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

FEB 5 1991

FEDERAL EXPRESS

Mr. John J. Surmeier
Chief, Uranium Recovery Branch
Division of Low-Level Waste
Management and Decommissioning
Office of Nuclear Materials Safety
and Safeguards
1 White Flint North
11555 Rockville Pike
Rockville, MD 20852

Dear Mr. Surmeier:

Enclosed are three copies of the Draft Comment and Response Document presenting the U.S. Department of Energy (DOE) responses to the open issues identified in your draft Technical Evaluation Report (dTER) for the Lowman, Idaho, uranium mill site. This document contains additional information regarding the Lowman site which will address the open issues identified in the dTER.

As you know, we have scheduled the start of remedial action for April 1, 1991, and are seeking conditional concurrence to enable construction activities to begin. We have scheduled a meeting prior to the Falls City, Texas, site visit to discuss the information provided in the enclosed document. This meeting will be held at the Drury Inn in San Antonio, Texas, at 2 p.m. on February 12, 1991. We expect personnel from your staff to discuss the enclosed information and give the DOE a determination as to whether it is sufficient to satisfy the open issues.

After the February 12 meeting we will formally submit a request for conditional concurrence for the Lowman site. It is cost effective to perform remedial action activities at this site in one construction season. Failure to begin construction prior to mid-April will jeopardize our ability to complete all activities in the 1991 construction season and increase costs to remediate the Lowman site.

Delete all dist. except CF, PDR, NUDOCS-abstract, 1 cy to ACNW & SWastha/NL04

WM-43 1/1

If you or your staff should require any additional information, please contact Mr. Paul Mann of my staff at FTS 845-5637.

Sincerely,

Mark L. Matthews
Project Manager
Uranium Mill Tailings Remedial Action
Project Office

Enclosures

cc w/enclosure:
C. Smythe, UMTRA
P. M[illegible]n, UMTRA
D. Bierley, JEG
C. Spencer, MK-F
C. Cody, IDEQ

cc w/o enclosure:
M. Abrams, UMTRA
S. Hill, JEG
J. Oldham, MK-F

D R A F T

RESPONSE TO COMMENTS

LOWMAN TER

FEBRUARY 1991

Draft 2/5/91

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 1, Open Issue No. 1

Section 2.4.3, Page 2.10

The NRC staff has reviewed DOE analysis of regional tectonics and seismicity and does not concur with the design acceleration proposed by DOE. Specifically, the NRC staff concluded that DOE did not provide sufficient justification to support the location of the southern boundary of the Idaho Seismic Zone 22 km north of Lowman site. Therefore, conservatively, the southern boundary could be located as close as 15 km north of the site. As a result, a magnitude 7.3 event occurring in the Idaho Seismic Zone 15 km from the Lowman site, at its closest approach, would generate a peak acceleration of .39g to be used as the design acceleration. Therefore, DOE should use .39g as the design acceleration, or provide additional justification to support the location of the southern boundary of the Idaho Seismic Zone. The NRC staff considers this an open issue.

SECTION 2

Response: By: Gerald Lindsey - TAC

Date: 2/4/91

The design earthquake recommended by the geology report is based on a Floating Earthquake (FE) of M-7.0 of a distance of 15 km from the site, which would result in an acceleration of 0.34g.

Although it is not typical or a requirement that the maximum earthquake (ME) be used as the FE, it was done as a more conservative approach because the structure of the region is not well understood.

The design acceleration of the FE is larger than the maximum potential for the Cat Creek Fault (ME of M=6.4 at a distance of 17 km) with a resultant acceleration of 0.29g); and it is larger than the ME of the Idaho Seismic Zone (ISZ) of M=7.3 of at a distance of 22 km with a resultant acceleration of 0.30g.

The distance of 22 km was taken from the boundary line shown on Plate 6.1 carefully derived from Reaveley (1985) and from La Forge and Hawkins (1987). The southern boundary of the ISZ is drawn as a smooth line to include all known epicentral locations. Plate 4.1 shows that the nearest epicenter is 27 km (17 miles) and the boundary line is positioned 22 km north of the site. The largest earthquake recorded with the ISZ within the 65-km site region is M=4.3.

The only theory offered for this zone that crosses the structural boundaries of the Idaho Batholith is that it could represent cooler, brittle rocks that border the hot ductil rocks of the aseismic Snake River Plain. This concept is discussed in the Section 2.4, on Regional structure setting (see Area Flow Map Figure 2.5).

It would be difficult to argue for a more conservative approach than to assume a FE equal to the ME of magnitude 7.3 on this boundary. It should be noted that the ME for the batholith estimated by studies such as Greensfelder (1976) and by Algermissen et al(1982) Table 7.1, who never recognized the existence of the ISZ trend is magnitude 6.5.

The DOE has concluded that there is no justification for assuming a closer boundary of the ISZ or to use a higher magnitude FE for the design earthquake because of the level of conservatism already applied.

For the location of the FE of the ISZ source area to result in the exceedance of the potential acceleration of the FE for the site region (Idaho Batholith seismotectonic provence) the south boundary would have to be moved to within 18 km of the site. There is no justification in the DOE UMTRA TAD (1989) for defining the boundary in this manner or for using the FE from one zone as the FE for another zone.

Plans for Implementation: None.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 2, Open Issue No. 2

Section 3.2.4, Page 3.2

The testing for the radon barrier material was performed on remolded samples of colluvium from test pits 10 and 16, located in the area of the proposed disposal cell. These tests may not be representative of the colluvium from the actual borrow area. Additional testing of samples from borings and/or test pits located in the planned radon barrier material borrow area needs to be performed. Furthermore, additional strength testing of the colluvial foundation material may be necessary (see Section 3.3.1). The NRC staff considers this an open issue.

SECTION 2

Response: ______________ By: TAC//RAC

Date: 2/4/91

Additional testing has been performed on colluvial material removed from the borrow area. The material is very similar to the material already sampled. The results of the new testing indicate that the borrow area material is slightly less permeable than the material previously sampled. There is no significant difference in the density when the materials are both compacted to 95% (ASTM 698). The results of the new testing are included in the attached MK-F letter of 17 January, 1991.

Plans for Implementation: The new data will be incorporated into the final RAP.

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 3, Open Issue No. 3

Section 3.3.1, Page 3.3 - 3.4

The staff concludes that DOE needs to re-evaluate the strength parameters, including consideration of additional testing of the colluvium, to ensure that appropriate and conservative values are selected, and perform re-analysis as necessary. The staff considers this an open issue. This conclusion is based on the following observations:

1) The pseudo-static analysis for short-term considerations resulted in a factor of safety very close to the minimum allowable:

2) The colluvial material has been shown to be the location of the critical failure surface in all loading cases.

3) The colluvial layer's strength parameters are base on an average of only two triaxial tests; and

4) The RAP presents conflicting results from the triaxial testing.

SECTION 2

Response: By: Ray Bennett - TAC

Date: 2/4/91

The DOE considers the strength parameters for the colluvium used in the pseudostatic analysis to be conservative values. The reason conflicting values for the strength of the colluvium appear is due to different interpretations of the data. The values in the Information To Bidders represent a computer generated "best fit" to the data. The numbers used in the calculations represent a more conservative interpretation of the data. The stability calculations are based on an ultimate strain of 4% even if this occurred at stresses below the maximum in the test. The DOE did perform a sensitivity analysis on the stability calculations (see RAC Calc 12-624-02-02, copy attached), the results of this analysis indicate the cell will remain stable under the specified conditions. The required factor of safety is 1.0 not 1.1 as stated in the RAP.

