GWOU ADMINISTRATIVE RECORD
SECTION TITLE:
GW-500-501-1.12

**Department of Energy**
Oak Ridge Operations
Weldon Spring Site
Remedial Action Project Office
7295 Highway 94 South
St. Charles, Missouri 63304

GW-500-501-1.12

December

Mr. Dan Wall
Mr. Tom Lorenz
U.S. Environmental Protection Agency
Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

Dear Mssrs. Wall and Lorenz:

**FINAL FEASIBILITY STUDY FOR THE GROUNDWATER OPERABLE UNITS (GWOU) AT THE CHEMICAL PLANT AREA AND ORDNANCE WORKS AREA, WELDON SPRING, MISSOURI**

This letter provides an update regarding activities related to the GWOU at the chemical plant area since the draft final Feasibility Study (FS) report was issued in March of 1998. The FS has recently been finalized incorporating comments received from the EPA, MDNR and the MDOC in April of 1998. Therefore, in addition to minor changes stemming from a final editorial review, some text deletions and additions were incorporated to reflect the comments received. Enclosed is a compilation of these comments and the corresponding responses. Copies of the final FS will be available to support public review of the Proposed Plan.

In addition to finalizing the FS, additional field tests were also performed to determine the effects of groundwater withdrawal on the aquifer and groundwater flow directions particularly in the area of the trichloroethylene (TCE) plume. These efforts were undertaken so that uncertainties related to groundwater removal and treatment for TCE could be better determined. The results of the pump test are presented in a completion report which has been recently transmitted to you. The results indicate that although a much higher yield than initially projected was obtained from the test well, the aquifer became dewatered and recovery is still occurring after four months. This indicates that the application of a conventional pump and treat type approach could not be performed on a continuous basis.

A re-evaluation of several technologies was also performed in an effort to identify the most viable technology or approach to address the TCE area. Technology vendors representing in-situ type approaches were invited to present information about their respective technology. As a result of these additional reviews and incorporating information gleaned from the recent pump test, it has been determined that the implementation of in-situ chemical oxidation of TCE may be feasible in remediating the TCE plume. Therefore, we plan to incorporate this technology into the proposed action that would be presented in the draft final Proposed Plan.

Mr. Dan Wall/Mr. Tom Lorenz

The draft final Proposed Plan for the Department of Energy will be transmitted for your review by December 23, 1998. Please do not hesitate to contact Karen Reed if you have any questions or concerns.

Sincerely,

Stephen H. McCracken
Project Manager
Weldon Spring Site
Remedial Action Project

Enclosure:
As stated

cc w/enclosure:
Larry Erickson, MDNR
MDNR Field Office
Ray Strebler, MDNR
Diana Travis, MDNR/DGLS
Mike Schroer, MDC
Bruce Stuart, MDNR
Ed Louis, USACE
Dan Mroz, USACE
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Marj Wesely, PMC
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Steve Warren, PMC
Bob Boettner, EM-421
Jim Donnelly, SE-311
Rachel Blumenfeld, CC-10
Yvonne Deyo, PAI
Weldon Spring Citizens Commission
Bob Swain, Bureau of Reclamation

cc w/o enclosure:
Walter Anderson, PMC
Peter Gross, SE-31
Mary Picel, ANL

**Attachment. Responses to Comments on the Draft Final Feasibility Study for Remedial Action for the Groundwater Operable Units, March 1998**

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| **EPA (Tom Lorenz)** | | | |
| **Specific Comments** | | | |
| 1. | 1. Table 2.2 Natural Attenuation | It is stated under the Implementability column that it may be difficult to show that natural attenuation is occurring. This may be the case for nitroaromatics and nitrates; however, there are standard analytical procedures for determining the effects of natural attenuation, with regard to TCE. The tests are listed on page 3-17 of this report. By monitoring for these parameters along the length of the plume, natural attenuation could be confirmed. | We agree that more information is available in the literature for measuring the effects of natural attenuation for TCE than for the other contaminants; we have revised the text accordingly to make this clarification. |
| 2. | 2. Section 3.3.2.2, Alternative 2: Monitoring with No Active Remediation, Page 3-6, First Bullet | Considerable discussion is provided on the large volume of the aquifer to be treated. However, the volume, as presented, is the volume of the aquifer including the solid matrix, which is misleading. The objective is to remove the contaminants from the aquifer; however, no alternatives deal with treating the aquifer matrix. If the objective is to treat the groundwater, an effective porosity value should be added to provide a more realistic picture of the quantities to be remediated. This is also significant considering the presentations throughout the report dealing with the low hydraulic conductivity of the formations, which can be directly related to low effective porosity. By incorporating an effecting porosity of nine percent, and using traditional groundwater units, the amount of treated material drops from 5.13 billion cubic feet to 11,000 acre feet. This discussion needs to be presented in a more realistic manner. | Text has been revised to include a calculation incorporating an effective porosity of 25%. |

