Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

JAN 30 1991

Mr. John J. Surmeier
Chief, Uranium Recovery Branch
Division of Low-Level Waste
Management & Decommissioning
Office of Nuclear Materials Safety
and Safeguards
Mail Stop 5-E-2
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Surmeier:

Enclosed for your review and concurrence are two (2) copies of the following documents comprising the final Remedial Action Plan (RAP) for the Belfield and Bowman, North Dakota, uranium mill tailings sites. These documents are furnished to enable you to assist the U. S. Department of Energy (DOE) in decisions involving remedial action at these sites.

Each RAP contains:

- o Volume I - Text, Appendices A through C
- o Volume II - Appendices D and E
- o Appendix F - Subcontract Documents, Final Design and Engineering Calculations
- o Information for Reviewers
- o Information for Bidders - Volumes I through IV
- o Calculations - Volume I through IV

Also enclosed are the DOE's responses to your draft Technical Evaluation Report. Please note that we have modified our original responses to NRC Open Issues number 2 and 5, and NRC Appendix A comments number 7, 22 and 24 (reference letter to the Nuclear Regulatory Commission (NRC) from the Uranium Mill Tailings Remedial Action Project Office, dated June 25, 1990) to provide consistency between our responses and the changes that were made to the final RAP. As agreed to in the meeting of May 15, 1990, between the NRC, the DOE and our Technical Assistance Contractor, and committed to in the letter of June 25, 1990, the definition of the uppermost aquifer has been modified and incorporated into Volume II, Appendix E, Water Resources Protection, Section E.2.1.3 of the final RAP.

Three original signature pages will be forwarded to you as soon as the State of North Dakota has signed and returned the pages to this office. Following execution of the signature pages by all parties, the final RAP

WM-74
WM-15
NL04

will be incorporated as Appendix B of Cooperative Agreement No. DE-FC04-82AL20536 between DOE and the State of North Dakota, and a final published version of the RAP containing an original signature page will be forwarded to you. Any subsequent revision to the final RAP will result in a modification to the cooperative agreement and requires execution by both the DOE and the State of North Dakota, and concurrence by the NRC.

In response to the request made by your office on January 15, 1991, we are forwarding four (4) copies of the above specified report and one copy of the DOE response to NRC comments to your subcontractor, Pacific Northwest Laboratories. If you have any questions, please contact Sharon Arp at (FTS) 845-4628.

Sincerely,

Mark Matthews

Mark Matthews
Project Manager
Uranium Mill Tailings Remedial Action
Project Office

Enclosures

cc w/enclosures:
R. Hall, NRC, URFO

cc w/o enclosures:
C. Smythe, UMTRA
S. Arp, UMTRA
M. Abrams, UMTRA
S. Hamp, UMTRA
S. Wastler, NRC, LLWM
S. Hill, JEG
C. Watson, JEG
J. Oldham, MK-F
D. Bradley, MK-F

NRC/HQ

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.2

1. NRC considers that the level of characterization presented for the ground-water hydrology at the Bowman and Belfield, North Dakota facilities is inadequate to demonstrate whether the water resources will be protected. The primary deficiencies are that:

   a. DOE has not adequately delineated the potentiometric surface areal ground-water flow patterns nor lateral or vertical hydraulic gradients for most of the upper hydrogeologic units identified at the Bowman and Belfield sites.

SECTION 2

Response: Draft TER Subsection 5.2(1.a) By: D. Heydenburg - TAC

Date: June 1, 1990

1. The DOE considers that the level of hydrogeologic characterization at the Belfield and Bowman UMTRA sites in North Dakota is adequate to demonstrate that water resources will be protected, based on evaluation of additional site characterization performed at the Bowman site and modifications to the Remedial Action Plan (RAP) as indicated in this response, and in responses to NRC Technical Review Comments (page 61 of Draft TER).

   a. At the Belfield site, the potentiometric surfaces for the upper zone of fine-grained sediments and the underlying lignite zone have been defined (page D-143, and Figures D.5.7 and D.5.8). Groundwater flow directions and horizontal and vertical hydraulic gradients may be inferred from these data, and are discussed in the document. Although there are only three monitor wells completed in the lignite zone, they are completed in a distinct hydrogeologic unit, and represent hydrologic conditions in the lignite zone (see response to NRC Technical Review Comment 2 on groundwater). The hydraulic gradient in the lignite zone is low, and fluctuations in measured groundwater elevations may result in minor variations in the configuration of the potentiometric surface and in the apparent flow direction over time. The lignite zone at the Belfield site has not been characterized to the extent of the units at the Bowman site because all contaminated material will be removed from the Belfield site, thereby removing the

SECTION 2 (Continued)

potential source of contaminants. Additional hydrogeologic characterization may be performed at the Belfield site during the groundwater restoration phase of the UMTRA Project.

At the Bowman site, the potentiometric surfaces for the middle lignite zone and the lower zone of fine-grained sediments have been defined (page D-151, and Figures D.5.19 and D.5.20). Additional groundwater elevation data collected from the new monitor wells in the upper zone of fine-grained sediments has provided information for completion of a water table map for the upper zone (this figure will be inserted in the revised document before Figure D.5.19). For interpretation of the water table configuration for the upper zone, see the response to NRC Technical Review Comment 10 on groundwater. Groundwater flow directions and horizontal and vertical hydraulic gradients may be inferred from these data, and are discussed in the document. Based on characterization information, there appears to be some hydraulic interconnection between the upper zone and the lignite zone, and the vertical gradient is generally downward through all zones.

Plans for Implementation: Complete

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.2

b. DOE has not adequately characterized the hydraulic properties of the various hydrogeologic units properly, due to:

- o inappropriate analytical methods, and/or
- o not accounting for highly transmissive units encountered during testing, within the average hydraulic property estimates.

SECTION 2

Response: Draft TER Subsection 5.2.5(1.b) By: D. Heydenburg - TAC

Date: June 1, 1990

b. This comment refers to calculation of the hydraulic conductivity from slug test data. The NRC prefers the use of the Bouwer-Rice method (1978 and 1989) and the Cooper, et al. method (1967) for slug test calculations in the unconfined and confined zones, respectively (letter to NRC from F. Spane of PNL, dated September 25, 1989). The Bouwer-Rice method was used for calculations of hydraulic conductivity in monitor wells in the upper zone at the Bowman site, and will be used for calculations of slug test data from the new monitor wells recently installed in the upper zone. This method was also used for calculations in the lignite zone because of the "semi-confined" nature of the unit. The Copper, et al. method will be used for calculations of slug test data from the lower confined zone. Calculations will be modified for the Belfield site as necessary.