Plans for Implementation: The RAP will be modified accordingly.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 4, Open Issue No. 1

Section 3.3.1, Page 3.4

Based on the staffs' conclusion regarding the estimated peak horizontal bedrock acceleration for the site (see Section 2.4.3), revision of the seismic coefficients used in the reanalysis may be necessary. The staff considers this an open issue.

SECTION 2

Response: ______________ By: Gerald Lindsey - TAC

Date: 2/4/91

Revisions of the seismic coefficients are not necessary. See response to Comment No. 1 on page 1 of this document.

Plans for Implementation: None.

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 5, Open Issue No. 4

Section 3.3.4, Page 3.5

The RAS indicates that the layer immediately above the radon barrier is to be a six-inch-thick sand bedding layer, intended to drain water laterally off the cell and serve as a filter between the radon barrier and the erosion protection. The calculations provide an acceptable basis for the gradation design of the bedding layer. However, the resulting gradation is not the same as the gradation presented in the construction specifications. The NRC staff considers this an open issue.

SECTION 2

Response: ______ By: TAC - RAC

Date: 2/4/91

The discrepancy between the calculations and the specification has been corrected. The required gradation for the bedding layer appears on page 02278-7 of the construction specifications. This gradation is shown by the cross hatched area on sheet 31 of the erosion protection calculations. Copies of both pages are attached.

Plans for Implementation: The RAP will be modified.

SECTION 3

Confirmation of Implementation:

Checked by: ______ Date: ______

Approved by: ______ Date: ______

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 6, Open Issue No. 5

Section 3.3.4, Page 3.7

The cover design does not include any considerations of frost protection. The final RAP needs to include justification for the elimination of a frost protection component of the cover. The NRC staff considers this an open issue.

SECTION 2

Response: ______ By: TAC - RAC

Date: 2/4/91

The radon barrier will not be protected from freezing. The DOE believes that since the radon barrier is more than three times thicker than required for control of radon emanation, and since the barrier is neither designed nor required to control infiltration, freezing will not significantly degrade the performance of the radon barrier. Under the most likely conditions (windblown and VP material on top of the radioactive sands), no radon barrier is required. These factors coupled with the harsh climatic conditions at Lowman lead the DOE to the conclusion that a frost protection layer is not required nor economically justified.

Plans for Implementation: The RAP will be modified.

SECTION 3

Confirmation of Implementation:

Checked by: ______ Date: ______

Approved by: ______ Date: ______

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 7, Open Issue No. 6

Section 3.4.2, Page 3.7

In addition, the staff has reviewed the field quality control portions of the specifications to assess consistency with RAIP. Based on this review, the staff finds that there is an inconsistency regarding testing of the radon barrier. The RAIP indicates that the radon barrier will be tested for gradation once every 1000 cubic yards placed; the specifications indicate this frequency to be once every 2000 cubic yards. Prior to the staff concurring in the program for testing and inspection, DOE needs to make appropriate revisions to ensure consistency with the RAIP. The staff considers this an open issue.

SECTION 2

Response: ____________ By: ____________

Date: 2/4/91

The appropriate changes will be made to the specifications to make them consistent with the RAIP.

Plans for Implementation: See above.

SECTION 3

Confirmation of Implementation:

Checked by: ____________ Date: ____________

Approved by: ____________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 8, Open Issue No. 7

Section 4.2.5.1, Upstream Apron, Page 4.4

The peak runoff rate for the upstream apron was estimated using the Rational Formula. DOE assumed that a gully would be formed immediately upstream of the apron and that the gully would discharge concentrated flows directly onto the apron. The apron would then act as an energy dissipation area to reduce flow velocities and to reduce the flow concentration which would occur on the topslope of the pile. The staff reviewed the calculations associated with this concept of the design. Based on that review, the staff believes that the concept of providing an energy dissipation and flow spreading apron is a reasonable one. However, the staff concludes that the apron has not been adequately designed and considers this an open issue.

Section 4.3, Page 4.5

However, as discussed above, DOE has used incorrect assumptions in determining flow rates. These incorrect flow rates result in incorrect parameters to be used in the design methods. DOE will need to revise their design for the upstream apron and possibly for the down stream apron.

Section 4.3.1, Upstream Apron

As discussed above, the riprap design for the upstream apron will need to be revised. Additionally, the width of the apron will need to be increased.

SECTION 2

Response: By: TAC - RAC

Date: 2/4/91

The DOE has redesigned the upstream and downstream aprons. The new designs are supported by the RAC calculations transmitted to the NRC by MK-F on 16 January, 1991. The revised design includes selective placement of 22" rock along a 25-foot-wide upstream apron and a 20-foot-wide toe apron. The above widths are those used in the analysis; the actual widths are larger due to minimum thickness requirements and transition zones.

Plans for Implementation: The appropriate changes will be made in the final RAP.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 9, Open Issue No. 8

Section 4.3.3

DOE should revise their calculations to consider the effects of gully advancement. Methods and criteria used in the DOE analysis at the Lakeview UMTRA site provide acceptable methods for estimating rock size, thickness, and depth to be used in protecting against future gullying downstream of an apron. This is considered to be an open issue by the NRC staff.

SECTION 2

Response: Section 4.3.3 By: TAC - RAC

Date: 2/4/91

The DOE has redesigned the upstream and downstream aprons. The new designs are supported by the RAC calculations transmitted to the NRC by MK-F on 16 January, 1991. The revised design includes selective placement of 22" rock along a 25-foot-wide upstream apron and a 20-foot-wide toe apron. The above widths are those used in the analysis, the actual widths are larger due to minimum thickness requirements and transition zones.

Plans for Implementation: The necessary changes will be made to the RAP.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 10, Open Issue No. 9

Section 4.4.2, Page 4.7

DOE has not conducted investigations to identify acceptable sources of rock in the site vicinity and the NRC staff considers this to be an open issue.

SECTION 2

Response: ______________ By: TAC - RAC

Date: 2/4/91

The DOE will require the construction subcontractor to provide suitable rock. Several potential sources of rock have been identified within a 100- mile radius of the site. Copies of the laboratory testing reports are attached. The actual source of the rock will not be known until the construction contract has been awarded. No rock will be placed on the cell until the source has been qualified and the test results provided by the NRC.

Plans for Implementation: As noted above.

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 11, Open Issue No. 10

Section 5.1, Page 5.1

DOE has not clearly stated their basis for meeting the EPA standards at the Lowman site in the RAP. Therefore, the NRC's assessment of the RAP for the Lowman site is based upon the staff interpretation of DOE's rationale. DOE will need to provide a concise and clear statement of their basis for meeting the EPA standards. The NRC considers this an open issue.

SECTION 2

Response: By:

Date: 2/4/91

The basis for meeting the EPA standards is summarized on page one of Attachment 4, Water Resources Protection Strategy. A more detailed discussion of the standards is provided on page 13 and 14 of Attachment 4. The organization of Attachment 4 closely follows the format requested by NRC (1989) in the "Standard Content and Format Guide."

Key elements of the performance assessment are summarized in the third bullet on page 2 and are discussed in detail on pages 14 through 18 of Attachment 4. In addition, the DOE will add a sixth hydrogeologic characteristic, below, to the five hydrogeologic characteristics listed on page 17 that demonstrate compliance with the proposed EPA groundwater standards.