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| 3. | 3. Section 3.3.2.8, Alternative 8: In-Situ Treatment of TCE Using In-Well Vapor Stripping, Page 3-38, Second Paragraph | This paragraph mentions the "radius of influence" for the In-Well Vapor Stripping technology; however, no quantitative representation is given for the Weldon Spring site. Provide a realistic indication of the radius of influence that is anticipated. | Text has been revised to include the calculations requested. |
| 4. | 4. Section 3.5.4.2, Implementability, Page 3-51, Fourth Paragraph | This paragraph refers to "significant amounts of data" supporting the ineffectiveness of a pump-and-treat system when dealing with TCE, yet provides no direct reference for this data. This is a very general statement. This section should show whether this data incorporates site characteristics similar to those at Weldon Spring, and whether the concentration levels are similar. It has been shown that at high concentrations of TCE, pump and treat is ineffective due to the aquifer matrix acquiring an affinity for the solvent, in essence becoming "solvent-wet." Describe whether this is the difficulty that is being referenced. | Text has been revised to clarify. |
| 5. | 5. Section 3.5.4.2, Implementability, Page 3-52, Second Paragraph | The first sentence states that the contaminants are "absorbed" by the activated carbon. Activated carbon works by "adsorption." Please correct this sentence. | The sentence has been deleted. |
| 6. | 6. Section 3.5.4.3, Cost, Page 3-53, First Paragraph | The cost for remediation appears to be mis-typed. The range is stated as "$41 million and $12 million." Should this read "$41 million and $120 million?" | Sentence revised to state $120 million. |

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| 7. | 7. Table 3.2, Screening of Preliminary Alternatives, Page 3-68 | Alternative 2 and Alternative 3 are listed as essentially the same technology; however, in the screening process alternative 2 appears to replace Alternative 3 as the natural attenuation alternative. Natural attenuation is undeveloped for nitroaromatics; however, its effectiveness for TCE is well documented and easily monitored with proper placement of monitoring points. One of the alternatives that is retained should address this fact. | The protocol on natural attenuation of chlorinated aliphatic hydrocarbons such as TCE requires extensive groundwater modeling to demonstrate that contaminant degradation will reduce concentrations below cleanup goals before potential exposure pathways are reached. The underground stratigraphy within the TCE-contaminated zone of the aquifer is heterogeneous and has been conceptualized to be a diffuse flow system, with superimposed conduit flow in large isolated fractures. These two regimes of groundwater flow greatly increase the complexity of the three-dimensional contaminant transport and flow modeling necessary to demonstrate natural attenuation. As such, it would be very difficult to model contaminant transport in sufficient detail to distinguish between decreases in TCE concentration due to dispersion versus decreases by degradation or other natural means. Whether natural attenuation is proven through detailed groundwater simulation is a major distinction between Alternatives 2 and 3, and was one of the reasons why Alternative 3 was not retained for further consideration. Further explanation on the screening of the various alternatives is provided in Section 3.6 (Screening Summary and Identification of Final Alternatives). |
| 8. | 8. Section 4, Detailed Analysis of Final Alternatives, Page 4-1 | The text states that two of the alternatives were retained from Section 3. However, there are four alternatives presented. Please list all retained alternatives. | Comment noted and text has been revised. |
| 9. | 9. Section 4.3.6, Implementability, Page 4-19 | Explain the reasoning behind the design flow rate of 1L/s. This was not explained in the text. This would provide for a system flow rate of 3000 gpm to 9750 gpm. | Revised "1 L/s" to "1.2 L/min." A reference has added to support 0.3 gpm value. |