Most of the monitor wells completed in the "highly transmissive" lignite zone recharged too rapidly from the slug tests to calculate a numeric value for hydraulic conductivity (see response to NRC Technical Review Comment 3 on groundwater). Hydraulic conductivities derived from slug tests are less reliable than those derived from aquifer pumping tests due to limitations inherent in the technique. Consequently, slug test values for hydraulic conductivity have not been used to calculate the average linear groundwater velocities for the different hydrogeologic units. Hydraulic conductivity values used for these calculations have been derived from aquifer pumping test data, which are more reliable.

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commiss'on

OPEN ISSUES

Draft TER Subsection 5.2.

c. Given (a) and (b) above, DOE has not accurately determined the average linear groundwater velocity or direction for most of the upper hydrogeologic units at the Bowman and Belfield sites.

SECTION 2

Response: Draft TER Subsection 5.2.5(1.c) By: D. Heydenburg - TAC

Date: June 1, 1990

c. The average linear groundwater velocity is an estimate based on reasonable values for hydraulic parameters such as hydraulic condurtivity, hydraulic gradient, and effective porosity. Values for these parameters are selected based on the most representative values (generally averaged) available from hydrogeologic characterization data for the site. Hydraulic conductivity values are based on results of aquifer pumping tests, and not slug test results. Hydraulic gradients are derived from average values from different sampling rounds. General groundwater flow path directions have been determined for hydrogeologic units of concern. References from the literature will be checked for possible ranges of effective porosity for fractured lignites. Sensitivity analyses will be done to evaluate the effects of parameter variation on the average linear groundwater velocity.

Plans for Implementation: N/A

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.2.

d. DOE has not adequately delineated the extent of areal contamination within the upper hydrogeologic units at the Bowman and Belfield sites due to a lack of spatially located borehole/monitor well sites. The NRC recommends that DOE collect/monitor well sites. The NRC recommends that DOE collect additional information, install additional monitoring well facilities, and re-analyze the existing test data to improve the level of characterization within the RAP for ground-water hydrological conditions at the Bowman and Belfield sites.

SECTION 2

Response: Draft TER Subsection 5.2.5(1.d) By: D. Heydenburg - TAC

Date: June 1, 1990

✓ d. Since the contaminated materials from both the Belfield and Bowman sites will be consolidated at the disposal site at Bowman, more intensive characterization was completed at the Bowman site. Additional hydrogeologic characterization may be undertaken at the Belfield site during the groundwater restoration phase of the UMTRA Project as needed to delineate further the extent of contamination related to uranium processing activities. Additional hydrogeologic characterization has been performed at the Bowman site, as a result of initial comments from the NRC, to further delineate the extent of contamination related to the uranium processing activities in the upper hydrogeologic zone. Results of water quality analyses and extent of contamination will be discussed in the final RAP. Additional hydrogeologic characterization will be undertaken at the Bowman site during the groundwater restoration phase of the UMTRA Project as needed. The location and configuration of the disposal cell will not preclude access for further characterization and remedial action of the groundwater as dictated by the next phase of the Project.

Plans for Implementation complete

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990
Document: Preliminary Final Remedial Action Plan
Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.2.5

2. If DOE's performance assessment relies partly on reducing conditions to attenuate hazardous constituents, then DOE needs to provide more rigorous methods to show that: (a) reducing environment exists at Belfield, and (b) that the groundwater travel time through the lignite zone is sufficient that the reducing conditions do have an effect.

SECTION 2

Response: Draft TER Subsection 5.2.5(2) By: D. Heydenburg - TAC
Date: ~~June 1, 1990~~ January 15, 1991

2a. Additional geochemical characterization has been performed at the Bowman site since July 1989. Core samples were taken from five boreholes in the vicinity of the site from the surface to just below the lignite zone, and were analyzed for geochemical parameters. Results of the study indicate reducing conditions in and adjacent to the lignite zone which tend to immobilize some metals encountered in groundwater. The revised document will include the results of the geochemical characterization and the effects on water resources. Additional geochemical characterization was not performed at the Belfield site as it was not considered necessary for development of the compliance strategy for groundwater protection.

2b. Discussion of groundwater flow characteristics in the lignite zone and adjacent units at the Bowman site has been revised - see Section D.5.4.2 of RAP.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________
Approved By: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.3.1

3. DOE must more rigorously demonstrate that the disposal cell cover will maintain a hydraulic conductivity of 10^{-8}cm/s and DOE needs to provide more complete information showing how the hydraulic conductivity of the infiltration/radon barrier of the disposal cell cover varies with changes in moisture.

SECTION 2

Response: Draft TER Subsection 5.3.1(3) By: N. Larson - TAC

Date: June 1, 1990

3. Standard laboratory testing has been performed on the materials to be used in the cover for the disposal cell at the Bowman site. All work was done in accordance with the procedures described in the DOE UMTRA Project Technical Approach Document.

   Laboratory tests results for the hydraulic conductivity of the cover materials conducted by Jacobs Engineering are in Appendix D of the RAP. These tests were performed on samples compacted to 95 percent of standard compaction. Table D.4.7 of the RAP shows that the radon barrier material has an hydraulic conductivity between 6.3E-9 and 2.5E-8 cm/s when compacted at 95 percent of standard compaction.

   Morrison Knudsen Environmental Services (MK-ES) performed more laboratory tests to quantify the effect of bentonite on the hydraulic conductivity of potential radon/infiltration barrier materials. In addition, the MK-ES tests were run on samples compacted to 100 percent standard compaction. The results of the MK-ES tests are shown in the MK-ES "Information to Bidders, Volume III," page A-163. These tests included samples not amended with bentonite. The test results showed that the addition of bentonite does not reduce the hydraulic conductivity of the cover materials. The average hydraulic conductivity for samples without bentonite, but compacted to 100 percent standard compaction, averaged 4E-9 cm/s; the highest hydraulic conductivity was 5.3E-9 cm/s.

   Construction specification call for compaction of the cover materials to a minimum of 100 percent standard compaction. The hydraulic

SECTION 2 (Continued)

conductivity used in the design, i.e., 1E-8 cm/s, is therefore nearly half an order of magnitude greater than the highest test value.

All testing was on saturated samples. As the cover materials dry, the hydraulic conductivity will decrease and be lower than the saturated condition. Since analyses were conservatively based on saturated parameters, a detailed discussion of the relationship of moisture content and hydraulic conductivity was not included. We do know that in general there is a decrease of hydraulic conductivity as the soil moisture content decreases, hence cover flux will be less than the design value of 1E-8 cm/s for partially saturated radon/infiltration barrier materials.

In order to maintain the low hydraulic conductivity of the radon/infiltration barrier and to insure that the hydraulic conductivity will not increase with time, reasonable engineering details have been included in the design of the disposal cell.

There is an 84-inch cover above the radon/infiltration barrier to protect it from both frost and desiccation cracking. The thick layer is also expected to protect the radon/infiltration barrier from root intrusion since most vegetation that will establish at the disposal cell is short-rooted prairie grass. Hence, it is unlikely that any of these mechanisms will lead to an increase in the permeability of the radon/infiltration barrier with time.