Dilution by groundwater underflow

Concentrations for antimony and vanadium in radioactive sand pore fluids can be diluted by groundwater underflow and below concentration limits at the point of compliance. The volume-weighted mean concentrations of these hazardous constituents in seepage from the radioactive sands in the disposal cell were mixed with groundwater underflow of median background concentrations using a calculation described in the Technical Approach Document (DOE 1989). The resulting concentrations of antimony and vanadium were below concentration limits at the point of compliance (TAC Calculation #LOW 02-91-15-03-00).

Plans for Implementation: The following summary will be added to the RAS on page 55, Section 5.0. Other portions of the text in the RAS and Attachment 4 of the RAP will be modified to reflect the summary text and the sixth element of the performance assessment:

To achieve compliance with the proposed EPA groundwater protection standards (Subparts A and B of 40 CFR 192), the DOE proposes to meet the EPA maximum concentration limits (MCLs) or background concentrations for designated hazardous constituents in groundwater in the uppermost aquifer (alluvium/weathered granodiorite) at the point of compliance (POC) at the Lowman disposal site near Lowman, Idaho. The proposed remedial action in conjunction with existing hydrogeological conditions at the Lowman site will ensure sufficient protection of human health and the environment. A detailed discussion is presented in Attachment 4. A summary of the principal features of the water resources protection strategy for the Lowman disposal site follows.

- o The disposal option proposed for the Lowman uranium processing site involves consolidation of radioactive sands and associated contaminated materials at the Lowman site. The materials will be placed in an above-ground disposal cell designed to reduce radon emanation, resist by erosion, preclude differential settlement, and remain stable against static and dynamic forces.

- o Design features in conjunction with existing conditions at the Lowman disposal site will ensure protection of human health and the environment. To achieve compliance with the proposed EPA groundwater protection standards at the Lowman disposal site, the DOE proposes to meet MCLs or background concentrations for the designated hazardous constituents in groundwater at the POC in the uppermost aquifer hydraulically downgradient from the disposal unit. The alluvium/weathered granodiorite is the uppermost aquifer at the Lowman disposal site.

- o The selection of hazardous constituents was based on hydrogeologic characterization at the Lowman site. These hazardous constituents resulted from the uranium processing operations and will be present in materials stabilized at the Lowman disposal site. The hazardous constituents were identified from descriptions of the uranium recovery process, characterization of the contaminated materials, and evaluation of groundwater quality data. Based on chemical analyses of pore fluids from suction lysimeters in the radioactive sands, the following hazardous constituents and elements of hazardous constituent compounds exceeded the laboratory method detection limits: aluminum, antimony, barium, copper, fluoride, molybdenum, net gross alpha, nitrate, strontium, uranium, vanadium, and zinc. Chromium, lead, and radium-266 and -228 also exceeded the laboratory method detection limits in neutral pH batch-leach tests. No concentration of hazardous constituents exceed the MCLs. Pore fluid concentrations of antimony, copper, vanadium, and zinc in the radioactive sands exceed the statistical maximum for background groundwater quality; these are designated hazardous constituents or elements in hazardous constituent compounds with sufficiently high source concentrations that they may affect groundwater quality.

- Concentration limits for the hazardous constituents that exceed laboratory method detection limits were selected based on proposed EPA groundwater protection standards for the UMTRA Project (MCLs), and the statistical maximum background concentrations (for constituents without MCLs) in groundwater in the alluvium/weathered granodiorite at the Lowman disposal site. The statistical maximum is represented as the 99 percent confidence maximum for constituents with normal and log-normal distributions. In some cases, based on the distribution, statistics were not appropriate and the maximum observed concentration or the method detection limit was chosen as the concentration limit (see Attachment 3, Section 3.5.). The proposed concentration limits for barium, chromium, lead, molybdenum, net gross alpha, nitrate, radium-226 and -228, and uranium will be the EPA MCLs. No concentration limits were proposed for copper or zinc because they are not reasonably expected to exist as the cyanide species listed in Appendix VIII of 40 CFR 261. Similarly, no concentration limits are proposed for aluminum and fluoride because they cannot exist in solution as the hazardous constituent compounds aluminum phosphate and carbon oxyfluoride. A concentration limit for strontium sulfide also cannot reasonably be assigned to the Lowman aquifer system due to the highly oxidizing environment. The proposed concentration limits for antimony and vanadium will be the statistical maximum background groundwater concentrations.

- Concentrations of antimony and vanadium in radioactive sand pore fluids can be diluted below concentration limits at the point of compliance.

  The volume-weighted mean concentrations of these hazardous constituents in seepage from the radioactive sands in the disposal cell were mixed with groundwater underflow of median background concentrations using a calculation described in the Technical Approach Document (DOE, 1989). The resulting concentrations of antimony and vanadium were below concentration limits at the point of compliance (TAC Calculation #Low 02-91-15-03-00).

- The POC at the Lowman disposal site will be the downgradient western edge of the disposal unit in the uppermost aquifer, which is the alluvium/weathered granodiorite.

- To demonstrate compliance of the proposed disposal cell design with the proposed EPA groundwater protection standards, design parameters were evaluated in conjunction with hydrogeologic characteristics of the Lowman site to determine the distribution of hazardous constituents in groundwater under steady state conditions.

- The following are the hydrogeologic characteristics important to the performance assessment of the proposed disposal cell: 1) presently, groundwater beneath the site is not contaminated with hazardous constituents moving downward from the processed or unprocessed radioactive sand piles; 2) both the processed and unprocessed radioactive sands are physically and chemically inactive; 3) infiltration through the disposal cell is limited; 4) pore fluids in upgradient native soils contain higher concentrations of soluble metals, including antimony and vanadium; 5) control of construction water will produce negligible transient drainage to pore fluids from the radioactive sands; and 6) concentrations of antimony and vanadium can be achieved at the point of compliance by dilution of seepage from the radioactive sands by groundwater underflow. Because concentrations of antimony and vanadium in groundwater are already in geochemical equilibrium with native soil concentrations, the presence of radioactive sands will not influence groundwater quality.

- The DOE has assessed the performance of the proposed disposal cell at the Lowman site in conjunction with hydrogeologic system, and has shown that the disposal cell will minimize and control releases of the hazardous constituents to groundwater and surface water and radon emanations to the atmosphere to the extent necessary to protect human health and the environment. Natural, stable materials have been proposed for use in construction of the Lowman disposal cell so that long-term performance is ensured. The DOE has also demonstrated that design features necessary for compliance with EPA groundwater protection standards minimize the need for further maintenance of the disposal site.

- A groundwater monitoring program will be carried out during and after the remedial action period to demonstrate that the initial performance of the disposal unit is in accordance with the design requirements, and to ensure compliance of the disposal site with the EPA groundwater protection standards. Groundwater in the uppermost aquifer will be monitored downgradient from the disposal cell at the POC, using existing DOE monitor wells, where applicable, and installing new monitor wells as necessary. Background groundwater quality will also continue to be monitored upgradient and crossgradient from the disposal cell. Compliance wells will be sampled quarterly during the first and second years following completion of remedial action activities, semi-annually for years three through six, and annually thereafter until the end of the performance monitoring period. The constituents to be monitored will include designated hazardous constituents, major anions and cations, and a standard suite of field parameters.

  Demonstration of cleanup and control of existing processing-related groundwater contamination will not be necessary based on the present level of site characterization, which suggests that there is no contamination of groundwater and that groundwater cleanup will not be required.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________________ Date: ____________________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 12

The NRC staff does not concur that DOE has demonstrated compliance with the proposed EPA groundwater protection standards. DOE has not adequately demonstrated that the concentrations of antimony and vanadium in the pore fluids of the radioactive sands is less than the concentrations of these constituents in the native soils. In addition, DOE has not adequately demonstrated that these are the only constituents of concern and that they will be attenuated by the subsoils under the pile.

