. EPA Commentor: Saric
Section#: NA Pg.#: NA Line#: NA Code:
Original General Comment# 4

Comment: Section 5.1.2 on Page 5-7 states that unless the property owner agrees to the installation of wells 2N and KN, DOE will not pursue the matter further and will not install the wells. This issue is discussed in greater detail in Section 5.2, where the results of additional modeling studies are presented. These results indicate that natural attenuation is as effective as active pump-and-treat methods. However, natural attenuation relies on two major actions: (1) reinjection of groundwater at the upgradient edge of the plume, which may have a significant impact on contaminant attenuation, and (2) the change of the K_d value by a factor of 10, which enhances

contaminant attenuation. Because the effect of groundwater injection on enhancing contaminant attenuation is unknown and the actual "apparent" K_d value is also uncertain, the models should simulate Scenario II with no injection and no change in the K_d value to quantify the impacts both actions have on the proposed path. The results of the new modeling scenarios should be presented in the revised report.

Response: As a result of a series of conference calls and meetings between DOE, EPA, and OEPA in January and February 1997, a final list of the new modeling scenarios to be examined in the BRSR was developed. This process resulted in the identification of a series of short list scenarios for further evaluation and ultimate inclusion in the report. These new scenarios have been added to Appendix E and were used to identify the revised preferred scenario discussed in Section 5. The technical aspects of this comment are also related to Comment 2; please see response to Comment 2.

Action: Please see action for Comment 2.

5. Commenting Organization: U.S. EPA Commentor: Saric
Section#: NA Pg.#: NA Line#: NA Code:
Original General Comment# 5

Comment: Appendix A discusses the appropriate values for adsorption and desorption coefficients for uranium in aquifer soils underlying the facility. However, the report does not sufficiently explain the uncertainties associated with the specific values selected. The report should explain the uncertainties associated with selection of a specific value for each of these coefficients. For a site as large as FEMP, sorption coefficients are expected to vary widely throughout the site. One report states that sorption coefficients for uranium in GMA soils near the water table range from 17 to 273 liters per kilogram (L/Kg) (Sidle and Lee 1996). Because these coefficient values are uncertain, estimation of the time needed to cleanup the aquifer is expected to be difficult and uncertain.

Response: DOE also recognizes that estimating the time needed to cleanup the aquifer is difficult and uncertain, and the uncertainties noted by the commentor also make it difficult to assign exact start dates for the out-year restoration modules until some actual in-the-ground remedy performance information is collected from the operation of the near-term modules. Appendix F provides a summary of an uncertainty analysis which was conducted to assess this issue. The uncertainty analysis looks at adsorption and desorption coefficients. This process applied the same uncertainty to all modeling scenarios so that a fair comparison between scenarios could be made. The overall objective is to identify an acceptable accelerated remedy that has an acceptable likelihood of improving on the cleanup time of the remedy described in the ROD. It is recognized that the ROD remedy is built around conventional technologies and restoration concepts and the accelerated remedy attempts to take advantage of new technologies and restoration concepts that still require "prove-out-periods" in the field. DOE is willing to commit to the accelerated remedy presented in Section 5 as a means to gain a desired improvement in overall cleanup time. Shortening the long-term Operation and Maintenance costs of the remedy and the need for water treatment for a period that extends longer than what is needed for FEMP's other operable units (as discussed on Page 1-4 of the report) were primary motivations for pursuing the accelerated remedy.

Action: No revision to the BRSR required.

6. Commenting Organization: U.S. EPA Commentor: Saric
Section#: NA Pg.#: NA Line#: NA Code:
Original General Comment# 6

Comment: The primary objective of the baseline scenario is aquifer restoration. As discussed in

the general and specific comments here, the baseline scenario has significant uncertainty associated with it and may actually not restore the aquifer any faster than the feasibility study scenario. Containment should be added to the 10-year scenario objectives, which would involve installation of wells at the downgradient edges of the plumes where they will not interfere with source area remediation and then installation of wells in the source areas when appropriate. Duplication of effort would apparently not occur because most of the wells proposed under the feasibility study scenario (positioned at the downgradient edge of the plumes) are part of the 10-year scenario. The objectives and baseline scenario should be revised accordingly.

Response: DOE agrees that containment of the plume in the respective areas serviced by each of the modules is a fundamental goal along with the ultimate restoration of the area. This containment objective will be one of the competing objectives that needs to be factored in to assignment of the overall hydraulic budget that is available for restoration across the site, and the sequencing strategy to be employed in the application of that budget. This has and will continue to be considered in the setting of performance objectives for the modeling scenarios evaluated in the BRSR.

Action: Text will be added to section 3.2 to reemphasize that containment of the 20 μg/L total uranium plume is a competing performance objective along with the need for active restoration of the plume.

7. Commenting Organization: U.S. EPA Commentor: Saric
Section#: NA Pg.#: NA Line#: NA Code:
Original General Comment# 7

Comment: The extraction/injection schedule for the baseline remedial strategy presented in Table 5-1 appears to indicate a different schedule than the schedule presented in Table 3-1 of the "Remedial Design Work Plan for Remedial Actions At Operable Unit 5" (RDWP). Although Table 3-1 in the RDWP presents a schedule for remedial design deliverables, the time frame for well installation and commencement of extraction/injection activities as presented in Table 5-1 of this report appears later in the 10-year baseline scenario than anticipated. For example, the RDWP indicates that the Waste Storage Area Extraction Module Design (Task 7) will be submitted as a prefinal package on November 30, 2001. However, Table 5-1 in this report indicates that pumping these wells will not begin until 2004 to 2006, resulting in a 3- to 5-year lag time between finalization of design and commencement of system operation. DOE should submit a schedule that incorporates all milestones that are consistent with both the RDWP and the baseline remedial strategy report.

Response: The RA Work Plan, which is now being submitted concurrently with the BRSR, will contain a schedule that incorporates the latest milestones derived from the preferred remedy selected in the BRSR. Both documents will reflect the same information. The enforceable dates for the design of the restoration modules that are contained in the RD Work Plan remain in effect.

Action: No revision to the BRSR required.

8. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 1.4 Pg.#: 1-8 Line#: 36 Code:
Original Specific Comment# 1

Comment: The text states that if hydraulic impacts are as desired but no additional treatment capacity is available, then the only viable option is to extend cleanup times. Nothing in the ROD precludes adding additional treatment capacity to the system to achieve the desired cleanup time. The report should be revised to state that extending cleanup times or adding additional treatment capacity are both viable options under this

situation.

Response: DOE agrees with the commentor, as addressed in the response to Comment 1. However, the text noted by the commentor was referring to the hydraulic capacity of the aquifer (i.e., extraction capacity), not the capacity of treatment. The word "extraction" should have appeared in front of the word "capacity" at the line noted by the commentor as in the preceding bullet. All of the operating situations discussed in the bullets on page 1-8 assume that treatment capacity is not the limitation (i.e., the amounts of treatment agreed to between DOE, EPA, and OEPA have been made available and have been applied).

Action: Revise sentence on line 36, page 1-8 to read "....and no additional extraction capacity is available..."

9. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 3.1.4 Pg.#: 3-4 Line#: 10 Code:
Original Specific Comment# 2

Comment: The report states that South Plume Removal Action wells will be handled as a single unit and that the extracted groundwater would be treated or discharged depending on the combined concentration occurring in the South Plume force main. Because only two of the five South Plume Removal Action wells are extracting contaminated water, the resultant concentration in the force main will be diluted; therefore, this approach does not meet the intent of the ROD. The treatment or discharge decision should be based on wellhead concentrations for each wells. This approach was agreed upon in the "Project Specific Plan for the Installation of the South Field Extraction System."

Response: The treatment or discharge decision for the South Field Extraction System Module wells will be based, as planned, on wellhead concentrations for each well as presented in the Project Specific Plan for the Installation of the South Field Extraction System. However, as a result of the resolution of the off-property landowner access constraints that were affecting the South Plume Optimization Module wells, DOE, EPA and OEPA have agreed to connect the two currently planned South Plume Optimization Module wells into the existing South Plume discharge line as agreed to by the affected landowner. The two new wells will thus be combined with the discharge from the existing South Plume Removal Action wells. The resolution of this issue was discussed in a conference with the EPA and OEPA on April 1, 1997, and the resolution is described in the new "Foreword" section that has been added to the BRSR. The property owner has denied access for any additional discharge lines on his property.

Action: The resolution of this issue will be added to a new "Foreword" section of the BRSR that discusses the key changes between the draft and the draft final versions of the document.

10. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 3.2 Pg.#: 3-6 Line#: 5 Code:
Original Specific Comment# 3

Comment: The report states that monitoring data will be evaluated frequently to determine the effectiveness of the system or identify potential problems. The schedule in the Integrated Environmental Monitoring Program (IEMP) does not describe a schedule of sufficient frequency to conduct evaluations. A specific monitoring schedule should be added.

Response: DOE agrees that monitoring needs to be addressed. Text will be added to the BRSR to reference where the monitoring activities will be defined. Specific monitoring schedules for start-up activities will be provided in the O&M plan (and updated as needed to address out-year modules). The IEMP establishes monitoring schedules for

each module following start-up; any additional monitoring activities deemed appropriate for inclusion in the IEMP as a result of the start-up monitoring activities will be added to the IEMP through its formal updating and revision process.

Action: Text will be added to Section 5.4.6 of the BRSR that states the following;

"Details of the start-up monitoring activities will be provided in the Operations and Maintenance Plan for the Aquifer Restoration and Wastewater Treatment Projects (defined as Task 2 in the Operable Unit 5 Remedial Design Work Plan (DOE 1996) which is scheduled to be submitted to EPA and OEPA in July, 1997. Once conditions have stabilized, any modifications to the long-term groundwater monitoring approach arising from the start-up monitoring will be incorporated into the IEMP as necessary (see page 3-74 of the IEMP [DOE 1997]), as part of the formal IEMP 2-year revision process."

11. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 3.4.3 Pg.#: 3-10 Line#: 23 Code:
Original Specific Comment# 4

Comment: The report states that any cleanup scenario that requires incremental treatment capacity extends beyond the commitment for extended treatment capacity in the ROD. No language in the ROD precludes additional treatment capacity. This sentence and all other sentences that imply that additional treatment is going beyond ROD requirements should be deleted.

Response: Agree. This comment is covered by Comment #1.

Action: See DOE action to Comment #1.

12. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 3.4.4 Pg.#: 3-11 Line#: 2 through 4 Code:
Original Specific Comment# 5

Comment: The report refers to several studies that indicate that adsorption is not a reversible phenomenon as time increases. Most of the studies referred to were conducted with organic compounds such as polychlorinated biphenyls and polycyclic aromatic hydrocarbons. The report refers to isotherm studies it has conducted with GMA solids in Lines 29 and 30. It is not clear whether these studies indicate different characteristics for adsorption and desorption for uranium. If so, these studies should be referenced in the discussion. If the studies did not indicate different coefficient values for adsorption and desorption, then further justification for assuming that adsorption and desorption coefficients are different should be provided.

Response: The lower adsorption value was determined through modeling. Model calibration indicates that the lower adsorption value best defines the historical loading and current dimensions of the total uranium plume. Desorption batch tests provided data to support the higher desorption value. The results of the batch tests were presented in Appendix F of the Operable Unit 5 Feasibility Study Report.

Action: A reference will be added in Appendix F (Page F-5, line 20) of the Baseline Remedial Strategy Report for the desorption batch test results contained in Appendix F of the OU5 Feasibility Study.

13. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 3.4.4 Pg.#: 3-11 Line#: 10 Code:
Original Specific Comment# 6

Comment: The statement that groundwater concentration will stabilize below the contaminant's designated cleanup level requires further clarification. Further information to justify this statement should be provided in the report.

Response: This statement is an assumption and will be identified as one.
Action: Text will be added to the report so that the statement will read; "..it is assumed that groundwater concentrations will stabilize below the contaminants ....."

14. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 4.1.2 Pg.#: 4-2 Line#: 29 Code:
Original Specific Comment# 7
Comment: The report states that South Plume Removal Action wells will be handled as a single unit and that the extracted groundwater would be treated or discharged depending on the combined concentration occurring in the South Plume force main. Because only two of the five South Plume Removal Action wells are extracting contaminated water, the resultant concentration in the force main will be diluted; therefore, this approach does not meet the intent of the ROD. The decision to treat or discharge should be based on the well head. This approach was agreed upon in the "Project Specific Plan for the Installation of the South Field Extraction System," dated May 1995.
Response: This comment is identical to Comment #9, and concerns the off-property landowner access issues, which have now been satisfactorily resolved to permit proceeding with the South Plume Optimization Module. See response provided in Comment #9.
Action: See Comment #9.

15. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 4.2.1 Pg.#: 4-4 Line#: 20 Code:
Original Specific Comment# 8
Comment: The report states that it is expected that the feasibility study scenario restoration time will increase to over 30 years if the transition K_d value is employed as it is in the baseline scenario. It is apparent from this statement that this possibility was not modeled. In addition, it is not clear why employing the apparent K_d value would reduce the remediation time for all scenarios other than the feasibility study scenario. Additional information to support these assertions should be included in the report.
Response: DOE did not model the feasibility study scenario using a transition K_d. Well placement in the baseline scenario is more of a controlling factor on clean up time than K_d is. In the feasibility study scenario the extraction wells are positioned downgradient of the plume. In the baseline scenario some extraction wells are positioned within the plume making the travel distance to the wells much shorter and resulting in shorter clean up times.
Action: No revision to the BRSR required.

16. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 4.3.2.2 Pg.#: 4-29 Line#: 30 Code:
Original Specific Comment# 9
Comment: The report states that if the treatment capacity and/or efficiency are significantly lower than expected, the extraction rate may need to be reduced in order to maintain the required discharge concentration. The report should acknowledge that additional treatment capacity is also a viable option and is preferred to increasing aquifer restoration times.
Response: This comment is similar to Comment #1.
Action: See DOE action for Comment #1.

17. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 4.3.2.2 Pg.#: 4-30 Line#: 3 Code:
Original Specific Comment# 10
Comment: The report states that the chance of additional treatment capacity resulting from the

addition of mobile treatment modules is very low. No language in the ROD precludes additional treatment. The report should include a discussion explaining why the chance of additional treatment capacity is very low.

Response: This comment is similar to Comment #1. The reason why the probability of additional treatment is considered low is based on current funding profiles which include expanding the capacity of the AWWT facility to the maximum extent achievable within the confines of Building 51. Increments of treatment beyond this expansion have not been budgeted for. As discussed in Comment #1, DOE does recognize that the need for additional treatment beyond this expansion is not precluded in the ROD, as noted by the commentor.

Action: See DOE actions for Comment #1.

18. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 5.2.1.2 Pg.#: 5-10 Line#: 10 Code:
Original Specific Comment# 11

Comment: The report states that wells 1 and 3N may be tied into the existing South Plume Removal Action pipeline. This approach is acceptable as long as extracted groundwater from each individual well can be sent for either treatment or discharge and is monitored at the well head. The report should clarify this matter.

Response: This comment is similar to Comment #9. Once the wells are connected to the South Plume Removal Action discharge line, then by definition the flows will be combined with that of the South Plume Removal Action wells and well-by-well treatment decisions for the two new wells is no longer possible. The combining of the flows for the new South Plume Optimization Module wells with that from the existing wells is the result of landowner access issues and requirements.

Action: See DOE action for Comment #9.

19. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 5.4.2 Pg.#: 5-32 Line#: 6 Code:
Original Specific Comment# 12

Comment: The report states that the combined uranium concentration in the extracted South Plume groundwater is less than 20 parts per billion (ppb) and that this groundwater does not require treatment. However, the ROD requires that an evaluation be made at each well to determine whether extracted groundwater should be treated or discharged. The report should propose a course of action that satisfies the intent of the ROD.

Response: DOE generally agrees; the commitment for well-by-well treatment decisions applies to each new well added by the remedy, but not to the existing South Plume Removal Action wells which will continue to discharge as a unit through the existing South Plume discharge line. (Priority decisions for treatment of this flow will be made based on discharge line concentrations as a whole.) The need to combine the flow from the two new South Plume Optimization Module wells with the existing South Plume Removal Action discharge line is the result of landowner access issues and requirements, as discussed in Comment #9.

Action: See action for Comment #9.

20. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 6.2.1 Pg.#: 6-3 Line#: 1 Code:
Original Specific Comment# 13

Comment: The report states that a fundamental objective is to use a "learn as you go" principle. Although this approach is evident in the sequencing of the modules of the 10-year scenario, adequate learning of aquifer response and of contaminant response to

injection and extraction until about year six, which does not allow sufficient time for DOE to make adjustments to meet the 10-year predicted restoration time frame.

Response: DOE plans on evaluating and implementing adjustments throughout the entire restoration, not just at the six year mark. The sequencing of the modules is predicated on the best understanding of hydraulic and geochemical limitations at this time, and other drivers such as the availability of physical access to the plumes underlying source areas. (Access to these areas for groundwater restoration is linked to the schedules of other projects that are removing the source areas.) Further refinements in the understanding of the hydraulic and geochemical limitations offered by the aquifer requires in the ground remedy performance data, which is the intent of the "learn as you go and respond accordingly philosophy".

Action: No revision to the BRSR required.

21. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 6.2.1 Pg.#: 6-3 Line#: 25 Code:
Original Specific Comment# 14

Comment: The report states that fundamental objective of restoring the off-property portion of the groundwater plume is FEMP's highest priority. This approach is not evident considering that the baseline scenario does not include wells 2N and KN and that wells 1 and 3N are not scheduled to be operating until 1999 to 2003. The report should be revised so that the implementation schedule matches the stated objectives.

Response: The implementation schedule and approach reflects the most rapid implementation which is allowed given current budgeting scenarios and the overlay of constraints due to landowner access issues. As discussed in Comment #9, the current configuration of the South Plume Optimization Module reflects the resolution of the access issues and the requirements imposed by the affected landowner. The preferred scenario presented in Section 5 was selected by DOE, EPA, and OEPA following a review of all of the new followup modeling scenarios selected for evaluation in the draft final BRSR, and the requirements imposed by the affected landowner.

Action: Section 5 has been revised to present the current configuration of the selected scenario.

22. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 6.2.1 Pg.#: 6-3 Line#: 34 Code:
Original Specific Comment# 15

Comment: The report states that the projected dates are DOE's best estimate for when design submittals will be necessary. The dates provided give year ranges such as 1999 through 2003. These dates are not sufficient to constitute a schedule considering that the report proposes that the enforceable construction schedules will be submitted with the prefinal design package. A more definite remedial design schedule should be presented in this report.

Response: The intent of the BRSR is to provide the technical background needed to proceed with the design of the baseline remediation strategy. The BRSR is thus a support document for the RD and RA Work Plans, which are intended to communicate enforceable requirements. The enforceable schedule for remedy implementation is contained in the RA Work Plan, which is now being submitted concurrently with the draft final BRSR. The enforceable provisions for design of the remedy (contained in the RD Work Plan and approved in August 1996) remain in effect.

Action: Utilize latest information from the draft final BRSR in developing the enforceable schedule contained in the RA Work Plan; submit RA Work Plan concurrently with the draft final BRSR.

23. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 6.2.1 Pg.#: 6-4 Line#: 1 Code:
Original Specific Comment# 16

Comment: The report proposes an "umbrella" remedial action work plan that will provide the enforceable construction schedule for the first module to be constructed. The report also states that the enforceable construction schedules will be established in subsequent remedial action work plan addenda. This approach provides too much flexibility and lack of enforceability. A schedule with firm milestones for each module should be included in the report.

Response: The approach described above is contained in the RD Work Plan that was approved in August 1996 (it was not proposed as a new approach in the draft BRSR). The RA Work Plan will be revised to include milestone dates for each of the modules as requested by EPA, along with a strategy for enforceability that DOE feels is acceptable for both parties given the uncertainties associated with the out year modules and the need for certain caveats for these modules as discussed at the March 18, 1998 meeting. The strategy will not generally conflict with the approach contained in the approved RD Work Plan mentioned above.

Action: Please see the RA Work Plan that is being submitted concurrently with this draft final BRSR. The milestone schedule contained in the RA Work Plan has been coordinated with the most recent information contained in this revised version of the BRSR.

24. Commenting Organization: U.S. EPA Commentor: Saric
Section#: 6.2.3 Pg.#: 6-4 Line#: 31 Code:
Original Specific Comment# 17

Comment: The report states that it is important to emphasize that the recommended path forward does not specify an enforceable restoration timeframe to be achieved at all cost. This statement is reasonable; however, enforceable construction schedules should be proposed.

Response: This comment is similar to Comment 23. Please see response to Comment 23.

Action: Please see action to Comment 23.