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| 10. | 10. Section 4.3.6, Implementability | The text lists the WSSRAP on-site disposal cell as a location for disposal services. Please explain if this is short-term disposal or disposal over the life of the project. If the latter, please verify whether the Department of Energy is willing to accept wastes for the next 30 years. | Sentence revised to state that site disposal cell is only available as an option for disposal of waste in the "short term." |
| 11. | 11. Appendix F | The use of Unit Price Books supplied with RACER should be done with caution. For example, in Table F.3 on Page F.9 for the concrete surface pad, the RACER database lists this as $3.66 per 2 in x 2 in x 4 in pad, which is not realistic. The cost breakdown sheets need to be reviewed carefully to ensure that the estimates are reasonable. These discrepancies can cause bias with cost estimating. | Reviewed spreadsheets and revised Appendix F accordingly. |

**MDNR Glen Carlson**
**Major Comments**

**Attachment. Responses to Comments on the Draft Final Feasibility Study for Remedial Action for the Groundwater Operable Units, March 1998**

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| 1. | 1. | The alternative "would satisfy the statutory preference for treatment as a principal element of remediation and provides reduction in toxicity, mobility, or volume of the contaminated groundwater through treatment."<br><br>Nevertheless, DOE and the Army declare this alternative has the highest cost. This is based on highly uncertain estimates of the number of wells required to remediate *all* TCE-contaminated groundwater above cleanup standards. For the WSOW, the estimates vary from 12 to 5,380 wells; for the WSCP, the estimates vary from 258 to 1,080 wells. It should also be noted that of the 258 wells estimated for the WSCP, 111 are estimated for a single cluster of wells; another estimate of 299 wells for the WSCP 200 are estimated for "zone 1." For the WSOW, as well, for one estimate of 28 wells, 20 wells are for a single contaminated zone.<br><br>In addition to the well clusters and contamination zones identified in Appendix C of the FS, other possible candidates include nitrate-contaminated groundwater north and south of the raffinate pits, uranium-contaminated groundwater north of the raffinate pits, and 2,4-DNT-contaminated groundwater in the northeast corner of the WSCP.<br><br>We repeat our suggestion that DOE and the Army identify localized areas of high contamination ("hot spots") and evaluate the feasibility of remediating <u>individual</u> hot spots. DOE and the Army should not limit their evaluation to alternatives that remediate <u>all</u> hot spots. | In response to this comment and to provide additional information for comparison, Alternative 4 (Groundwater removal and on-site treatment using GAC) was added for detailed analysis. An additional alternative, Alternative 9 (In-situ chemical oxidation of TCE by Fenton Chemistry) has also been added to provide the necessary information regarding this technology.<br><br>The analysis presented in Appendix C provides for estimates of the number of extraction wells needed for all observed zones of contamination at both the WSCP and the WSOW. The additional candidate areas suggested in this comment were included in the analysis. The nitrate and uranium north and south of the raffinate pits are analyzed in Zone 3 and the 2,4-DNT at northeast corner of the WSCP analyzed in Zone 1 (see Appendix C of FS). We acknowledge that there are uncertainties in the calculations but these uncertainties are primarily related to the complex hydrogeology and heterogeneous geology of the site.<br><br>Although the recently completed pump test performed at the TCE area of the WSCP indicate that the aquifer was more transmissive than previously estimated, recharge is limited by structural controls, which results in dewatering of the area. Therefore, pump-and-treat may not be effective in that it could still take a long time to affect a decrease in TCE concentrations.<br><br>Essentially, the calculations performed for this alternative indicate that the number of wells and/or the length of time required to remediate the so-called individual "hot spots" are large.<br>Concentrations of nitroaromatic compounds, nitrate, and uranium can be monitored in the next several years to determine positive impacts from source removals. The implementation of a pump-and-treat technology to address these contaminants at this time would be premature and might take an equally long or longer period of time at a greater cost than monitoring. |