SECTION 2

Response: ______________ By: ______________

Date: 2/4/91

The discussion on geochemical attenuation of the constituents antimony and vanadium was provided to explain why they are not groundwater contaminants. Even if the seepage from the radioactive sands is not in geochemical equilibrium with the groundwater environment, the concentrations of these constituents in the radioactive sands are not sufficiently high to cause an exceedance of concentration limits at the point of compliance because they are diluted by groundwater underflow.

Key elements of the performance assessment are summarized in the third bullet on page 2 and are discussed in detail on page 14 through 18 of Attachment 4. In addition to the five hydrogeologic characteristics listed on page 17 that demonstrate compliance with the proposed EPA groundwater standards, the DOE will add a sixth hydrogeologic characteristic below.

Dilution by groundwater underflow

> Concentration of antimony and vanadium in radioactive sand pore fluids can be diluted by underground underflow to below concentration limits at the point of compliance. The volume weighted mean concentrations of these hazardous constituents in seepage from the radioactive sands in the disposal cell were mixed with groundwater underflow of median background concentrations using a calculation procedure described in Section 8.3.2 of the Technical Approach Document (DOE, 1989). The resulting concentrations of antimony and vanadium were below concentration limits at the point of compliance (TAC Calculation #LOW 02--91-15-03-00).

Of all the hazardous constituents that were identified in the radioactive sand pore fluids (TAC Calculation #LOW-04-90-12-07), none exceed the MCLs and only four, antimony, copper, vanadium, and zinc exceed the statistical maximum for background groundwater quality (TAC Calculation #LOW-01-91-12-08). No concentrations limits were proposed for copper and zinc as they cannot exist in solution as cyanide species as listed in Appendix VIII of 49 CFR 261 (see discussion for Comment No. 19). Therefore, the performance assessment needs to be concerned only with meeting the concentration limits for antimony and vanadium.

Plans for Implementation: The above discussion will be added to the RAS and Attachment 4 of the RAS will be modified to reflect the summary text and the sixth element of the performance assessment.

<u>SECTION 3</u>

Confirmation of Implementation:

Checked by: ______________________________ Date: ____________________

Approved by: ______________________________ Date: ____________________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 13, Open Issue No. 17

Section Page 5.1

The NRC does not agree that DOE has adequately demonstrated that there is no existing groundwater contamination on the site; therefore, the staff does not concur that no clean up is required.

SECTION 2

Response: By: Gerald Lindsey - TAC

Date: 2/4/91

Additional groundwater and bedrock contour maps and cross sections have been prepared to better illustrate the relationship of the water table flow to the downgradient discharge point a the spring (561). The data also include some new information from 16 radiation contamination assessment boreholes, data from five geophysical (seismic) survey lines, and a reassessment of eight geotechnical boreholes to establish the bedrock contact. The bedrock surface controls the flow of the saturated alluvium and the veneer of weathered granodiorite, termed the alluvium/weathered granodiorite aquifer.

The geotech boreholes that were cased with 2-inch PVC did not reflect the water table conditions accurately because the casing in some cases was above the zone of saturation, for example hole No. 02 had a total depth of 68 feet and water level was measured after coring at 35 feet. The depth of casing extends only to 34.4 feet and subsequent measurement indicates the borehole well is dry. Using these initial water level measurements in wells 021 to 029, a more detailed map can be prepared.

Based on drilling information and hydraulic test results there is a large contrast between the conductivity of the bouldery outwash alluvial deposits and the bedrock, which had saturated clay filled fractures. The evidence indicates that flow over the bedrock contact is the preferred flow path and the spring flow (point 561) represents the water quality of the saturated alluvium that underlies the disposal area. This water quality has been characterized in Table 3.16 of Attachment 3 and has been statistically compared with upgradient water quality as present in Calculation # LOW-02-91-14-11-00. The results of that calculation shows that there has been no exceedance of MCLs or background in the downgradient sampling point.

The evidence indicates that there is a relationship between the saturated alluvium water table and the water level in the bedrock for areas immediately surrounding the saturated alluvium. Where the alluvium is thin and no saturated overburden occurs, the bedrock aquifer is poorly defined. The paleogully that lies close to wells 575 and 022 represents a separate zone of recharge to the bedrock aquifer. Observed flows at depths of 17 feet depth in trench 009 are unfiltered runoff below a fill and the paleogully incision into bedrock, has a narrow saturated thickness of only 2 feet. The outlet of this gully which is incised to the grade level of Clear Creek, represents a drainage of a very limited amount of alluvial flow.

The fracture flow in the saturated bedrock zone is apparently sufficiently diffused so that there is no other prominent flow or seepage. The spring flow at point 561 is at an elevation of 3,860 feet which is at least 20 feet lower than the water level within the disposal cell area and mill site.

Plans for Implementation: A new bedrock contour map will be inserted as Figure 3.5 and existing Figures 3.3 and 3.4 will be revised to show new cross sections and the new potentiometric contour.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 14

Section 5.2.1, Page 5.2

Although DOE has not described the vertical extent of the unconfined aquifer, they believed that the unweathered granodiorite acts as a basal confining unit for the aquifer because of its low primary porosity.

SECTION 2

Response: By: Gerald Lindsey - TAC

Date: 2/4/91

The vertical extent of the saturated alluvial thickness is shown in greater detail in the cross section on the revised Figure 3.3. The base level of Clear Creek at elevation 3,828 feet is expected to control the gradient flow in the bedrock that is recharged by the saturated alluvium. See response to comment No. 13.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: Date:

Approved by: Date:

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 15

Section 5.2.2, Page 5.4

If it is determined through further characterization of the site that contamination is present, additional hydraulic testing will be needed to characterize the hydraulic properties of the terrace alluvium. Additional testing will be needed to determine whether or not preferential flow paths exist within the lower zones of the alluvium deposits. Such flow zones will largely dictate the flow velocity of contaminants. DOE's field derived hydraulic conductivity for the alluvium is only based upon one well. The well used for this determination is drilled into fluvial deposits which may have different hydraulic properties than the glaciofluvial deposits on the terrace. Core tests were performed on the upper part of the terrace alluvium, which contains more silt and clay than the lower part that contains gravel and cobbles. Therefore, it is likely that the linear groundwater velocity in the basal alluvium could be greater than that predicted by DOE.

SECTION 2

Response: ______________ By: ______________

Date: 2/4/91

Additional site characterization data are discussed in response to comments 13 and 14. The combination of data from geophysical surveys, boreholes, backhoe pits, piezometers, and monitor wells is of sufficient density to define the geology and hydrology. This information was not presented originally. The additional site characterization information has defined a paleochannel that contains most of the saturated alluvium. As shown on the attached revised potentiometric map (see response to comment 12), all of the groundwater flow lines in the limited extent of saturation within the alluvium/weathered granodiorite converge along the axis of the paleochannel and indicate that most groundwater in the alluvium discharges to the spring at monitor location 561. Concentrations of hazardous constituents at this spring do not exceed MCLs or statistically exceed background water quality (Calculation #LOW-02-91-14-11-00). Discharge at this spring is a collective average of groundwater water quality in the alluvial/weathered granodiorite aquifer at the site, thereby providing there is no groundwater contamination.