RESPONSES TO OEPA COMMENTS
ON THE DRAFT BASELINE REMEDIAL STRATEGY REPORT
REMEDIAL DESIGN FOR AQUIFER RESTORATION (TASK 1)
(OCTOBER 1996)

25. Commenting Organization: Ohio EPA Commentor: OFFO
Section#: Pg.#: Line#: Code: M
Original Comment# 1

Comment: The major goals of the Baseline Remedial Strategy Report as outlined in the Remedial Design Work Plan for Remedial Actions at OU5 have been addressed in this submittal. The goals are:

- use the SWIFT model to evaluate four cleanup scenarios (25, 15, 10, 7.5 years)
- compare the costs of the scenarios
- recommend a revised strategy to serve as a design basis for a full-scale program

There are however two major limitations to this Report: property access difficulties and modeling uncertainties.

Ohio EPA acknowledges that to a large extent the property access issues are outside of DOEs control. However, at the meeting between DOE, USEPA, PRC, Ohio EPA and Mr. Knollman, Mr. Knollman seemed quite receptive to PRCs suggestion of alternative technology (remote well house and valving). This report makes no mention of any efforts undertaken by DOE to pursue this technology. It is Ohio EPAs expectation that DOE aggressively pursue the implementation of this technology and make any possible concession to his privacy concerns. We are specially eager to have the four wells in the South Plume Optimization module sited as originally conceptualized. There are major inefficiencies in operating the South Plume extraction wells in a plume containment mode if the 2N and KN wells can not be used. It is also worth reiterating that the Ohio EPA does not support the possibility of now or in the future condemning any property to gain access for well installation.

While in general we agree that the SWIFT groundwater model is accurate and useful, we have several reservations about how it was used to support this report:

- the full three-dimensional nature of the model simulations has not been address
- the Kds change in an unrealistic manner
- DOE is using the model beyond the model's capability and credibility

The first bullet is addressed in a more specific comment below. Our concerns with how the model is used center mostly around the making of distinctions between scenarios that appear to be different but may in fact be the same considering the uncertainties of the models. For example, the system performance measures for the 10-year scenario (Table 4-6) and the baseline scenario (Table 5-2) are distinctly different even through the major difference between the scenarios is that extraction wells 26 and 27 are not used in the 15 year scenario. It would appear that dominant controlling factor is the time at which the Kd is changed from 1.78 to 17.8. This Kd effect overwhelms the effect of not using the two South plume wells. The importance of understanding the limitations of the model are critical in planning a long-term remedial strategy.

Response: DOE held several meetings with the off-property landowner affected by the optimization wells, and successfully resolved the off-property landowner access issues. The successful resolution of the off-property landowner access issues resulted in several modifications to the South Plume Optimization Module. The modifications include the elimination of proposed well KN from further consideration; the addition of well 2N at a new location agreeable to the landowner; and the placement of well

3N into a "contingency" mode for future consideration based on actual remedy performance data. Based on the preferences of the landowner, it was agreed that the two new South Plume Optimization Module wells (Wells 1 and 2N) would be routed to the existing South Plume discharge line and combined with the flow from the South Plume Removal Action wells. The two new wells will also be installed as low-profile "flush mount" wells as described in the South Plume Optimization Module prefinal design package. For clarity, these two new wells will be renamed as South Plume Recovery Wells "RW-6" and "RW-7" for use in this report and in follow-up future design submittals.

DOE is thus planning on installing the "flush mount" type wells that were suggested by PRC. Please see Comment Response 42 for additional discussion of this issue.

DOE is aware of the model limitations that EPA is referring to, and DOE understands the impact that the modeling limitations place on planning a long term remedial strategy. DOE is evaluating modeling data with these limitations in mind to minimize the impact that the limitations are placing on the project. In addition to wells 26 and 27 in the 10 year modeling scenario, the ten year scenario also has additional wells in the southfield area, and that is why the clean-up time is reduced by 5 years.

Action: Section 5 of the draft final BRSR will reflect all changes in the preferred scenario, and a "Foreword" has been added to the document to summarize major changes from the draft version.

26. Commenting Organization: Ohio EPA Commentor: OFFO
Section#: 1.4 Pg.#: 1-8 Line#: last bullet Code: c
Original Comment# 2

Comment: It is premature to mention the possibility of pursuing a technical impracticability waiver. In practice, there are several technical options (such as fine tuning to reduce stagnation zones, lixiviant addition, etc.) that would be evaluated prior to reaching the conclusion that the remediation has become asymptotic. Please add a bullet with a brief discussion of some of the enhancements to the remediation project that will be evaluated if the rate of progress becomes asymptotic.

Response: DOE does not generally feel that it is premature in this technically oriented document to mention the possibility of pursuing a technical impracticality waiver should the restoration appear to become asymptotic. DOE does agree that some possible enhancement options need to be mentioned, however, as requested by OEPA.

Action: The last bullet will be revised to read; "...may need to pursue different enhancement technologies (possibility of using lixiviants, pulse pumping, etc.) or a technical impracticability waiver to terminate operations. The need for such enhancements would require further detailed evaluations as to their applicability and effectiveness."

27. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 1.1 Role of the FS"Base Case" Remedy Pg.#: 1-2 Line#: 5-8
Code: c
Original Comment# 3

Comment: Is this present worth cost of this 27-year base case comparable to the costing included for the alternatives later in this document? Where is the information on these costs located?

Response: The present worth cost of the 27-year base case found in the OU5 FS is $160 million. The four alternative scenarios presented in the BRSR (new Table 4-11) range from $65 million to $110 million. All these present worth cost estimates used the same discount rate of 2.8 %.

Action: The revised present worth calculations will be provided in the report in Table 4-11 and added to the cost appendix (Appendix C).

28. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 1.3 Key Factors Affecting Cleanup Performance Pg.#: 1-6 and 1-7
Line#: Code: C
Original Comment# 4
Comment: Please include a discussion of the deleterious effects of iron bacteria on the performance of injection wells in this section.
Response: Agree.
Action: The following text will be added to section 1.3.2 of the report.

> However, it is difficult to quantify potential deleterious effects of iron bacteria on the long-term success for the groundwater injection operation. If the expected benefits of groundwater injection do not materialize due to iron precipitation problems, the actual groundwater cleanup time may not be significantly shorter than the 27 years time frame estimated in the Operable Unit 5 FS. The full-scale Groundwater Injection Demonstration along the FEMP southern fenceline planned for 1998 will provide more information for re-evaluating long-term feasibility, operation and maintenance requirements, and effects of groundwater injection.

29. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 1.3 Pg.#: 1-7 Line#: 30-31 Code: C
Original Comment# 5
Comment: The two natural factors that affect cleanup time and cost for the aquifer are the hydraulic characteristics and capacity of the aquifer, and the geochemical processes that occur within the aquifer (i.e., K_d). Lines 30-31 indicate that a complete uncertainty analysis was performed for both factors. However, in Appendix F, only a discussion of the uncertainty analysis associated with K_d is presented. Either clarification as to what the quantified uncertainties associated with K_d should be presented here, or reference should be made to uncertainty discussion in Appendix F.
Response: A reference to Appendix F is needed.
Action: DOE will reference the uncertainty discussion found in Appendix F.

30. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Pg.#: 3-2 Line#: Code: C
Original Comment# 6
Comment: The regional groundwater flow directions are not consistent with the potentiometric surface (i.e., Figure 4-7 and 5-4).
Response: Generalized regional groundwater flow directions are illustrated in Figure 3-1. DOE agrees that the arrows indicating the regional groundwater flow direction need to be adjusted to better conceptualize flow conditions.
Action: The arrows in Figure 3-1 which depict regional groundwater flow directions will be adjusted accordingly.

31. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 3.1.5 Pg.#: 3-4 Line#: 20-21 Code:
Original Comment# 7
Comment: The only reason 27 years was found to be acceptable was because DOE stated that it would take that long. The DOE committed to investigation alternative technologies (injection) as part of the approved FS document. Now that faster alternatives have been found, 27 years is no longer considered an acceptable time frame to Ohio EPA.

Response: The reference to the 27 year time frame was made in the past tense, referring back to the Operable Unit 5 Feasibility Study. The very next sentence in the text states that "However, shorter restoration time frames are preferred by EPA, and OEPA, and the FS contained a commitment on the part of DOE to further evaluate measures to reduce cleanup time as part of remedial design." DOE is making a concerted effort to accelerate the clean up time needed to restore the aquifer as desired by all parties, and it is recognized OEPA fully supports this goal. There are however, many technical uncertainties that remain that need to be proven out at the field scale with "in-the-ground" actual remedy performance information before we will know whether the computer predictions of shortened cleanup time will actually bear out through deployment of the new technologies and enhanced restoration concepts. These uncertainties were also noted by EPA in Comment #5 as they affect cleanup time. While the computer simulations and expectations appear highly promising, it is important to bear in mind that field results will be the true test of the accelerated remedy.

Action: Section 5 of the draft final BRSR will be revised to contain the latest information concerning the anticipated benefits of the preferred remedy.

32. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 3.1.5 Pg.#: 3-4 Line#: 24-25 Code:
Original Comment# 8
Comment: Shortening operations and maintenance (O&M) is only part of the cost savings. Shortening the period which DOE incurs resource damage liabilities is also a real savings.
Response: Comment acknowledged.
Action: No revision to the BRSR required.

33. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 3.2 Pg.#: 3-5 Line#: 20 Code:
Original Comment# 9
Comment: Change to on and off-property cleanup time.
Response: Agree, but off-property cleanup time takes priority over on-property clean up time during the aquifer restoration.
Action: Text will be changed to read "on and off-property".

34. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 3.2 Pg.#: 3-5 Line#: bullets Code:
Original Comment# 10
Comment: Add a bullet stating that DOE will seek alternative technologies to address owner access problems.
Response: This comment is similar to Comment 25, and the document now reflects that access problems have been resolved. Please refer to the response for Comment 25.
Action: Please refer to the action for Comment 25.

35. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 3.2 Pg.#: 3-6 Line#: 14-17 Code:
Original Comment# 11
Comment: Add bullet stating that DOE will investigate alternative construction technologies to deal with known problems, such as iron fouling and electrical malfunctions.
Response: Agree. DOE is incorporating lessons learned and preventative maintenance/troubleshooting techniques developed through the operation of the South Plume Extraction System (i.e., screen design and placement, well rehabilitation and

preventative maintenance for iron fouling, and electrical surge protection equipment) into the construction of new aquifer restoration system wells. Doe would also like to mention that the design of the new South Plume Optimization wells include these considerations, as noted in the prefinal design package for the wells.

Action: A bullet will be added to read as follows: "Incorporate lessons learned through the operation of the South Plume Extraction System (i.e., design and placement of well screens, management of iron fouling concerns, electrical surge protection, and pump design)."

36. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 3.3.3 Pg.#: 3-7,3-8 Line#: 29-3 Code:
Original Comment# 12
Comment: The DOE needs to be flexible in these instances. Efforts to compromise with the landowners through the use of alternative technologies are appropriate.
Response: Agree. See response to Comment 25..
Action: See action to Comment 25.

37. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 3.4.4 Pg.#: 3-12 Line#: 12 Code: E
Original Comment# 13
Comment: The values of K_d should include units.
Response: Agree.
Action: Units (L/kg) will be added to the values.

38. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 3.4.4 Geochemical Conditions Pg.#: 3-12 Line#: 30-31
Code: C
Original Comment# 14
Comment: The assumption that the fouling problems caused by iron bacteria can be resolved for long term injection is probably not realistic. Chemistry of the groundwater can be controlled at the treatment facility, but when it is reinjected and mixing with untreated groundwater, fouling problems will begin to occur.
Response: Agree. Conditions for plugging the injection well screens with iron bacteria are present in the aquifer and these conditions will be affected by the injection process. DOE is optimistic though that the plugging of injection well screens can be adequately controlled, otherwise, DOE would not be proceeding with the injection demonstration. The proof, however, remains to be determined at the field scale and at longer durations via the demonstration. If the injection process turns out to be unimplementable for the long term, as revealed by the demonstration project, then it will not be pursued for incorporation in the other out-year modules.

Optimism for a successful demonstration is supported by the results of geochemical modeling and two short term injection tests. The first injection test resulted in the rapid growth of iron bacteria and plugging of the injection well screen. Geochemical modeling, conducted subsequent to the first test, predicted how to successfully alleviate the iron plugging problem. A follow-up injection test demonstrated that the plugging problem produced by the first injection test was properly identified and corrected during the second test, just as the geochemical modeling predicted it could be. The remaining issue is time -- can plugging of the injection well screen with iron bacteria be controlled for longer periods of injection?

To address the issue of time, DOE is proceeding with an injection demonstration that

consists of 5 injection wells. Should the demonstration prove successful, (i.e., plugging of the well screen does not adversely effect the injection goals) then DOE will proceed with additional injection wells to help accelerate the groundwater clean-up.

Action: No revision to the plan is required at this time. Future out-year modules could require revised plans if injection does not prove to be an implementable, reliable technology. The overall schedule for remediation could be affected as well, if it turns out the technology cannot be relied on for acceleration.

39. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Table 4-1 Pg.#: Line#: Code: E
Original Comment# 15
Comment: On Column 6, lists Years 11 to 10. This should 11 to 20.
Response: Agree.
Action: Column 6 will be corrected to read 11 to 20.

40. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.2.5.2 Extraction/Injection pumping Rate Schedule Pg.#: 4-21
Line#: 11-14 Code: C
Original Comment# 16
Comment: Will "plugging rate" change, or will the period between required scale removal be lengthened? It seems like the latter would be the case, and this would not necessarily translate to lower maintenance requirements, only less frequent maintenance requirements?
Response: Velocity is directly proportional to pressure. As velocity increases the change in pressure also increases. Change in pressure can drive the production of both chemical and biological precipitates. Therefore, if the velocity entering a screen is lowered, the change in pressure across the face of the screen is also lowered, resulting in less chemical and biological precipitates at the screen face. Therefore, lower maintenance requirements may actually be realized (as well as less frequent), which would be great news for the remedy.
Action: No revision to the BRSR required.

41. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.2.5.2 Extraction/Injecting pumping Rate Schedule Pg.#: 4-21
Line#: 8-14 Code: C
Original Comment# 17
Comment: The cost estimates include cost associated with maintaining the horizontal wells as identical to maintenance of vertical wells. Won't these wells have a significantly higher O&M expense?
Response: Horizontal wells will have a higher O&M cost than vertical wells. DOE though did a cost comparison at the lower O&M cost and the option appeared to be too costly when compared with other options. Re-evaluating the horizontal well option at a higher O&M cost would not alter the decision that has been selected, it would just make it even more pronounced.
Action: No revision to the BRSR required.

42. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 4.3.1.1 Pg.#: 4-26 Line#: Table 4-9 Code:
Original Comment# 18
Comment: What is the relative costs of a vertical well with underground supply lines such as

proposed to DOE by PRC in the September 17, 1996 meeting with DOE, Ohio EPA, USEPA, and Mr. Knollman?

Response: DOE is planning on installing the wells that were suggested by PRC on September 17th. The wells initially proposed for the South Plume Optimization were close to the PRC design with the exception of having overhead electrical power supply lines. The groundwater discharge lines were planned for below ground installation. The electrical power supply lines will now be routed underground, resulting in a low profile "flush mount" well design as suggested by PRC. The incremental cost incurred to have an underground electrical supply system compared to the original design is expected to increase electrical service costs by approximately 50% per well.

Action: Revise Section 5 of the BRSR to incorporate landowner access resolutions, which also include use of the flush mounted well.

43. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.2.5.1 Pg.#: 4-18 Line#: 18 Code: C
Original Comment# 19
Comment: While is it understood that the placement of the horizontal wells is restricted by the groundwater model grid placement and alignment, it is suggested that wells D, E, and F be moved further north. This would greatly facilitate well placement with having to access off-property locations.
Response: Horizontal wells D,E, and F all originate on property, eliminating off-property access concerns altogether. Figure 4-1 illustrates the approximate location of the screens for each of the horizontal wells, not the total well lengths.
Action: No revision to the BRSR required.

44. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.2.5.1 Pg.#: 4-18 Line#: 29 Code: C
Original Comment# 20
Comment: Please provide a reference and further details regarding the pipe flow model, Fathom.
Response: DOE agrees that a reference and further details of the pipe flow model need to be added to the BRSR.
Action: Additional details about the Fathom pipe flow model will be added to Section B.3.1 of Appendix B as follows:

The Fathom model (AFT 1995) uses the Newton-Raphson method to solve the fundamental pipe flow equations that govern mass and momentum balance. Numerical solutions are obtained by iteration, and matrix methods optimized for computational speed are employed in Fathom to obtain numerical convergence. Fathom also combines the traditional piping network modeling with an easy-to-use graphical user interface with drag-and-drop capability.

45. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Pg.#: Figure 4-4 Line#: Code: C
Original Comment# 21
Comment: The "C" horizontal well shown on Figure 4-4 is not listed in Table 4-7.
Response: The omission of the "C" horizontal well from Table 4-7 was an oversight.
Action: "C" horizontal well pumping rates will be added to Table 4-7.

46. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.3.2.5 Pg.#: 4-32 Line#: 2-8 Code: M
Original Comment# 22
Comment: The modelers seem to be placing too much credibility and confidence in their ability to

apply models to predict future contaminant transport and geochemical changes. It is difficult to fully accept the notion that DOE would place such great emphasis of the temporal change in K_d. During the transition from a low K_d of 1.78 L/Kg to the higher K_d of 17.8 L/Kg, the model representation lets 89 percent of the dissolved uranium mass simply disappear.

Response: The groundwater model is the best tool that DOE has to predict future plume movement and clean-up. The temporal change in K_d needs to be factored into the modeling process. The change is not totally understood but the uncertainty has been bracketed. Given the range of uncertainty, DOE has elected to take a conservative approach in applying the transition and make the K_d transition in one step. This results in a larger plume than what might actually result up until the time that the transition is made, but the risk of under-designing the restoration system is lowered by taking this approach. The model does not let 89% of the dissolved uranium mass simply disappear. The model redistributes the uranium mass to the solid matrix where it is available for desorption at the larger K_d value.

Action: No revision to the BRSR required.

47. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.3.3.4 Pg.#: 4-34 Line#: 14-15 Code: C
Original Comment# 23

Comment: The particle tracking (Figure 4-12) should be described in greater detail. In the FS, vertical diagrams were presented to show the variation with depths of migration patterns. It is interesting to note how the particle tracks abruptly change direction. For example particle tracks emanating from the Plant 6 wells make 90 degree turns. Presumably this is caused during the step from zero to 500 gpm during pumpage from years 3-5 (Table 4-7). Please provide additional comments and discussion.

Response: DOE agrees that additional discussion of the particle tracks would make the figure easier to understand. As far as vertical particle tracks are concerned, additional modeling was performed in the area around the fence line injection wells and the additional proposed well (well 22) in the South Field. This information was presented at the January 13, 1997 meeting between DOE, U.S. EPA, Ohio EPA and Fluor Daniel-Fernald. The handouts from this meeting will be included in Appendix E of the revised Baseline Remedial Strategy Report.

Action: Replace Section 4.3.3.3 with the following.

4.3.3.3 Predicted Hydraulic Impacts and Uranium Plumes

Figures 4-6 through 4-8 show the modeled groundwater flow patterns under the selected preliminary groundwater remediation strategy. Corresponding groundwater drawdown contours are shown in Figures 4-9 through 4-11. Groundwater and uranium capture zones with and without retardation resulting from this remedial strategy are presented in Figures 4-12 and 4-13. The particle tracks in Figures 4-12 and 4-13 were generated with STLINE (part of the SWIFT modeling software). Particles were seeded in model layers 1 and 2 and reverse tracked for each of the constant pumping periods in the modeling scenario in a reversed sequence. The initial STLINE run seeded particles at the pumping well locations and reverse tracked each particle for the last constant pumping interval. The final particle positions (horizontal and vertical) in the last constant pumping period were used as input for the initial particle locations for the next to last constant pumping period. This process was repeated in a reverse sequence through each of the constant pumping periods until the particles were at their initial locations before pumping

began. The abrupt changes in particle tracks indicate the particle locations when nearby pumps were turned on for the next constant pumping interval. The projected uranium concentration contours are shown in Figures 4-14 through 4-16.

48. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.3.2.1 Pg.#: 4-29 Line#: 14-15 Code: C
Original Comment# 24
Comment: The possibility of significant delays in the source-area remediation schedule given the 10-year site-wide remediation plan is considered moderate. However, a 50/50 chance of delays occurring should not be considered "moderate", but rather as equal probability of happening as not happening. This statement should be clarified. In addition, if the additional vertical extraction wells inside the excavated zone do not achieve the predicted clean-up and becomes impractical, what significance will this have on the 10-year site-wide remediation plan? If there are contingencies for this type of delay, they should be presented and discussed.
Response: DOE is pushing for the shortest possible clean-up that can be achieved given all of the competing goals and objectives which need to be achieved at the FEMP. If predicted clean-up appears to become impractical, then contingency actions will need to be taken to see if the situation can be improved. Details for any necessary contingency action would be presented at a later date after the nature of the delay can be defined. However, a general strategy to address the issue has been presented in Section 5.4 of the report. The general strategy includes adjusting operational conditions, adding additional wells, and utilizing other technologies.
Action: No revision of the BRSR required.

49. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 4.4.2 Pg.#: 4-48 Line#: 16-17 Code: C
Original Comment# 25
Comment: Supporting evidence needs to be presented to justify this conclusion. The downward migration of uranium due to additional injection could have an impact on estimated cleanup times. If no vertical expansion of the plume is occurring, then plots which depict the simulated uranium concentrations at deeper layers of the model should be presented. In addition, vertical cross-sections of particle tracking should also be shown which depict the simulated flow field with respect to depth.
Response: Vertical particle tracking is discussed in the response and action to Comment 47. Vertical expansion of the plume does occur in the model, due to inadequacies in the SWIFT code to handle vertical dispersion near pumping wells where vertical velocities are relatively high.
Action: No revision to the BRSR required.

50. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 5.1.2 Pg.#: 5-7 Line#: 17-19 Code:
Original Comment# 26
Comment: Ohio EPA concurs that DOE should not initiate condemnation proceedings against the Knollman property. At the September 17, 1996 meeting, Mr. Knollman stated that he would accept flush mounted extraction wells if O&M were kept to a minimum. The DOE needs to investigate this technology, as they committed to at that meeting. Condemnation or abandonment of installation are not the only two alternatives in this situation.
Response: This comment is similar to Comment 25, and the landowner access issue has been resolved. Please refer to the response to Comment 25.

Action: Please refer to the action for Comment 25.

51. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 5.2.1.1 Pg.#: 5-9 Line#: 14-30 Code:
Original Comment# 27
Comment: What are the estimated uranium mass removals for the 5 scenarios?
Response: The estimated uranium mass removals for the 5 scenarios (7.5 years, 10 years, 15 years, 25 years, and the baseline remedial strategy) are given in Tables 4-8, 4-6, 4-4, 4-2, and 5-2 respectively. Table 5-2 is incorrect, but will be corrected in the next draft of the BRSR.
Action: Correct Table 5-2 in the draft final BRSR.

52. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: 5.2.1.1 Pg.#: 5-9 Line#: Code: M
Original Comment# 28
Comment: The contour plots in Figures 5-12 through 5-16 shows simulated uranium concentrations through time. It is unclear from which layer in the SWIFT model these concentrations are associated with. If the groundwater concentrations displayed are combined from all model layers, how are they combined? An examination of the SWIFT data sets used in this modeling, when post-processed (see attached contour plots), shows vertical migration of the uranium plume to the deeper layers (i.e. model layers 4,5 & 6). There is no indication that examination of the model's sensitivity to vertical dispersion, or what steps were taken to minimize unwanted numerical dispersion in the vertical plane in the model were undertaken.

While the 20 ppb contour does not migrate to the deepest layer, what these plots do show is the change in concentrations over a fairly short distance (a few hundred feet). For example, in the contour plot included for concentrations in model layer 3, the distance from the 5 ppb to the 20 ppb contour is no more than a few hundred feet in the vicinity of Willey Road. How does an adjustment of hydraulic conductivities (as part of a sensitivity analysis) or dispersivities affect the location of these contours? The extent of the 20 ppb may or may not be significantly affected, but proper documentation of this analysis needs to be presented.

Response: Figures 5-11 through 5-13 in the revised report (corresponding to the old Figures 5-12 through 5-13) illustrate the maximum 10-foot average uranium concentrations regardless of the model layer. Usually the maximum 10-foot average concentrations occur in the top ten feet of the saturated aquifer and consist of both Layer 1 and portion of Layer 2 of the groundwater model. A weighted average, weighted by thickness, was used to assign concentration values to each layer.

Because vertical flow is not significant in the aquifer, except in the vicinity of injection and extraction wells, it is expected that the hydraulic conductivity values used in the model will not significantly affect the vertical distribution of uranium. Therefore, the DOE has examined the model's sensitivity to vertical dispersion and looked at steps to minimize unwanted numerical dispersion in the vertical plane in the model by adjusting the dispersivity values. Informal discussions have been held with Geotrans on the issue. Simulations without any dispersion in the vertical direction were performed by changing the SWIFT code (Subroutine COEFF3). Currently, this is the only meaningful way in SWIFT to evaluate the impact due to unwanted vertical dispersion. Slightly higher concentrations result in the upper model layers when vertical dispersion is completely turned off. Concentrations in the lower layers decrease more significantly. According to Geotrans the actual vertical dispersion may

be even lower. However, the aquifer cleanup time is not expected to be significantly impacted. The aquifer cleanup time will be more significantly impacted by uncertainty associated with the future geochemical conditions which is evaluated in Appendix F of the report. Because the simulations of reduced vertical dispersion were not performed using an officially revised and accepted SWIFT code, formal presentation of the results is considered inappropriate.

Action: No revision to the BRSR required.

53. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Pg.#: Line#: Code: C
Original Comment# 29

Comment: With regards to the vertical migration of the plume based on model simulations, the question is: Based on actual sampling, what is the vertical extent of uranium contamination and does the model accurately predict this vertical migration, or are simulated concentrations observed at deeper layers the result of unwanted numerical dispersion?

Response: The model does accurately depict the present vertical extent of the total uranium plume. Sampling data was used as initial input into the groundwater model. As for future predictions, the modeled vertical extent of the total uranium plume is effected by numerical dispersion. Vertical numerical dispersion is further discussed in the response to Comment 49.

Action: No revision to the BRSR required.

54. Commenting Organization: Ohio EPA Commentor: DDAGW
Section#: 5.2.1.3 Pg.#: 5-11 Line#: 6-8 Code:
Original Comment# 30

Comment: Mr. Knollman has not granted approval for placing Wells 2N and KN based on current well design. The DOE has not presented any construction alternatives.

Response: DOE has held several meetings with the off-property landowner to resolve the key landowner access issues associated with the off-property portion of the remedy that were identified in the October, 1996 draft of the BRSR. At the time that the October, 1996 BRSR was issued the landowner access issues had not been resolved.

The successful resolution of the off-property landowner access issues resulted in several modifications to the South Plume Optimization Module. The modifications include the elimination of proposed well KN from further consideration; the addition of well 2N at a new location agreeable to the landowner; and the placement of well 3N into a "contingency" mode for future consideration based on actual remedy performance data. Based on the preferences of the landowner, it was agreed that the two new South Plume Optimization Module wells (Wells 1 and 2N) would be routed to the existing South Plume discharge line and combined with the flow from the South Plume Removal Action wells. The two new wells will also be installed as low-profile "flush mount" wells as described in the South Plume Optimization Module prefinal design package. For clarity, these two new wells will be renamed as South Plume Recovery Wells "RW-6" and "RW-7" for use in this report and in follow up future design submittals.

Action: Revise Section 5 of the BRSR to incorporate resolutions of landowner access concerns.

55. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: A.3.1 Pg.#: A-3 Line#: 32-33 Code: C
Original Comment# 31

Comment: This statement should either be removed or modified. The use of the term "fine tune remedial system designs" indicates that only a modest change is made in the remedial design, whereas the Baseline Remedial Strategy, based on the results of modeling, is significantly different in that site-wide cleanup times have been reduced from 27 to 10 years.

Response: The term "fine tune remedial system designs" will be removed from the report.

Action: As stated in the response.

56. Commenting Organization: Ohio EPA Commentor: OFFO
Section#: A.3.1 Pg.#: A-3 Line#: Code:
Original Comment# 32

Comment: Although it is premature to discuss a technical impracticability exemption at this time, it is Ohio EPAs expectation that complex models would be used to support such a pleading.

Response: DOE acknowledges the comment. If the need to discuss a technical impracticality exemption should occur, data will be collected, analyzed, and presented with a recommended course of action. The analysis may involve modeling predictions as part of the determination.

Action: No revision to the BRSR required.

57. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: A.4.3 Pg.#: A-7 Line#: 19-26 Code: M
Original Comment# 33

Comment: While it is true that the SWIFT model cannot simulate a continuous transition process between adsorption and desorption conditions, it does not seem necessary to simplify the continuous process into a two-stage process only. It is unclear if an alternate scenario was considered whereby the transition between adsorption/desorption conditions was modeled more gradually, i.e., at the end of each model year, a revised K_d was used based on an estimate of the transition that had taken place between adsorption and desorption conditions during that time frame. Such a "pseudo-continuous" transition in K_d would provide, it seems, a better representation of the actual continuous change in adsorption/desorption ratios. At the very least, such a simulation would provided an additional sensitivity analysis of K_d by the SWIFT model and its impact on clean-up times.

Response: Alternate scenarios for modeling K_d transitions were considered, including a more gradual transition as is suggested in the comment. The two-stage process was selected because it is the most conservative approach. Any method that utilized a gradual transition will result in smaller plume size predictions. Given the uncertainty that evolves around the process, conservatism is warranted.

Action: No revision to the BRSR required.

58. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: F Pg.#: F-6 Line#: 20 Code: M
Original Comment# 34

Comment: It is stated that the recommended baseline remedial strategy does not increase hydraulic impacts to the GMA even when more extraction wells are included. This statement needs further clarification. The addition of extraction wells should have an impact on the hydraulic characteristics of the aquifer, perhaps a significant impact. If there are no significant impacts on the aquifer under the baseline remedial strategy, then it is unclear how cleanup time can be reduced from 27 years to 10 years.

The addition of extraction wells and groundwater injection, or even a change in the

time that an extraction/injection well operates will have an impact on groundwater levels in the aquifer and the capture zone for the well field. The capture zone associated with the baseline remedial strategy is not presented. At the very least, this should be presented so that it could be compared to the capture zone of the well field based on the 7.5, 10, 15, and 25 year scenarios previously performed.

Response: Reducing the cleanup time from 10 years to 27 years did impact the aquifer, but the impact was considered acceptable. The capture zone for the baseline remedial strategy will be included in the next draft of the BRSR.

Action: Figures 5-15 and 5-16 will be added to Section 5.0 to show the capture zones for the baseline remedial strategy.

59. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Pg.#: Line#: Code: C
Original Comment# 35

Comment: To evaluate the application of the SWIFT model, data sets were converted to MODFLOWT. This is a newly released transport module for MODFLOW. The reason for the model conversion was two-fold. First, by converting the data files from one code to another, further inspection and review is performed. Second, the results of the two models can then be compared to ensure solution accuracy.

In converting the data format, no significant observations were noted. The application of boundary heads from the regional model appear to be correct, as well as the assignments of hydraulic properties (hydraulic conductivity, transmissivity, porosity, etc.).

In comparison the two codes, SWIFT and MODFLOWT, several observations are noted. First, it was confirmed that the two model produce essentially the same results (predicted pressure/head and concentration). Second, tests, were made using MODFLOWT regarding the numerical algorithms.

Using MODFLOWT, an additional input variable is offered, namely vertical dispersivity. Vertical mixing using SWIFT has been identified as a potential problem (FS, Section F.7.7.3). Using MODFLOWT, reduced values of dispersivity were simulated, but due to time constraints, results are not conclusive as the effects this has on the predictive simulations. There is doubt that ratios cause this small dispersivity to be overshadowed. The net effect is that the model may predict more vertical mixing than actually occurs. This results in the predicted plume to attenuate as a result of the unrealistic vertical mixing and is not a necessarily a conservative approach in optimizing the remediation wells. The model may cause the plume to unrealistically migrate vertically and spread.

This would then reduce the concentration levels in the upper horizons. When viewed from above, this would cause the size of the plumes to be smaller as a result of the vertical mixing. Thus the model predictions may be somewhat erroneous in the well optimization.

Response: DOE is aware of the dispersivity issue, and is interested in being kept informed with any additional observations that Ohio EPA is able to make with the use of MODFLOWT.

Action: No revision to the BRSR required.

60. Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section#: Pg.#: Line#: Code: C

Original Comment# 36

Comment: Visualization of predictive groundwater contaminant transport is difficult to present in report format. The model results presented by DOE are generally limited to areal views using simple contour plots. It is not known whether DOE has or plans to use more advanced software to "see" the plume in three dimensions. Using the SWIFT data sets provided, computer simulations for the first year were reproduced and output files sent to the EVS software package, developed by C-Tech. These type of tools are best displayed interactively in which the display options can be changed and the plume rotated. To convey the concept, a sample display is shown below. This is a first draft showing an exploded view of the six-layer model.

The figure below helps to convey the importance of addressing the plume with depth. This issue of plume containment with depth can be easily visualized using similar software.

Response: DOE agrees that three dimensional displays of plume geometry can be helpful in understanding and interpreting model results. The kriged plume which is used as input for the selected baseline scenario was modeled with Intergraph's Micro station Modeler Software to obtain a three dimensional representation of plume geometry. Furthermore, SWIFT modeling results can be viewed with this same software to observe plume behavior with time. As the commentor notes however, this type of representation most easily lends itself to interactive viewing in front of a computer display screen and is not very illustrative when reduced to a 2-D representation and included in a report. For this reason DOE will continue to use three dimensional modeling and visualization tools to interpret plume data and modeling results but will use 2-D contour plots whenever appropriate in written reports.

Action: No revision to the BRSR required.

61. Commenting Organization: OEPA Commentor: Tom Schneider
Section#: Pg.#: Line#: Code:
Original OEPA Supplemental Comment# 1

Comment: OEPA Supplemental Comment 1: DOE received the following verbal comment from OEPA the week of March 24, 1997. In the revised Baseline Remedial Strategy Report can DOE provide the mass of uranium removed by each restoration module by year of operation?

Response: DOE discussed this comment with OEPA on the weekly conference call which took place on April 1, 1997. In that call DOE agreed to provide the uranium mass removed by module by year for the final scenarios to be included in the revised report.

Action: Add a new table to Section 5 (Table 5-3) and two new tables to Appendix E (Table E-16 and E-17) depicting the mass removed by module by year for the baseline scenario and for scenario C-1 and C-2 respectively.