The radon/infiltration barrier material on the top and sides will experience very little shear stress since the steepest slope is only five horizontal to one vertical (5:1). A volume increase, hence permeability increase, due to shear is not expected. Indeed, the clays may have some thixotropic properties that would help them increase in strength with time. Strength increases could cause permeability decreases.

Because of the need to maintain the constructed radon barrier permeability over time, it will be most inappropriate and even imprudent to install any monitoring holes (including neutron probe holes) into or through the constructed radon barrier. Any such holes would be potential points at which cover distress could initiate and from which cover degradation could spread. Accordingly we strongly urge against any new NRC requirement to install monitor holes through the radon barrier to confirm (at best short-term) radon/infiltration barrier permeability.

Plans for Implementation: None

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: __________

Approved by: ______________________ Date: __________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.4.1.1

4. DOE needs to add Nitrate and gross alpha to the list of hazardous constituents, provide an explanation why beryllium, cobalt, thallium and tin where not analyzed for and perhaps add them to the list of hazardous constituents, and sample for organics.

Response: Draft TER Subsection 5.4.1.1 By: D. Heydenburg - TAC

Date: June 1, 1990

4. Concentrations of nitrate in groundwater of approximately two times the MCL of 44 mg/l occur in lysimeter 545 at the Belfield site, in monitor well 517 (completed in the upper zone) at the Bowman site, and in several existing wells approximately one mile northwest (and generally upgradient) from the Bowman site. Concentrations of nitrate in groundwater are not expected as a result of uranium processing activities at either the Belfield or Bowman sites, because the processing operation involved only combustion of the lignite, and no chemical, metallurgical, or nuclear processes were used. Concentrations of nitrate detected at the two sites are most likely a result of application of fertilizer to adjacent cultivated lands or effluent from nearby septic tanks. Similar concentrations of nitrate detected in shallow groundwater in existing wells northwest of the site substantiate these potential sources. Therefore, nitrate is not considered a hazardous constituent related to uranium processing activities at the sites.

Activities of gross alpha have not been determined for the source at the sites because of insufficient water available from the suction lysimeters to perform the analyses. Activities of gross alpha in groundwater beneath the Bowman site are variable, and are within the range of two times the MCL. Although not considered a problem at the site, gross alpha will be considered a hazardous constituent at the Bowman site and will be added to the list.

SECTION 2 (Continued)

Beryllium, cobalt, thallium, and tin were not on the list of potentially hazardous constituents during the earlier phases of site characterization activities at the Belfield and Bowman sites, and therefore were not routinely analyzed for. Analyses have been performed for these constituents during more recent water quality sampling rounds, with beryllium and tin being below detection limits, and cobalt and thallium showing up at several locations. Concentrations of these constituents will be evaluated and added to the list if applicable.

Since no organic chemicals were used in the uranium processing activities at either of the sites, screening for organic constituents was not included as part of the routine site characterization. Samples from selected monitor wells at the Bowman site have recently been analyzed for organics, and none have been observed above detection limits.

Plans for Implementation: Complete

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990
Document: Preliminary Final Remedial Action Plan
Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.4.1.2

5. An alternative POC should be considered after more rigorous hydrogeologic characterization is done.

SECTION 2

Response: Draft TER Subsection 5.4.1(5) By: D. D. Heydenburg - TAC
Date: ~~June 1, 1990~~ January 5, 1991

5. Recent Hydrogeologic characterization data for the upper zone of fine-grained sediments at the Bowman site have indicated that the saturated interval in the upper zone is not a laterally continuous integrated aquifer unit, but consists of groundwater in "perched" zones and in heterogeneous units with lateral and vertical facies variations (see response to NRC Technical Review Comment 10 on groundwater). However, there is some hydraulic interconnection between groundwater in the upper zone and the lignite zone, and the upper zone functions as a pathway for contaminant migration into the lignite zone. Therefore, for purposes of regulatory compliance with the EPA groundwater protection standards, the uppermost aquifer would include the entire saturated thickness of sediments from the water table (represented by groundwater elevations for monitor wells completed in the upper zone) through the base of the middle lignite zone (the 10+ foot thick interval of silty claystone that underlies the lignite zone would comprise the basal confining unit for the lignite zone and therefore the uppermost aquifer). The water resources protection strategy will be modified to reflect the expanded definition of the uppermost aquifer. Since the groundwater flow directions are somewhat variable for the potentiometric surfaces of these two units of the uppermost aquifer, the point of compliance for post-remedial action groundwater monitoring purposes should be extended to cover the eastern and southern boundaries of the disposal cell. Monitor wells should be completed in both zones of the uppermost aquifer.

SECTION 3

Confirmation of Implementation:

Checked by: ____________________ Date: ____________________
Approved By: ____________________ Date: ____________________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.4.2

6. A more complete performance assessment shall be performed and more fully described in the RAP such that the NRC and/or an independent group can evaluate if the proposed disposal cell design along with the natural site conditions will be able to limit constituents to the MCL's or background concentrations at the POC.

SECTION 2

Response: Draft TER Subsection 5.4.2(6) By: D. Heydenburg - TAC

Date: June 1, 1990

6. The performance assessment section will be revised to reflect the recent data collected at the Bowman site, and the modified definition of the uppermost aquifer. A summary of geochemical conditions at the Bowman site and effects on the water resources protection strategy will be included in this section. Calculation sets are available to verify procedures used in evaluating performance of the disposal cell.

Plans for Implementation: Complete - section E.3.2, pg. E-19

SECTION 3

Confirmation of Implementation:

Checked by: __________ Date: __________

Approved by: __________ Date: __________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.4.2

7. DOE needs to demonstrate that the predicted groundwater discharge volume is reasonable.

SECTION 2

Response: Draft TER Subsection 5.4.2(7) By: D. Heydenburg - TAC

Date: June 1, 1990

7. Based on recent information collected at the Bowman site and the modification to the definition of the uppermost aquifer, infiltration of tailings leachate and groundwater discharge volumes will be reevaluated and substantiated in the applicable calculation sets.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ____________________ Date: ____________

Approved by: ____________________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.3.1

8. Until the performance capabilities of the infiltration/radon barrier is adequately assessed by DOE, NRC cannot evaluate if release will be minimized sufficiently.

SECTION 2

Response: Draft TER Subsection 5.3.1(8) By: D. Heydenburg - TAC

Date: June 1, 1990

8. The performance capabilities of the infiltration/radon barrier for the Bowman disposal cell will be reevaluated as indicated in responses to comments 3, 6, and 7 above.