The density of monitor wells and piezometers suggest that there are no unknown flowpaths and that the areal extent of groundwater in the alluvium/weathered granodiorite is limited (see response to comment 13 and 14).

Extensive hydraulic testing of the alluvium was not performed as most of the alluvial monitor wells were either dry or completed across the alluvium/weathered granodiorite contact. The hydraulic conductivity of the alluvium is among the most permeable materials that were tested at the site. However, the groundwater velocity is not dependent upon the hydraulic conductivity in one well as it depends more on the average hydraulic conductivity along the flow path. The hydraulic conductivity in the alluvium/weathered granodiorite along the flow path towards the spring ranges from one to 0.1 ft/d as shown on Table 3.3 of Attachment 3. Th. geometric mean of these conductivities is 0.5 ft/d (Calaculation # LOW-02-91-.4-03-00). These hydraulic conductivities are within the range of literature hydraulic conductivities tabulated by Freeze and Cherry (1979) in Groundwater. Thus, the range of the groundwater velocity could be as much as one order of magnitude higher The DOE agrees with the NRC that the groundwater velocity of 0.16 ft/d that was calculated using the lower hydraulic conductivity, presented in the RAS Attachment 3 on page 14, is overly conservative in that it provides for less dilution by groundwater underflow. The DOE will provide in the RAP that groundwater velocities could be calculated with the geometric mean and state that groundwater velocities could be even higher due to coarse graded materials in the bottom of the paleochannel. The dilution by underflow calculation described in response to comments 11 and 12 used both hydraulic conductivities and even the lower hydraulic conductivity of the alluvium is sufficient to demonstrate compliance with the standards. Similarly, if hydraulic conductivities are higher than measured, groundwater in the alluvium will flush faster, ensuring that hazardous constituents have reached the point of discharge at the spring by this time. Therefore, additional hydraulic conductivity tests are not necessary as the hydraulic conductivities presented are conservative for the purpose of the performance assessment.

Plans for Implementation: The above discussion will be added to the RAS and Attachment 4 of the RAS will be modified accordingly.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 16

Section 5.2.4, Page 5.5

If further characterization demonstrates that the alluvium/weathered granodiorite aquifer is contaminated from the radioactive sand piles, DOE will need to reanalyze water quality data for Clear Creek during low flow to insure that contaminants leaching into the creek are sufficiently diluted.

SECTION 2

Response: ______________ By: ______________

Date: ______________

Because most groundwater at the site in the alluvium and weathered granodiorite discharges to the spring at monitor location 561 (see response to comments 13, and 15) contamination is not expected in the creek. There is no exceedance of MCLs or background at the spring (Calculation #LOW-02-91-14-11-00). Although Clear Creek has been sampled seasonally, there have been no water quality influences from the processing site (Calculation #LOW-01-91-15-01). Quarterly sampling in the creek has defined water quality during the winter low-flow period. No water quality impacts would be anticipated because the volumetric rates of dilution between groundwater discharge and river flow are many orders of magnitude. Furthermore, nothing in groundwater or the radioactive sands exceeds the MCLs and nothing in groundwater or the radioactive sands exceeds the MCLs and nothing in groundwater presently exceeds background nor is projected to exceed concentration limits at the point of compliance.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 17, Open Issue No. 11

Section 5.3, Page 5.5 - 5.6

The NRC staff, wever, cannot conclude that transient drainage will not cause a mounding effect, which could lead to problems with the structural stability of the embankment. DOE needs to quantify the amount of mounding anticipated to occur within the pile. Such an analysis is warranted because the gradient of the foundation material will likely cause any water percolating into the cell to accumulate at the toe of the facility. In addition, DOE has not demonstrated that long-term mounding will not occur given that both the radon barrier and the foundation material (i.e., colluvium) will have a saturated hydraulic conductivity of 1E-5 cm/s. Any reduction in the conductivity of foundation material caused by loading from the pile could result in mounding within the cell, which may affect the structural stability of the pile at the toe. The NRC considers this an open issue.

SECTION 2

Response: By: Ray Bennett - TAC

Date: 2/4/91

The DOE does not consider transient drainage to be a problem for the Lowman s for the following reasons:

a) The RAC has estimated the amount of construction water which is to be added to the cell to be less than 2,000,000 gallons (app. 267,000 cft), see RAC Calc. 12-660-01-00.

b) This volume of water is equal to a layer approximately 9 inches thick over the 8.2 acre area of the cell. The least permeable foundation material has a hydraulic conductivity of approximately 4x10-5 cm/sec (see RAC Calc. 12-624-01-00). Thus, if all the construction water were to be immediately drain to the bottom of the cell the underlying material would absorb it in approximately seven days. In reality water will drain to the bottom of the cell at a much lower rate.

c) Based on these factors the DOE does not expect water to accumulate at the bottom of the cell.

The DOE does not consider long-term ponding to be a problem since the hydraulic conductivity of the foundation material is approximately 20 times the annual rainfall. Furthermore the permeability of the foundation material is insensitive to the consolidation resulting from the weight of the disposal cell. This is illustrated in the attached figure from Cedergren (Cedergren, 1989).

Reference:
Cedergren, Harry R.,"Seepage, Drainage, and Flow Nets," Third Edition, Wiley Interscience, 1989

Plans for Implementation: The DOE will be modified accordingly.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 18, Open Issue No. 12

Section 5.4.1, Page 5.6

Based upon an independent analysis of the information prov[illegible] by DOE, the NRC staff concludes that in addition to the hazardous constituen[illegible] identified by DOE, the following constituents should be included in the list: fluoride, nickel, gross alpha, and selenium. Each of these constituents were above the detection limit in the pore fluids, all could be derived from the materials on-site, all are included in Appendix VIII list. Fluoride, nickel, and selenium could be trace elements associated with the rare minerals within the radioactive sand piles. The NRC staff considers this an open issue.

Section 5.4.1.2, Page 5.8

As discussed in TER Subsection 5.4.1.1, DOE needs to include fluoride, nickel, gross alpha, and selenium to the list of hazardous constituents and identify concentration limits for these constituents. The NRC considers this an open issue.

SECTION 2

Response: By:

Date: 2/4/91

In response to this comment, DOE conducted a review of existing and newly acquired water quality data. Because recent sampling of lysimeters in the radioactive sands has detected fluoride and net gross alpha, they will be added to the list of hazardous constituents and elements in hazardous constituent compounds. Nickel and selenium should not be added as they do not exceed laboratory method detection limits in any analyses of radioactive sand pore fluids (Calculation # LOW-12-90-12-06).

No concentration limits have been proposed for nickel and selenium because they do not exceed laboratory method detection limits in radioactive sand pore fluids or neutral batch-leach tests. No concentration limits are proposed for fluoride for reasons in response to comment 10,. However, the MCL for net gross alpha is proposed as its concentration limit.

Plans for Implementation: Fluoride and net gross alpha will be added to the list of hazardous constituents and elements in hazardous constituent compounds that exceed laboratory method detection limits.

The MCL for net gross alpha will be proposed in the RAS. An explanation that no concentration limit has been proposed for fluoride because it is an element in the manmade compound carbon oxyfluoride that is not related to uranium processing, but listed in Appendix VIII, will also be included in the RAP. Section 3.1.1 of Attachment 4, page 13, will be revised so that references to Appendix I and Appendix IX hazardous constituents are deleted and the only reference is to the 1987 EPA proposed groundwater standards.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 19, Open Issue No. 13

Section 5.4.1.1, Page 5.7

Copper and zinc are not listed in Appendix VIII as hazardous constituents; therefore, they should not be included in the list of hazardous constituents. However, copper and zinc cyanide compounds are listed as hazardous constituents. Since both copper and zinc were measured above the detection limit in the pore fluids of the sands and cyanide was measured above background in the groundwater, these compounds may have been used in the process of the sands. DOE needs to show that copper cyanide and zinc cyanide should not be included in the list of hazardous constituents. The NRC considers this an open issue.