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| 2. | 2. | Migration of TCE contamination south of the Chemical Plant across the groundwater divide remains a significant risk. "The areal extent of TCE contamination at the site extends from east of Raffinate Pit 3 to the south and southeast of Raffinate Pit 4." FS, p. 1-18. Assuming, as suggested by DOE, that the raffinate pits are the source of the TCE, contamination has apparently flowed south, *toward* the groundwater divide (See FS, Figure 3.7, p. 3-34). This behavior is not completely inexplicable since TCE, which is denser than water, could migrate against the flow of groundwater. We reiterate our comment made during our review of the GWOU *Remedial Investigation*: What investigation has been made of TCE migration south across the groundwater divide? | On the macro-scale it appears that TCE-contaminated groundwater is flowing toward the groundwater divide. In reality, this feature is not a "line" from which groundwater would flow downgradient from, but rather a broad feature where minor variations in groundwater elevations can occur. Since the TCE contamination occurs in a discrete area, this problem must be dealt with on a micro-scale.<br><br>Utilizing the hydraulic head distribution map from the RI (Figure 3-7), it can be seen that the groundwater divide is a broad feature, which incorporates the area where the TCE contamination has been delineated. A closer comparison of the groundwater elevations in this area indicates that there is typically less than a 1-foot difference across the area south and southwest of Raffinate Pits 3 and 4. All of the wells in this area also have minor fluctuations in groundwater elevation (less than 2.5 ft – RI – Table B.15). Based on this data, the groundwater is flowing along the divide to the trough, which has been identified on the hydraulic head distribution map presented in the RI (Figure 3-7). This trough is connected to the preferential flow system that has been identified to discharge at Burgermeister Spring.<br><br>A tracer test was performed in a well located near the center of the TCE plume. Results show that groundwater originating from this area does not cross the divide, but rather flows north toward Burgermeister Spring. No positive results were identified in the spring itself.<br><br>It is true that TCE, as well as other DNAPLs, could migrate against the flow of groundwater, but in this case there is no free product of DNAPL plume. The TCE present at the chemical plant is in the dissolved phase and will migrate with the groundwater, therefore movement against the groundwater gradients will not likely occur. |

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| 3. | 3. | The justification for waiver of groundwater cleanup standards is incomplete. The need for a Technical Impracticability (TI) waiver is suggested, but no details on the scope of the waiver are given, and the technical justification is flawed and incomplete. DOE and the Army have not yet clearly identified the ARARs or cleanup standards for which the TI waiver is sought and the areas over which the TI waiver will apply. A TI waiver is not a blanket waiver, i.e., groundwater cleanup standards are not necessarily waived for all contaminants throughout the affected areas and for all time. | Comment noted. Discussion regarding TI and its scope is not typically part of an FS. The FS has been revised to provide available data that could be used to support a TI at a later time, if needed. However, discussion regarding need for a waiver has been deleted. |
| 4. | 4. | Reliance on institutional controls shifts responsibility for protecting the public to innocent landowners. Institutional controls should not substitute for active response measures as the sole remedy unless such measures that actually reduce, minimize, or eliminate contamination are not practicable. Treatment and permanent remedies are preferred over simply preventing exposures through legal controls. Institutional controls are a necessary supplement when waste is left in place, when there is no practicable way to actively remediate a site, or when they are the only means available to protect human health. | Comment noted. |

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| | | DOE and the Army have not yet demonstrated that active remediation is impracticable or that institutional controls are the only means available to protect human health. The institutional controls anticipated by DOE and the Army include deed restrictions prohibiting residential or agricultural use of groundwater. Drilling for mineral, water, or other purposes would also be prohibited. Without firs exhausting all practicable active measures, it is inappropriate for the DOE and the Army to attempt to shift to innocent parties (including private landowners) the burden of preventing exposures to contamination and the cost of damaged natural resources. | Active remediation of sources is currently being implemented as part of the chemical plant ROD and Ordnance Works OU1 ROD. The evaluations in the FS indicate that there may be no alternative available to actively address groundwater contaminants in a timely and cost-effective manner because of the limitations imposed by the complex hydrogeology of the site. |
| 5. | 5. | Point of compliance. EPA guidance states, for groundwater, remediation levels should be attained throughout the contaminated plume, or at and beyond the edge of the waste management area. DOE and the Army instead propose that Burgermeister Spring (approximately 1 mile north of the WSCP and WSTA) be the point of compliance for the demonstrating attainment of groundwater cleanup standards. | Comment noted. However, it should be considered that the 1990 NCP Preamble at 55 FR 8753 and page 17 of the *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (EPA 540-R-96-023, October 1996) indicate that in some cases, such as where several distinct sources are in close geographic proximity, it may be appropriate to move the point of compliance to "encompass the sources of release." In such cases, the point of compliance may be defined to address the problem as a whole, rather than source by source. Because contaminated groundwater may discharge and pose a risk to environmental resources, "groundwater PRGs should be set at levels that are protective of these other resources" (page 17, *Rules of Thumb for Superfund Remedy Selection*, EPA 540-R-97-013, August 1997). |