Plans for Implementation: Complete

SECTION 3

Confirmation of Implementation:

Checked by: ____________________ Date: ____________

Approved by: ____________________ Date: ____________

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UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: ____________

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.4.4

9. The extent of contamination at Bowman needs to be better defined before DOE can design an adequate post-disposal ground-water monitoring program at Bowman. The extent of contamination at Belfield needs to be further defined before DOE can design an adequate cleanup program of relict contaminated groundwater.

SECTION 2

Response: Draft TER Subsection 5.4.4(9) By: D. Heydenburg - TAC

Date: June 1, 1990

9. The extent of existing groundwater contamination in the upper zone of fine-grained sediments at the Bowman site has been more adequately delineated based on water quality results from recently installed monitor wells. These data will be included in the revised document. The extent of existing contamination in groundwater in the lignite zone has previously been delineated. This information will be used as a baseline for comparing results of groundwater monitoring during the post-remedial-action period.

Plans for Implementation: Complete

SECTION 3

Confirmation of Implementation:

Checked by: ____________ Date: ____________

Approved by: ____________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.4.5

10. DOE needs to submit a corrective action plan for Bowman.

SECTION 2

Response: Draft TER Subsection 5.4.5(10) By: D. Heydenburg - TAC

Date: June 1, 1990

10. The corrective action plan (E.3.5) will be expanded to include additional failure scenarios of the disposal unit along with appropriate corrective action measures that could be implemented within 18 months after a potential exceedence of the groundwater standards.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

JACOBS ENGINEERING GROUP INC., ALBUQUERQUE OPERATIONS

TO: [redacted]atson

FROM: RHeydenburg

DATE: January ?, 1991

SUBJECT: Belfield/Bowman Site: NRC-TER "Open Issue Number 10" - Revision

With reference to the NRC-TER (January 12, 1991) "Open Issue Number 10" for the Belfield/Bowman site, the following revised response is submitted (see initial response of June 1, 1990, submitted to the DOE on June 8, 1990).

> "The potential for failure of the disposal cell at the Bowman disposal site is unlikely and the worst-case failure scenario is discussed in Section E.3.5 of the RAP. A detailed corrective action plan will not be submitted until an excursion is identified. At such time, alternative corrective action plans would be evaluated that could be implemented within 18 months of detection of an excursion."

RH/11

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.5

11. DOE needs to demonstrate in the RAP that disposal of the tailings at Bowman can proceed independently of restoration.

SECTION 2

Response: Draft TER Subsection 5.5(11) By: D. Heydenburg - TAC

Date: June 1, 1990

11. Section E.4 will be revised to demonstrate that disposal of contaminated materials at the Bowman site can proceed independently of groundwater restoration activities.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: __________

Approved by: ______________________ Date: __________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: June 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

OPEN ISSUES

Draft TER Subsection 5.5

12. DOE needs to provide a restoration plan for Belfield and Bowman.

SECTION 2

Response: Draft TER Subsection 5.5(12) By: D. Heydenburg - TAC

Date: June 1, 1990

12. The groundwater restoration plan will be developed and implemented under the next phase of the UMTRA Project.

Plans for Implementation: N/A

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ____________

Approved by: ______________________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

CONFIRMATION ITEMS

Draft TER Subsection 6.2.1

1. DOE should confirm that the assumed value of 1.0 pCi/l for the ambient air radon concentration is a representative value by conducting field measurements.

SECTION 2

Response: Draft TER Subsection 6.2.1 By: M. Miller - TAC

Date: June 1, 1990

1. Agreed. The actual air radon concentration will be measured before, during, and after remedial action.

Plans for Implementation: N/A

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: ______

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

CONFIRMATION ITEMS

Draft TER Subsection 5.4.1.2

2. DOE needs to provide details of their POC ground-water monitoring program in their Surveillance and Maintenance Plan at Bowman.

SECTION 2

Response: Draft TER Subsection 5.4.1.2(2) By: D. Heydenburg - TAC

Date: June 1, 1990

2. Details of the point of compliance groundwater monitoring program will be provided in the Surveillance and Maintenance Plan.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______ Date: ______

Approved by: ______ Date: ______

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

GROUNDWATER

Page D-187, Table D.5.3

1. Water-level data for well 523 are not presented in the report. If there is a reason for not including these data (i.e., because of non-representativeness), then this should be discussed in the text. Otherwise, these data should be utilized in development of the potentiometric map for the hydrogeologic unit it monitors.

SECTION 2

Response: Page D-187, Table D.5.3 By: D. Heydenburg - TAC

Date: June 1, 1990

1. Groundwater elevation (water-level) data for monitor well 523 (installed in 1982) at the Belfield site are not included because the well is no longer being used as a sampling point. The monitor well was screened in a predominantly claystone zone and lacked hydraulic interconnection with more permeable units of the upper zone of the Sentinel Butte aquifer system in the vicinity of the site. Therefore, water-level data from this monitor well were not considered to be representative of site conditions.

Plans for Implementation: see pg D-143, section D.5.3.1

SECTION 3

Confirmation of Implementation:

Checked by: __________ Date: __________

Approved by: __________ Date: __________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

GROUNDWATER

Page D-143, Figure 5.8

2. This is a little misleading with respect to flow in the lignite--i.e. only three wells. A three-point problem for solving ground-water flow direction and gradient assumes all three points are on the same planar surface. If they are on convergent flow planes (e.g, upper fine-grained), this could give anomalous results. In examining several measurements items, completely different gradients and flow directions are also indicated, e.g., 3/88 Hgrad. = .0001 S-SE flow direction; 3/87 Hgrad. = .001 E-NE flow direction. It is recommended that a potentiometric map for the lignite zone, based on more data points, be presented in the RAP.

SECTION 2

Response: Page D-143, Figure 5.8 By: D. Heydenburg - TAC

Date: June 1, 1990

2. The potentiometric surface for the lignite zone at the Belfield site (Figure D.5.8) was determined from three monitor wells completed in the lignite zone (and thus representing the same "planar surface" of a hydrogeologic unit, the lignite zone) (see Figures D.5.4 and D.5.5 for cross sections showing screened intervals in the lignite zone). The hydraulic gradient observed in the lignite zone is low because of the low topographic relief in the area and the relatively higher transmissivity in the fractured lignite, which facilitates equilibration of water levels. Since the hydraulic gradient is low, minor variations in water levels measured at different times will affect the configuration of the potentiometric surface. Data from all measurements were plotted, and the groundwater flow direction was generally towards the east (with variations north and south of east), with a hydraulic gradient "averaging" 0.0004 (range from 0.0001 to 0.001). Figure D.5.8 shows the potentiometric surface based on measurements taken during March 1987, which is representative of average groundwater flow directions (and also has a consistent date with the potentiometric surface map shown in Figure D.5.7 for the upper zone).