SECTION 2

Response: By: William Downs - TAC

Date: 2/4/91

Neither copper cyanide, zinc cyanide, nor cyanide ion should be listed as a hazardous constituent for the Lowman UMTRA Project site. A review of the records available of analyses performed by Ford, Bacon & Davis Utah Inc. (FBDU, 1981) and conversations with the last superintendent of the mill (Porter, 1989) indicates that operations were limited to the physical separation of monazite concentrates from the placer sands. The only chemical additive that was used in the entire process was a flocculent (aerofloc 500, American Cyanamid Corp., Inc.) that was added to the process water during the spring runoff when the influent water was cloudy (Porter, 1989). Cyanide (CN^-) is used as a leaching agent for the dissolution and recovery of precious metals such as gold (Huiatt and others, 1983). Because precious metal was never recovered from the Lowman ores, there was never any reason for cyanide to have been introduced into the system.

The only indication that cyanide exists in the system at all is a series of analyses from three downgradient wells which were sampled in August 1987. These were the only wells sampled during this sampling round and the measurements were the only ones above the detection limit in three years of sampling. In addition, the measured concentrations of 0.02 to 0.03 mg/l are sufficiently close to the minimum detection limit of 0.01 mg/l that they are within the range of analytical error. In subsequent samplings, cyanide was not observed above the detection limits.

References:

FBDU (Ford, Bacon & Davis Utah Inc.), 1981, Environmental Assessment of Radioactive Sands and Residues, Lowman Site, Lowman, Idaho, DOE/UMT-0118 FBDU 360-17, UC70. prepared for DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Porter, D., 1989, Personal communication from D. Porter of Lowman, Idaho, past superintendent of Lowman uranium processing plant, to Donald R. Metzler, Hydrological Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico.

Huiatt, and others (J. L. Huiatt, J. E. Kerrigan, F. A. Olson and G. L. Potter), 1982, Proceedings of a Workshop on Cyanide from Mineral Processing, Utah Mining and Mineral Resources Research Institute, Salt Lake City, Utah.

Plans for Implementation: No concentration limits will be proposed for copper and zinc in the RAS.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 20, Open Issue No. 14

Section 5.4.1.2, Page, 5.7

The NRC staff does not concur with the proposed concentration limits identified in Table 5.3. The statistical maximum background concentrations, used as proposed concentration limits, for aluminum, strontium, and vanadium do not agree with the statistical maximum concentrations derived in DOE's analyses. DOE needs to provide supporting calculations to justify the proposed concentration limit for these constituents. The NRC considers this an open issue.

Section 5.4.1.2, Page 5.8

DOE has proposed to use t e Idaho/EPA secondary drinking water supply standards for copper zinc, since no MCLs have been established for these constituents. The NRC staff does not consider these to be appropriate limits. In accordance with Section 192.02 (ii) of 40 CFR Part 192, either background, MCLs, or alternate concentration limits (ACLs) must be used as concentration limits. If copper and zinc cyanide are included as hazardous constituents (see TER Section 5.4.1), DOE will need to propose appropriate concentration limit for these compounds. The NRC considers this an open issue.

SECTION 2

Response: ______________________ By: ______________________

Date: 2/4/91

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________________

Approved by: ______________________ Date: ______________________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 21, Open Issue No. 15

Section 5.4 1.2, Page 5.8

DOE has proposed a concentration limit of 44 mg/l for nitrate; the proposed concentration limit in 10 CFR Part 192 is 10 mg/l as measured by nitrogen. DOE needs to use either the proposed EPA MCL of 10 mg/l or the background concentration, or propose an ACL. The NRC considers this an open issue.

SECTION 2

Response: ______________ By: Will Downs - TAC

Date: 2/4/91

Nitrate is an oxyanion consisting of one nitrogen bonded to three oxygens, NO_3^-. A nitrogen ion has a mass of 14.01 g/mole and the three oxygens have masses 16.00 g/mole each for a total mass for a total mass of 62.01 g/mole for the nitrate ion. Because the concentrations are measured in mg/l (mass/volume), the concentration of 44.0 mg of nitrate/l is the same as 10.0 mg of nitrate-nitrogen/l (62.01/14.01 = 4.426). By expressing the concentration limit as 44 mg nitrate/l, the DOE has proposed the MCL of 10 mg nitrate-nitrogen/l.

Plans for Implementation: The DOE agrees to express the concentrations in terms of nitrate-nitrogen in the RAS. A similar reduction of 4.43 times will be applied to those concentrations reported as nitrate.

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 22

Section 5.4.2, Page 5.8

DOE must demonstrate......

SECTION 2

Response: ______ By: ______

Date: 2/4/91

The basis for meeting the EPA standards and the elements of the performance assessment are discussed in responses to Comments 11, 12, 15.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______ Date: ______

Approved by: ______ Date: ______

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 23

Section 5.4.2, Page 5.8 - 5.9

DOE concludes that the radioactive sands are not subject to geochemical weathering because they are placer deposits that are end-stage weathering products. Further, DOE believes that the chemical stability of the sands is demonstrated by the fact that there is no existing groundwater contamination on the site even though the sands have been openly exposed to the environment for the last 30 years. The NRC staff does not concur that DOE has adequately determined that the EPA standards will be met. The NRC considers this an open issue, as discussed below.

SECTION 2

Response: ______ By: ______

Date: 2/4/91

Plans for Implementation: The DOE will state in the RAS that it will monitor the spring at location 561 as part of its groundwater monitoring plan.

SECTION 3

Confirmation of Implementation:

Checked by: ______ Date: ______

Approved by: ______ Date: ______

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 24

Section 5.5, Page

DOE used only five on-site/downgradient wells to determine that no groundwater contamination has occurred; this appears to be too few wells to assess the water quality condition of an area covering 35 acres. Statistical analyses performed by NRC staff shows that the well location and well spacing is unsuitable for detecting a small contamination plume that could have formed from several of the smaller sand and ore pi[illegible], and the dr[illegible] pond.

In DOE's statistical comparison of h[illegible] constituents in on-site/downgradient wells to concentrations in background wells, no analyses were made of cadmium, gross alpha, lead, silver, and uranium even though the statistical maximum background concentrations of these constituents on-site/downgradient wells exceeded the statistical maximum background concentrations. DOE did not provide and explanation as to why no comparison was made on these constituents.

SECTION 2

Response: By:

Date: 2/4/91

The DOE has provided an additional assessment of groundwater conditions that demonstrates no groundwater contamination in these response items. The DOE has described in response to comments 13 and 15, how a contaminant plume would have moved along the axis of the paleochannel and discharge to the spring at location 561. Therefore, it is concluded that no contaminant plumes could have gone undetected. For the site conditions, DOE has demonstrated in response to comments 13, 15, and 16, that there are sufficient control points for groundwater monitoring.