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| 6. | 6. | The risk from multiple contaminants is ignored. CERCLA requires that "where the aggregate risk of [multiple] contaminants based on existing ARARs exceeds $10^{-4}$ or where remediation goals are not determined by ARARs, EPA uses $10^{-6}$ as a point of departure for establishing preliminary remediation goals." DOE and the Army have calculated Preliminary Reduction Goals (PRGs) based on risk from individual contaminants. They have not yet demonstrated that the aggregate risk of multiple contaminants based on existing ARARs does not exceed $10^{-4}$. If the aggregate risk exceeds $10^{-4}$, the PRGs should be recalculated to comply with $10^{-6}$ point of departure. | The risk from multiple contaminants has been determined and presented in the BRA. Calculations of PRGs based on risk from individual contaminants are consistent with EPA recommended methodologies. A review of the PRGs indicate that the aggregate risk from the carcinogenic COCs (i.e., TCE, 2,4,6-TNT, 2,4-DNT, and uranium) should not exceed the $10^{-4}$ risk for the residential scenario. |
| 7. | 7. | Reasonable maximum exposure scenario. The risk-based Preliminary Remediation Goals (PRGs) are correctly based on $10^{-6}$ risk of excess cancers as the point of departure. However, the reasonable maximum exposure (RME) scenario is incorrectly determined to be recreational instead of residential. The proposed PRGs based on the *recreational visitor* exposure scenario are approximately 100 times the values for the residential scenario. DOE and the Army justify their "belief" in the recreational visitor scenario by ignoring the surrounding properties ("It is unlikely that the shallow aquifer *beneath the WSCP and the WSOW* would be used by a future resident." FS, p. 1-20, emphasis added.) or by appealing to unspecified "county zoning requirements for future housing developments" and a limited sample of municipal building permits and new well construction. | The RME of a recreational visitor scenario has consistently been presented in the RI/FS documents prepared for the GWOUs of the WSCP and the WSOW. Therefore, to be consistent, risk-based PRGs were appropriately based on the $10^{-6}$ or Hazard Index of 1 equivalent for the recreational scenario. However, since ARARs for the primary contaminants (TCE, 2,4-DNT, nitrate) are below the $10^{-6}$ risk equivalent or Hazard Index of 1 for the residential scenario, concentration decreases achieving these standards would result in groundwater conditions that would be protective of a residential scenario or use. |

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| | | Well logs provided to DOE and the Army show that several domestic wells in the area are open to the upper, weathered portion of the Burlington-Keokuk Limestone. Domestic use of the groundwater at this level has existed, does currently exist, and can be expected to continue. While DOE and the Army state they are aware of only one off-site private drinking water well shown to contain elevated levels of site-related contaminants and that the problem was resolved by installing municipal water lines to Twin Island lakes, the possibility of contamination of groundwater that could potentially be used for domestic drinking water is not as remote as the reader is led to believe. | Review of the list of wells referenced in the comment has indicated that none of the domestic wells located in the area of influence from both the chemical plant and ordnance works are active or exist. Existing wells screened in the same geologic units are separated from the aquifer present beneath the chemical plant and ordnance works by a regional groundwater divide (Dardenne Creek) and therefore cannot be impacted by either of these sites. |
| 8. | 8. | DOE and the Army continue to misrepresent the position of the State of Missouri. The FS (at p. 1-8) contains the following quote of Mimi Garstang, Deputy Director, Division of Geology and Land Survey: "Although some voids occur in the uppermost bedrock, they are generally isolated and display limited vertical or lateral continuity." We have repeatedly stated that Ms. Garstang made this statement in regard to collapse potential for the disposal cell. She did not, as the FS implies, suggest that voiding could not provide a significant pathway for contaminant migration. DOE and the Army response to our comments is "Comment noted," but they have as yet failed to put ms. Garstang's statement in the proper context. This along with DOE's and the Army's taking credit for natural attenuation without adhering to the applicable technical protocols casts doubt on the entire analysis in the FS. | The text that is the subject of this comment has been revised and reference to Ms. Garstang's report has been deleted. |