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Page D-143

3. The fact that two slug test recovered too quickly for analysis should not preclude the assignment of a greater than (≤) value for hydraulic conductivity. Because of their importance in calculating groundwater velocity, these higher hydraulic conductivity test values should be incorporated in estimating the average hydraulic conductivity for this unit. In addition, some discussion should be devoted somewhere about the reason for the high transmissivity in the lignite zones, e.g., due to fractures and joints, etc.

SECTION 2

Response: Page D-143 By D. Heydenburg - TAC

Date: June 1, 1990

3. Measurements of water level recovery during slug tests were taken with an electric sounder and not a pressure transducer, resulting in relatively infrequent measurements every 0.5 minute (versus multiple readings taken during a similar time period with the more sophisticated equipment). Thus, the rapid recovery noted in wells completed in the lignite zone was too rapid to get any meaningful data when measuring at 0.5 minute intervals, and a "greater than" value for hydraulic conductivity (as determined by the Cooper, et al. method) would not be meaningful.

   Hydraulic conductivities derived from slug tests are less reliable than those derived from aquifer pumping tests due to limitations inherent in the technique. The slug tests provide a relative indication of the differences in hydraulic conductivity between the hydrogeologic units, and indicate the range of variability in hydraulic conductivity in each unit across the site. Consequently, these slug test values for hydraulic conductivity have not been used to calculate the average linear groundwater velocities for the different hydrogeologic units. Hydraulic conductivity values used for these calculations have been derived from aquifer pumping test data, which are more reliable.

   The high transmissivity in the fractured lignite zone at the Bowman site is discussed on page D-151.

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4. The pumping test (DOE 1983a) is of particular interest due to possible: 1) time-variant behavior of water-quality parameters; 2) observation well response(s), 3) boundary effects, e.g., from river influence, leakage from the overlying upper-confined, etc and 4) effects from partially penetrating wells. No information, however, is provided in the text concerning any of these hydrologic phenomena. Including this type of information in the RAP would improve the ground-water hydrological characterization for the various hydrogeologic units investigated at both sites.

SECTION 2

Response: Page D-143 By: D. Heydenburg - TAC

Date: June 1, 1990

4. The aquifer pumping test conducted in monitor well 521 (in the lignite zone) at the Belfield site was performed during 1982 by an earlier contractor on the UMTRA Project, and the only data available are those presented in the referenced document (DOE, 1983a). This was a single-well pumping test run for 6.1 hours at two different discharge rates, and only transmissivity and hydraulic conductivity were estimated without reference to any other hydrogeologic parameters or phenomena. No additional aquifer pumping tests were deemed necessary during this phase of the project at the Belfield site, but should be undertaken during the groundwater restoration phase. Aquifer pumping tests have been conducted in units at the Bowman site (which will also be the disposal site for materials from both the Belfield and Bowman sites) (see page D-152).

Plans for Implementation: N/A

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5. The average linear ground-water velocity for the lignite zone is questionable due to the uncertainties in hydraulic gradient and hydraulic conductivity (see previous comments to RC #4 and #5). In addition, the effective porosity is probably much lower (perhaps 5-10%) due to the predominance of fracture permeability. Justification for parameter estimates used in calculating ground-water velocities (e.g., hydraulic gradients, hydraulic conductivity, etc.) should be provided. New estimates for the average linear ground-water velocity should be calculated based on the recommended revisions outlined in RC #3 and #4.

SECTION 2

Response: Page D-144 By: D. Heydenburg - TAC

Date: June 1, 1990

5. The average linear groundwater velocity is an estimate based on reasonable values for hydraulic parameters such as hydraulic conductivity, hydraulic gradient, and effective porosity. Values for these parameters are selected based on the most representative values (generally averaged) available from hydrogeologic characterization data for the site. Hydraulic conductivity values are based on results of aquifer pumping tests and not on slug test results. Hydraulic gradients are derived from average values from different sampling rounds. References from the literature will be checked for possible ranges of effective porosity for fractured lignites. Sensitivity analyses will be done to evaluate the effects of parameter variation on the average linear groundwater velocity.

Plans for Implementation: N/A

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Page D-145

6. The identification of the location used to store sludge and stack residues on the north side of the site is probably important with regard to establishing point source/ground-water contamination relationships. Surface runoff from the site could also be important for recharging the underlying zones with contaminated water. Information should be provided that indicates the likely location(s) for the storage of these wastes on site.

SECTION 2

Response: Page D-145 By: D. Heydenburg - TAC

Date: June 1, 1990

6. The exact locations of potential point sources for contaminants related to uranium processing activities at the sites are difficult to ascertain because of the lack of historical information available concerning locations of lignite stockpile areas, sludge disposal ponds, etc. Available information indicates that these potential point source areas were located within the designated site boundaries. Runoff of surface water from the site could also contribute contaminants to groundwater because of infiltration of water through contaminated soils in the unsaturated zone.

Plans for Implementation: N/A

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Page D-147

7. NRC staff concurs that contamination of deeper potable aquifers appears to be of no concern because of depth and distance conditions. However, general rates of pumping and drawdowns observed at the nearby municipal sites (i.e., the town of Belfield) should be presented to qualitatively assess the potential vertical leakage from overlying contaminated sources. Although the DOE has indicated that the contaminated upper aquifer systems (at both the Belfield and Bowman sites) are not being used for public supply, they are being used for domestic uses. The specific domestic uses are not indicated. However, information on the specific domestic uses is important in determining possible indirect exposure to people using the water. Further, the people using the water should be informed about the possible risks associated with exposure to the contaminants in the water. Additionally, the groundwater pumpage may effect the rate and direction of contaminant movement in the immediate area near the groundwater.

SECTION 2

Response: Page D-147 By: D. Heydenburg
Date: ~~June 1, 1990~~ January 15, 1991

7. Review of existing data indicated that no additional significant information was available on water resource use in the vicinity of the Belfield and Bowman sites. The Belfield municipal wells are completed to depths of approximately 1800 feet below the surface in hydrogeologic units that are not hydraulically connected with the shallow hydrogeologic units. Contamination of groundwater in the deeper aquifers caused by site-related contamination appears to be of no concern. Use of groundwater for domestic purposes is limited in the site areas, and people are aware of the groundwater quality issues.

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Page D-150

8. Tl 'stence of an artesian flowing well one-half mile west of the B. site suggests a local discharge phenomena, i.e., this condition doe. not exist in a recharge area. This also contradicts the text statement of no discharge to surface water bodies. Efforts should be made to reconcile these opposing hydrological conceptual models. For example, if the artesian flowing well is believed to "tap" deeper confined aquifer units (e.g., based on available hydrochemical data), then this could be the rationale utilized for explaining the different vertical ground-water gradient conditions.