In calculation LOW #12-90-12-06, all hazardous constituents and elements contained in hazardous constituent compounds that exceed laboratory method detection limits and that do not occur as hazardous constituent compounds that are insoluble, were considered for analysis as potential groundwater contaminants. All hazardous constituents were below the MCLs in groundwater (Calculations LOW #01-91-14-11-0). No statistical calculations were performed for cadmium and silver because they are not hazardous constituents related to residual radioactive materials that exceed laboratory method detection limits. Net gross alpha, not gross alpha, has been added to the hazardous constituent list; but all concentrations in groundwater are below the MCL (calculation LOW-____) . Statistical analyses of net gross alpha, lead, and uranium were not performed because the standard is the MCL, and all sample data were below the MCL.

All quality control/quality assurance procedures are documented in standard operating procedures available on file at the Jacobs Engineering Group Albuquerque UMTRA Operations Office. Pertinent standard operating procedures have been provided as an attachment to these response items. For practical purposes they were not included as an attachment to the RAS.

Based on the information presented in these response items and that originally presented in the RAS, the DOE maintains that it is in compliance with the EPA standards listed in Subparts B and C of 40 CFR 192.

Plans for Implementation: Additional characterization data and discussion will be added to the RAS to further identify the density of geologic control and sufficiency of the groundwater monitoring system. Net gross alpha has been added as a hazardous constituent that exceed laboratory method detection limits. Its concentration limit will be proposed in the RAS as the MCL. Fluoride will be added to the list of hazardous constituents and elements as hazardous constituents compounds that exceed the laboratory method detection limits.

SECTION 3

Confirmation of Implementation:

Checked by: ____________ ____________ Date: ____________

Approved by: ____________ ____________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 25, Open Issue No. 16

Section 5.6, Page 5.12

DOE has not adequately demonstrated that the EPA standards will be met at the point of compliance. Additional information is needed to assess that water within the radioactive sand piles is of a higher quality than the ambient groundwater, and a more conclusive analysis of the subsoil attenuation properties. The following information is needed:

a. an appropriate comparison of pore fluid concentrations in the radioactive sands to pore fluid concentrations in the native soils
b. a demonstration that the pore fluid samples taken from the radioactive sands were taken at the appropriate locations within the piles
c. a demonstration that the only constituents of concern are antimony and vanadium
d. a more conclusive analysis of the attenuation properties of the subsoils under the pile.

SECTION 2

Response: ______ By: William Downs - TAC

Date: 2/4/91

Response to 23a:

a. The radioactive sands at the Lowman site are the result of several different sizing and concentration operations and greater than 90% of the material is in the range of 0.15 mm to 1.18 mm (sieve range: +100 to -16)(Lowman RAP, Information to Bidders, Volume I). This relatively large size and complete sorting allows for a very high effective porosity (>50%) and an extremely high hydraulic conductivity (0.10 cm/s). Sixteen lysimeters were installed in the tailings piles and only those that are located very near to the tailings-sediment interface produce liquid and, then, only in the late fall and spring. During some of these sampling events, there is only sufficient sample obtained to be able to conduct analyses on a limited number of constituents.

Of the six lysimeters placed within the native soils upslope of the Lowman site, only one has produced a sample for analysis. This data base will not allow a statistical analysis.

An attempt was made to determine the distribution of hazardous constituent concentrations as a function of site material (e.g. black sands, white sands, ore, etc). There is sufficient variability in the limited data sets that the coefficients of variation (CV = Std. Dev./Mean) exceed 0.50 which, of course, can generate negative concentrations, a physically meaningless value, for the lower confidence limit. The attached Table One is a qualitative comparison of the mean or median value computed for the radioactive sands lysimeter samples with the single value available for soil pore fluid. Many of the constituents for which analyses were performed on both types of samples were below the detection limit in both cases. For those elements (14) for which detectable data exist, none had a higher concentration in the sands than in the subsoils. The last column in Table One is a listing of the difference between the soil pore fluid and the sand pore fluids.

Plans for implementation: This discussion will be added to the RAS.

Response to 23b

b. Because the tailings sands have such a high hydraulic conductivity and are very loose, it is virtually impossible to maintain an open hole with a hand auger or to position a vehicle on top of the pile for the purpose of installing lysimeters. The locations of the lysimeters, both horizontally and vertically, were determined by the ability to gain access. Some lysimeters were placed to collect fluid from the center of the pile and others were placed to collect samples from the base. Only those lysimeters at the base of the pile have ever yielded samples and, then, only during the wet seasons. The only time that fluid collects within the piles is when it perches on the subpile sediments. Because the lysimeter samples from the sands may not represent equilibrium, batch leach tests were conducted using distilled water and the individual types of sands.

Plans for Implementation: None.

Response to 23c

c. In order for an element or nuclide to be listed as a hazardous constituent, it must be reasonably expected to be in or derived from the residual radioactive material and it must be listed in Table A or Appendix I of 40 CFR 192.02 (a)(3)(i). Because the Appendix I constituents have not been made final, the constituents listed in Appendix VIII of 40 CFR 261 that are referred to in 40 CFR 192 are the official constituent list. All concentrations of hazardous constituents that appear in the revised concentration limit, Table Two (attached), are less than the MCLs in the radioactive sand pore fluids.

TABLE ONE
Qualitative Comparison of Elemental Concentrations within Soil and Tailings Pore Fluids

Element	Tail. Pore Fl. Concen. (mg/l)	Soil Pore Fl. Concen. (mg/l)	Soil - Tail. Difference
Aluminum	0.050	<0.1	Insuff. data
Antimony	0.026	0.031	Positive
Arsenic	0.005	<0.01	Insuff. data
Barium	0.05	<0.1	Insuff. data
Beryllium	0.005	<0.01	Insuff. data
Cadmium	0.0005	<0.001	Insuff. data
Calcium	8.52	28.6	Positive
Chromium	0.005	<0.01	Insuff. data
Copper	0.025	0.11	Positive
Iron	0.015	0.12	Positive
Lead	0.005	<1.01	Insuff.data
Magnesium	1.87	6.54	Positive
Manganese	0.026	0.33	Positive
Molybdenum	0.005	0.03	Positive
Nickel	0.02	<0.04	Insuff. data
Potassium	1.77	4.9	Positive
Selenium	0.0025	0.006	Positive
Silver	0.005	<0.01	Insuff. data
Sodium	6.92	11.1	Positive
Strontium	0.05	0.17	Positive
Thallium	0.05	<0.01	Insuff. data
Uranium	0.0015	0.0043	Positive
Vanadium	0.09	0.42	Positive
Zinc	0.066	0.257	Positive

Response to comment 23c: (continued)

Only antimony and vanadium constituents without MCLs are higher in radioactive sand pore fluids than background water qualities (Calculation #Low-01-91-12-08). All other potentially hazardous constituents should exist in concentrations either below background or designated maximum concentration limits (Table 3.1, Lowman RAP). Therefore, the conclusion was reached that even though the calculated groundwater concentrations for antimony and vanadium exist in higher concentrations in the sample of native soil pore fluid, they should be listed as hazardous constituents and given concentration limits.

No concentration limits have been proposed for elements which are components of inorganic compounds listed in Appendix VIII of 40 CFR 261. These compounds are manmade and were not used in the processing of the radioactive sands. Included among these compounds are aluminum phosphide, carbon oxyfluoride, copper cyanide, strontium sulfide, zinc phosphide, and zinc cyanide.

Plans for Implementation: The revised concentration limit table will be added to the RAS.

Response to 23d:

d. In the spring of 1990, test pits were excavated into the materials beneath the ore stockpile (TP-645) and beneath one of the black sand piles (TP-648). The subsurface material beneath the ore stockpile is weathered granite and that beneath the black sand tailings pile is colluvium. Samples of the subsurface material were subjected to EPA Extraction Method 3050 and the extractants were analyzed for their hazardous constituents. The working hypothesis was that if constituents had been leaching out of the overlying materials, there should be a regularity of distribution within the subsurface materials that would provide estimates of the loading capacity and the amount of material that had been introduced into the subsurface.