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| | | The evaluation of remedial alternatives described in the Feasibility Study does not contain enough information to select one alternative as the preferred alternative. Remedial alternatives that are protective of human health do not survive even preliminary screening, but alternatives that are not protective are analyzed in detail. The minor revisions to the FS do not change our opinion that the evaluation contained in the draft final FS is superficial and seems merely an attempt to justify an alternative preferred by DOE and the Army without regard for the merits. | The evaluation presented in the FS is adequate. Only, that it indicates that perhaps with the exception of in-situ chemical oxidation of TCE, not one of the active remedial alternatives clearly provides a definite increase in protection to human health and the environment in a timely and cost-effective manner. |
| **MDOC (Letter from James Fry)** | | | |

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| 1. | 1. | Thank you for the opportunity to comment on the March, 1998 draft of the *Feasibility Study for Remedial Action for the Groundwater Operable Units At The Chemical Plant And The Ordnance Works Area, Weldon Spring, Missouri.*<br><br>As you know, the Missouri Department of Conservation is owner of more than 14,000 acres surrounding the Weldon Spring Chemical Plant and Weldon Spring Training Area. Our ownership constitutes the majority of non-Federal land potentially impacted by groundwater contamination from the chemical plant and activities associated with it.<br><br>Our agency is interested in the cleanup process both from the standpoint of being an agency responsible for fish, wildlife, and forest resources and also as impacted landowner. We rely heavily on the expertise of the Department of Health and the Department of Natural Resources in matters pertaining to public health and environmental quality. There appear to be no current detrimental impacts to aquatic or terrestrial wildlife resulting from groundwater contaminants, as outlined in this report. | |

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| | | The alternatives selected for final consideration would not actively remediate groundwater contamination, except TCE, as it affects non-Federal (i.e., Department of Conservation) lands. Responsibility for providing protection from remaining contaminants would appear to rest largely on this agency, to be accomplished by not using groundwater and prohibiting its future use through deed restrictions. Table 2.1 Summary of Screening Analysis for Institutional Controls notes that "The DOE and DA have accountability for as long as contamination is present." Further comments in the table note that "Ownership and use of deed restrictions would be easy to implement and resources would be readily available" and that the cost would be "low." Restricting all further extraction of groundwater and minerals from our lands is not without "cost" to our agency and the Missouri Conservation Commission has not agreed to this action. The report does not indicate how much of our property would be restricted or its location. Presumably a deed restriction would be "in perpetuity." | Deed restrictions and other similar methods of groundwater-use restrictions have not been identified by the DOE and the DA.<br><br>The analysis presented in Table 2.1 of the FS was merely describing technical or engineering implementability. We agree administrative implementability of deed restrictions should be acknowledged. Therefore, text in Chapter 2 and Table 2.1 has been revised to reflect this concern. The MDOC would be contacted and consulted before any discussion or plan for groundwater use restrictions takes place. |
| | | The monetary value of land is usually negatively impacted by deed restrictions. As indicated in previous correspondence, our agency has no plans to sell these lands in the foreseeable future, but *never* doing so is not a foregone conclusion. Also, sale of water or mineral rights could be considered. The option of using groundwater for our own purposes also has value, even though we have no immediate need for it.<br><br>This agency will continue to cooperate in planning and implementation of appropriate remedial actions. We believe the report should better reflect the negative aspects, to non-Federal interests, of passive remediation alternatives. | |