SECTION 2

Response: Page D-150 By: D. Heydenburg - TAC

Date: June 1, 1990

8. Flowing water from existing well 593, approximately 0.5 mile west of the Bowman site, does not represent a natural discharge phenomenon, but is a result of a well penetrating a hydrogeologic unit under confining conditions. This well is upgradient, so there is no potential for groundwater in this area being contaminated as a result of uranium processing activities at the Bowman site. Water quality data indicate that the water is similar to water from other domestic wells in the vicinity that are completed in deeper hydrogeologic units. The statement regarding no discharge of groundwater to the surface refers to groundwater from the unconfined upper zone or the semi-confined lignite zone in the vicinity of the Bowman site.

Plans for Implementation: N/A

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Page D-165 through 171, and D-177 through 182

9. It is misleading on water table, potentiometric, and hydrochemical isopleth maps to show all site boreholes when the figure is delineating an areal pattern for only one of the three hydrogeologic units (e.g., Figure 5.20, D-178). It gives the impression that more data is available than actually there.

   In addition, contours should be dashed and not solid where the pattern is uncertain (i.e., for these figures, most of the contours should be dashed--not solid). The current contouring usage gives a false sense or certainty in the spatial patterns.

SECTION 2

Response: Page D-165-171, D-177-182 By: D. Heydenburg - TAC

Date: June 1, 1990

9. A standard base map was used for potentiometric surface and concentration distribution maps that showed all monitor well locations as points of reference. Where data were available for a particular point, values for such data were shown adjacent to the point, all other points were left blank. For clarity, extraneous points will be deleted. Contour lines will be reviewed to ascertain representativeness of data presented.

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Page D-178

10. Figure D.5.20 has only five data points. The potentiometric surface could just as easily be contoured like the overlying lignite zone (i.e., Figure D.5.19), which has more control data points for its construction. NOTE: The upper aquifer only has five data points also, and the text (D-151) states that the "...data are not sufficient to construct a potentiometric surface.

The NRC staff believes that the potentiometric pattern for the lower aquifer is expected to be similar to that of the directly overlying lignite zone (i.e., due to its interconnectedness and close proximity). It is recommended that a dashed contoured pattern be constructed for this hydrogeologic unit.

SECTION 2

Response: Page D-178 By: D. Heydenburg - TAC

Date: June 1, 1990

10. Based on the groundwater elevation data points available for the lignite zone (9 points) and the underlying zone of fine-grained sediments (5 points) at the Bowman site, the configurations of the potentiometric surfaces for the two zones are distinctive and different. There is no reason to expect that the potentiometric surfaces should be similar, as they represent two distinct hydrogeologic units with different hydrological characteristics. The main similarity is that groundwater in both zones flows generally toward the east and south, which reflects the regional flow direction. The hydraulic gradient in the lignite zone is low (less than 0.001) and spatially variable, which will result in minor variations in apparent flow direction over time. The hydraulic gradient in the lower zone is relatively consistent and higher than in the lignite zone (approximately 0.005). Hydraulic interconnection between the lignite zone and sandier intervals of the lower zone is presumed to be minimal because of the relatively consistent silty-clay unit directly underlying the lignite zone (lower confining unit for the uppermost aquifer).

SECTION 2 (Continued)

Eight additional monitor wells have been completed in the upper zone of fine-grained sediments at the Bowman site in response to initial comments by the NRC on the preliminary final RAP (July 1989) regarding lack of spatially located monitor wells to define hydraulic parameters in this zone further. The configuration of the water table, based on groundwater elevations measured during March 1990 in ten DOE monitor wells completed in the upper zone, indicates a northwest-southeast trending ridge (from monitor well 517 to 525), with local groundwater flow to the northeast and southwest at a gradient of approximately 0.004. Interpretation of these data indicate that the saturated interval in the upper zone is not a laterally continuous integrated aquifer unit, but consists of groundwater in "perched" zones and in heterogeneous units with lateral and vertical facies variations. There is hydraulic interconnection within this saturated interval, but varying water levels result from differential equilibration of water percolating through the interval. This interpretation is based on the water table configuration, data from aquifer pumping tests in five monitor wells in the upper zone, and the lithologic characteristics of the upper zone (lateral and vertical facies variations with a predominance of clay- and silt-sized material).

Plans for Implementation: Complete - see pg D-153/154, Figure D-5.20

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GROUNDWATER

Page D-152

11. Results from the pumping tests are stated to indicate "...semi-confined conditions in the lower zone." The basis for this statement is not indicated in the text or tables. If it is based on storativity value calculations only one storativity value is listed in Table 5.9 (for the lignite zone), and it is indicative of confined aquifer conditions. The basis for classifying these zones as being semi-confined and confined should be provided.

SECTION 2

Response: Page D-152 By: D. Heydenburg - TAC

Date: June 1, 1990

11. The indication of semi-confined conditions for groundwater in the lignite zone at the Bowman site is based on the observation of a recharge source to groundwater as the pumping test (monitor well 526) progressed. This recharge was interpreted to be leakage from the overlying sediments of the upper zone (as indicated by drawdown in adjacent monitor well 517 completed in the upper zone). The upper zone is characterized by lateral and vertical variations in litnology with variable degrees of hydraulic interconnection between the units, resulting in semi-confining conditions for groundwater in tha lignite zone.

Plans for Implementation: Deleted Statement

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GROUNDWATER

Page D-153

12. The average linear ground-water velocity estimates provided are not valid, due to a biased under-estimate of average hydraulic conductivity (i.e., primarily to the lower fine-grained sediments), and hydraulic gradient uncertainty. New estimates of average hydraulic conductivity should be determined (see RC #4 and #6), and average linear ground-water velocities recalculated for the respective hydrogeologic units.

SECTION 2

Response: Page D-153 By: D. Heydenburg - TAC

Date: June 1, 1990

12. The average linear groundwater velocities calculated for the lignite zone and lower zone at the Bowman site are valid based on the values estimated for the hydraulic parameters used in the equation. The hydraulic conductivities for the lignite zone and lower zone were based on aquifer pumping test data (and not slug test data), and the hydraulic gradients in the zones appear to be reasonable.

Plans for Implementation: Provided additional justification pg D-156, section D.5.4.2

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GROUNDWATER

All Potentiometric Maps

13. It should be recognized that for hydrogeologic units that exhibit significant salinity variations between wells (e.g., for the middle lignite unit, total dissolved solids varies between 1400 and 7700 mg/L) and which have low area hydrauiic gradients (i.e., less than 10-3), potentiometric maps should be presented in potentials expressed in a standard reference fluid density. Conventionally this is normally taken as fresh water (i.e., with a density of 1.00 g/cm^3 at STP conditions) for most hydrologic investigations. Although this is not expected to produce a big difference in predicted ground-water flow patterns (i.e., in comparison to those determined from observed fluid-column salinity conditions), it should be examined for all potentiometric surface maps presented in the report.