The results of the analyses are presented in the Lowman RAP Attachment 3, Figures 3.12 and 3.13. The main observation is that there is no regularity of distribution for the hazardous constituents that indicates that any contribution has been made to the subpile materials. While there are very few samples seven from TP-645 and eight from TP 648, low population statistical analyses indicate that all of the samples combined and those within each test pit are members of the same normally distributed population. Consequently, the DOE is confident that while the absorption efficiency and geochemical loading capacity of the subpile materials are unknown, the facts that the groundwaters contain no hazardous constituents and that there has been no apparent build up of hazardous constituents in the subsurface materials indicates that virtually nothing is leached from the tailings piles and that any available attenuation capacity can only act as an insurance against the spread of contamination.

Plans for Implementation: None.

SECTION 3

Confirmation of Implementation:

Checked by: ______________________ Date: ______________

Approved by: ______________________ Date: ______________

TABLE TWO

Summary of DOE proposed concentration limits for hazardous constituents and elements existing in hazardous constituent compounds at the Lowman site, Idaho.

Hazardous constituent	DOE proposed concentration limit[a]
Antimony	0.005[b]
Barium	1.0[c]
Chromium	0.05[c]
Lead	0.05[c]
Net gross alpha	15p[c](Ci/l)
Molybdenum	0.1[c]
Nitrate	10.0[c]
Radium -226 and -228	5[c] (pCi/l)
Vanadium	0.03[b]
Uranium	0.044[c]

[a] In mg/l unless other wise noted; pCi/l = picocuries per liter.
[b] Statistical maximum background groundwater. See attachment 3, Section 3.5 for analysis of background groundwater quality.
[c] EPA MCL (40 CFR 192.02).

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 26, Open Issue No. 18

Section 6.2.1, Page 6.2

Values for Ra-226 concentrations in Table 6.1 and Sections 6.3.6 and 6.4 of the RAS are not in agreement with those used in the supporting calculation. This is considered an open issue by the NRC staff.

SECTION 2

Response: ______________ By: Gere Millard - TAC

Date: 2/4/91

Radium -226 concentrations in Section 6.3.6 and Table 6.1 were corrected to agree with MKE supporting calculations on 10/10/90 and will be incorporated into the final. There are no Ra-226 concentrations in Section 6.4 of the preliminary Final RAS.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 27, Open Issue No. 2

Section 6.2.1, Page 6.2 - 6.3

Physical properties of the radon barrier soil were selected by DOE based on the results of laboratory testing on two samples identified as being representative of the material that will be used to construct the radon barrier. DOE did not provide sufficient substantiation that these samples were representative of the area designated as the radon barrier borrow (see Section 3.2.2). The parameters assigned by DOE for the radon barrier in the analyses must therefore be substantiated before the NRC staff can concur in the design of the radon barrier. The NRC staff considers this an open issue.

SECTION 2

Response: ______________ By: G. Millard, R. Bennett - TAC

Date: 2/4/91

Six additional samples of radon barrier materials have been collected from four test pits within the borrow area on the Lowman site. Geotechnical testing of these materials indicates that they have similar percent moistures at compactions of 95%, densities, permeabilities, and percent fine materials when compared to the original borrow soil samples collected. Therefore, design of the radon barrier based on the original borrow soil samples is representative of the colluvium to be used for a cover.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 28

Section 6.2.2, Page, 6.3

The NRC staff used the RAECOM computer code (NRC, 1989) to try to estimate the required radon barrier thickness using the parameters proposed by DOE. The parameters for the radon barrier soil were selected based on the material types specified as acceptable radon barrier in specifications. However, the uncertainties in the parameters as discussed in Section 6.2.1, were such that the staff was unable to reach a conclusion with respect to radon barrier thickness. Therefore, until resolution of the open issues discussed in Section 6.2.1, the NRC staff is unable to conclude that a 1.5-foot-thick radon barrier is adequate to meet the EPA standard.

SECTION 2

Response: ____________ By: ____________

Date: 2/4/91

As previously discussed, the additional radon barrier materials sampled have geotechnical characteristics that are similar to the original two samples collected. The colluvial radon barrier material has therefore been adequately represented in the radon barrier design. If should be noted that under realistic conditions, uncertainties in the RAECOM parameter estimates will not result in the requirement for a cover thickness in excess of 1.5 feet.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ____________ Date: ____________

Approved by: ____________ Date: ____________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 29, Open Issue No. 19

Section 6.3, Page 6.3

No action level was proposed to define a significant radiation hazard. Should DOE wish to impose a supplemental standard for uranium that is consistent with the EPA standard, the criteria (after cleanup of Ra-226) would be 10 pCi/g total uranium in the top 15 centimeters of soil and 30 pCi/g total uranium in subsequent 15 centimeter layers. However, should DOE elect to support another cleanup standard, then DOE should present justification under 40 CFR 192,21 and 192.22 for use of supplemental standards. The RAP discussion on supplemental standard for uranium should be revised to reflect one of these options. The staff considers this an open issue.

SECTION 2

Response: ______ By: Gere Millard - TAC

Date: 2/4/91

The RAS will be modified to include supplemental standards for total uranium in soil of 10 pCi/g for the first 15 cm and 30 pCi/g in subsequent 15 cm layers.

Plans for Implementation: See response above.

SECTION 3

Confirmation of Implementation:

Checked by: ______ Date: ______

Approved by: ______ Date: ______

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 30, Open Issue No. 20

Section 6.3, Page, 6.4

It should be noted that DOE has indicated that two areas with low average radium-224 concentrations may be considered for supplemental standards on the basis of environmental harm to riparian and forested areas. These two areas were not specifically identified and no justification for the application of supplemental standards were provided in the RAS. DOE should indicate if supplemental standards will be used, and if so, identify the areas to which they will be applicable and provide a justification for the supplemental standards being proposed. The NRC staff considers this an open issue.

SECTION 2

Response: ______________ By: Gere Millard - TAC

Date: 2/4/91

A discussion of the justification for application of supplemental standards to the windblown and waterborne areas at Lowman will be included in the RAS. Areas proposed for exclusion by supplemental standards will be identified in Figure 1.2 of the RAS.

Plans for Implementation:

SECTION 3

Confirmation of Implementation:

Checked by: ______________ Date: ______________

Approved by: ______________ Date: ______________

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Lowman, Idaho Date: February 1, 1991

Document: Draft TER

Commentor: NRC

Comment No. 31

Section 6.3, Page 6.4

The final radiological survey will be based on analyses of nine samples from each 100 M^2 area composited to determine average radium -226 concentrations. In areas of windblown contamination, a nine-point, hand-held composite gamma measurement technique or a gamma scanning tractor may be used to verify that the EPA standards have been met. No provisions were made to verify these techniques by calibrating with soil sampling. This will be considered an open issue item.

SECTION 2

Response: ____________ By: Jere Millard - TAC

Date: 2/4/91

RAC procedure 015 details calibration, routine operating checks, and a quality assurance program which includes collection of composite soil samples on 2 grids per 25 surveyed. The RAS will be modified to include this information concerning gamma or RTRAK scanning verification.

Plans for Implementation: See note above.

SECTION 3

Confirmation of Implementation:

Checked by: ____________ Date: ____________

Approved by: ____________ Date: ____________