SECTION 2

Response: All Potentiometric Maps By: D. Heydenburg - TAC

Date: June 1, 1990

13. The significance of salinity variations between monitor wells, particularly in units that have low areal hydraulic gradients (lignite zone), will be evaluated to determine the affect on the potentiometric surface maps.

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GROUNDWATER

Pages D-264/265

14. There is a discrepancy in the text and Table 6.1 concerning flood records on the Heart River. The text states that the period of record ended in 1984 with a peak discharge of 8,080 cfs recorded on May 9, 1970, while Table 6.1 lists that a peak discharge of 8,080 cfs was recorded in 1987. A revision should be made to correct this inconsistency.

SECTION 2

Response: Pages D-264/265 By: V. Dery - TAC

Date: June 1, 1990

The correct date for the peak discharge of 8,080 cfs is May 9, 1970, and will be revised in the text accordingly.

Plans for Implementation:

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GROUNDWATER

15. As a general statement with respect to hydrological nomenclature it should be noted that the term "hydrostratigraphic unit has been repeatedly misused in the text. As intended by G. Maxey (who proposed the term), a "hydrostratigraphic unit" is reserved for distinguishing between major geohydrologic units...which consist of an aquifer or a combination of aquifers and confining beds that comprise a framework for a reasonably distinct hydraulic system...." It was never intended to be used to describe minor, thin, discontinuous units (which are spatially interconnected), such as found at the Belfield/Bowman sites. It is recommended that the text refer to the upper fine-grained, middle lignite, etc., as local hydrogeologic units and not hydrostratigraphic units.

SECTION 2

Response: Groundwater - No. 15 By: D. Heydenburg - TAC

Date: June 1, 1990

15. The term "hydrostratigraphic unit" is being used in a generic sense to denote stratigraphic units in a hydrogeologic framework. The term "hydrogeologic unit" (as suggested by the NRC) may be substituted for the above term when discussing the upper, middle, and lower units specifically.

Plans for Implementation: The term "hydrostratigraphic unit" has been replaced by the term "hydrogeologic unit"

SECTION 3

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GROUNDWATER

16. With regard to the analytical methods used during site characterization slug tests the following should be noted:

    - The Ferris-Knowles (1963) and Hvorslev (1951) methods should not be used for any of the test analyses, due to inherent analytical limitations. That is why they were replaced by more "rigorous methods" [e.g., Cooper et al. (1967), Bouwer (1989), etc.]

    - The use of the Bouwer-Rice method (1978) should be utilized in view of considerations presented by (Bouwer). [Bouwer, H., 1989. "The Bouwer and Rice Slug Test - An Update" Groundwater 27 (3): 304-309.]

    - The Bouwer-Rice (1978) and Skibitzke (1963) methods should not be used for the semi-confined to confined conditions reported for the middle lignite and lower fine-grained sediments. Instead, the method described by Cooper et al. (1967) is more appropriate and should be used.

SECTION 2

Response: Groundwater - No. 16 By: D. Heydenburg - TAC

Date: June 1, 1990

16. Hydraulic conductivities derived from slug tests are less reliable than those derived from aquifer pumping tests due to limitations inherent in the technique. The slug tests provide a relative indication of the differences in hydraulic conductivity between the hydrogeologic units, and indicate the range of variability in hydraulic conductivity in each unit across the site. The appropriateness of different analytical methods for interpreting slug test data will be evaluated, and modification of existing calculations will be made as necessary.

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GEOTECHNICAL COMMENTS

18. RAP, Volume I, Figure 4.4, page 59

This shows an infiltration radon/barrier 1.0 feet in thickness whereas the test on page 54 indicates a thickness of 1.5 feet. Calculation B/B-950-03-00 of Volume II of the Calculations indicates on Sheet #3 that the thickness of the barrier was conservatively established at 18 inches during a meeting on January 5, 1989.

SECTION 2

Response: Volume I, Fig. 4.4, page 59 By: V. Dery - TAC

Date: June 1, 1990

18. Figures 4,2 through 4.4 reflect the conceptual design that was presented in the February 1988 draft RAP document and should have been replaced with the final design figures in the preliminary final. The latest figures will be incorporated into the final RAP and will reflect what is contained in the text.

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GEOTECHNICAL COMMENTS

RAP, Volume I, Figure 4.3, Page 58

19. This shows the riprap toe protection to be 7 feet deep whereas the text on page 54 indicates 3.5 feet and on page 61 the value is indicated to be 4 feet. Volume III of the Calculations with Calculation B/B-920-03-01 indicates the design is based on 3.5 feet of material with 0.5 feet being Type I bedding rock and the remaining 3 feet being Type C riprap.

SECTION 2

Response: Figures 4.3, Page 58 By: V. Dery - TAC

Date: June 1, 1990

19. See response to comment 18.

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GEOTECHNICAL COMMENTS

RAP, Volume I, Page 64

20. The infiltration/radon barrier is indicated to have a saturated hydraulic conductivity of 10^{-8}cm/sec. or less whereas on page 71 the value is stated 10^{-7}cm/sec.

SECTION 2

Response: Volume I, Page 64 By: V. Dery - TAC

Date: June 1, 1990

20. The design saturated hydraulic conductivity of the infiltration/radon barrier is 10^{-8}cm/s; the value shown in the text on page 7 will be corrected.

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GEOTECHNICAL COMMENTS

RAP, Volume II, Table D.4.1, page D-128

21. (a) Location 204, first sample listed; sample depth range is 7.5 - 8.0 feet not 0.0 -1.5 feet; (b) Location 250, sample depth range is 0.0 - 1.5 feet not 0.1 - 1.5 feet.

SECTION 2

Response: Vol. II, Table D.4.1 Page D-128   By: V. Dery - TAC

Date: June 1, 1990

21. Sections a-b agreed. The correction will be made in Table D.4.1.

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GEOTECHNICAL COMMENTS

RAP, Volume II, Table D.4.2, Page D-129

22. (a) Location 001, sample depth range is 4.0 - 8.0 feet not 6.0 - 8.0 feet not 6.0 - 8.0 feet; (b) Location 109, second sample listed, noted as a lean clay (CL) but it is probably better described as a silty clay (CL-ML) since it falls within the cross-hatched areas of the A-Line Chart. This double symbol best describes the material in the USCS; (c) for the third sample listed the liquid limit should be 36.0, not 33.0 as shown. See page C-22 of Volume II of Information to Bidders; (d) Location 152, the soil listed as CL should be as shown on Figure D.4.4 which uses SC-CL. The material is a coarse grained soil and is clayey sand with the fine portion being lean clays. The material is correctly classified in Figure D.4.4.

SECTION 2

Response: Vol. II, Table D.4.2, Page D-129 By: V. Dery - TAC

Date: ~~June 1, 1990~~ January 15, 1991

22. Sections a-d agreed. The corrections will be made in Table D.4.2.

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GEOTECHNICAL COMMENTS

RAP, Volume II, Table D.4.3, Page D-131

23. (a) Location 204, for the first sample listed the sample depth range is 10.0 - 12.0 feet not 10.0 - 11.0 feet; (b) Location 204, the second sample listed is classified as CL (lean clay) yet Table C-8, page C-14 of Volume I of the Information to Bidders shows a "N/A" for the liquid limit and plasticity limit and that the material is non-plastic and Figure D.4.9 classifies the material as CH; (c) Location 219, the depth of the separation of layers is 8.0 feet, not 8.5 feet.

SECTION 2

Response: Vol. II, Table D.4.3, Page D-131 By: V. Dery - TAC

Date: June 1, 1990

23. Section a and c agreed. The corrections will be made in Table D.4.3. Section b: Based on plasticity data and mechanical sieve test results shown in Volume II (Information to Bidders), the correct classifications for the second sample from location 204 is ML. All tables and figures will be revised to reflect this.

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GEOTECHNICAL COMMENTS

RAP, Volume II, Table D.4.4 and Figure D.4.5, Pages D-131 and D-76, respectively

24. Location 1, the sample depth should be 4-8 feet, not 6-8 feet.

SECTION 2

Response: Vol. II, Table D.4.4 Figure D.4.5, Pages D-131 and D-76, respectively By: V. Dery - TAC

Date: ~~June 1, 1990~~ January 15, 1991

Agreed. The correction will be made in Table D.4.4 and Figure D.4.5.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

GEOTECHNICAL COMMENTS

RAP, Volume II, Figure D.4.7, Page D-78

25. Lists the maximum dry density as 100.8 pcf when actually one of the compaction curve data points from the tests yielded 100.9 pcf that seems to be the peak value on pages A-69 and A-7 of volume III of the Information to Bidders.

SECTION 2

Response: Vol. II, Figure D.4.7, p. D-78 By: V. Dery - TAC

Date: June 1, 1990

25. Comment is correct.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

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Commentor: Nuclear Regulatory Commission

GEOTECHNICAL COMMENTS

RAP, Volume II, Figure D.4.14, Page D-85

26. Mislabled. The consolation curve represents material that is foundation material at the Bowman site.

SECTION 2

Response: Vol. II, Figure D.4.14 By: V. Dery - TAC

Page D-85

Date: June 1, 1990

26. Agreed. The correction will be made in Figure D.4.14.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: __________ Date: __________

Approved by: __________ Date: __________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

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Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

GEOTECHNICAL COMMENTS

RAP, Volume III, Specification 02200, Earthwork, Page 02200-6

27. Article 1.6F refers to Specification 01052, Article 1.6. The article does not exist.

SECTION 2

Response: Vol. III, Spec. 02200 Earthwork, Page 02200-6 By: V. Dery - TAC

Date: June 1, 1990

27. The correct article that Specification 02200, Earthwork, Article 1.6F refers to is Specification 01052, Article 1.5 on page 01052-2. The specification will be revised in the text.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ____________ Date: ____________

Approved by: ____________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

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Commentor: Nuclear Regulatory Commission

GEOTECHNICAL COMMENTS

RAP, Volume III, Specification 02278, Erosion Protection, Pages 02278-3

28. Section 1.7B contains a reference to Section 2.1.C.1.c which does not exist.

SECTION 2

Response: Vol. III, Spec. 02278 By: V. Dery - TAC

Erosion Protection, Pages 02278-3

Date: June 1, 1990

28. The correct section that Specification 02278, Erosion Protection, page 02278-3, Section 1.7B refers to is Section 2.1.G on page 02278-4. The specification will be revised in the text.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: __________ Date: __________

Approved by: __________ Date: __________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

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Commentor: Nuclear Regulatory Commission

GEOTECHNICAL COMMENTS

RAP Calculations, Volume II

29. Calculation B/B-950-02-00, dated 03/20/89, "Radon Barrier Design-RAECOM Input Data," Sheet 3. There is a reference to Reference No. 2 of the calculations and Reference 2 is Calculation B/B-929-01-02, "Embankment Design-Bowman (layout/capacity). The existing calculation with that title is B/B-929-01-01 that with Revision 1 date 03/3/89. It is not clear whether the error is in Calculation B/B-950-02-00 or in Calculation B/B-929-01-01 that might be out of date. The discrepancy should be explained and the impact of any necessary changes should be reflected in the appropriate calculations.

SECTION 2

Response: RAP Calc., Volume II By: V. Dery - TAC

Date: June 1, 1990

29. The correct calculation number for "Embankment Design - Bowman (Layout/Capacity) referred to in Calculation B/B-950-02-00 ("Radon Barrier Design - RAECOM Input Data") is B/B-929-01-01 not B/B-929-01-02. The error in Calculation B/B-950-02-00 will be corrected.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ____________

Approved by: ______________________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Belfield/Bowman Date: January 12, 1990

Document: Preliminary Final Remedial Action Plan

Commentor: Nuclear Regulatory Commission

GEOTECHNICAL COMMENTS

RAP Calculations, Volume II

30. Calculation B/B-950-02-00, dated 03/20/89. "Radon Barrier Design - RAECOM Input Data," Sheet 3, Reference 3. The reference is listed as calculation B/B-929-02-00, "Embankment Material Properties," however, the calculation was revised and is now contained in RAP calculations, Volume I as calculation B/B-929-02-01 dated 03/28/89. The discrepancy should be explained and the impact of any necessary changes should be reflected in the appropriate calculations.

SECTION 2

Response: Calculations, Volume II By: V. Dery - TAC

Date: June 1, 1990

30. Reference 3 in Calculation B/B-950-02-00 is Calculation B/B-950-01-00 "Statistical Analysis of Ra-226 Concentrations," not B/B-929-02-00 "Embankment Material Properties" as you have stated in your comment. Nevertheless, in response to your comment, Reference 4 should be Calculation B/B-929-02-01 "Embankment Design - Material Properties (Contaminated Materials and Foundation Soil In-Place)" not B/B-929-02-00. The error in Calculation B/B-950-02-00 will be corrected.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

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Commentor: Nuclear Regulatory Commission

GEOTECHNICAL COMMENTS

31. Clarification is needed regarding the compaction requirements of the contaminated material. The RAP text in Volume I, Section 4.3.9, page 69 indicates the contaminated material will be compacted to 90 percent of the Standard Proctor densities whereas Specification 02200 in Section 3.8.A defines the minimum compaction to be 95 percent of the Standard Proctor densities.

SECTION 2

Response: By: V. Dery - TAC

Date: June 1, 1990

31. Specification 02200 in Section 3.8.A is correct; the minimum compaction of the contaminated material will be 95 percent of the Standard Proctor densities. The RAP text will be revised to reflect this.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______ Date: ______

Approved by: ______ Date: ______