Department of Energy
Albuquerque Operations Office
P. O. Box [illegible]00
Albuquerque, New Mexico 87185-5400

NOV 03 1994

WM-86

Mr. Joseph J. Holonich, Chief
High-Level Waste and Uranium Recovery
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards
Mail Stop 5E-4 OWFN
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Holonich:

Please find enclosed our responses to comments made by your staff and the Colorado Department of Public Health and the Environment on the Remedial Action Plan for the Slick Rock UMTRA Project site. I will be contacting Mr. Mike Layton, of your staff, to schedule a conference call to discuss any outstanding issues. If you have any comments or questions, please contact me at your earliest convenience at (505) 845-6130.

Sincerely,

Russel Edge

Russel Edge
Site Manager
Uranium Mill Tailings Remedial Action
Project Office

Enclosure

cc w/o enclosure:
C. Smythe, UMTRA
D. Bierley, TAC
M. Leaf, TAC
W. Migdal, TAC

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PDR WASTE
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COH/UMT/0594/0023

STATE OF COLORADO

COLORADO DEPARTMENT OF HEALTH
Dedicated to protecting and improving the health and environment of the people of Colorado
Grand Junction Regional Office
222 S. 6th Street, Rm. 232
Grand Junction, CO 81501-2768
FAX: (303) 248-7198

Roy Romer
Governor
Patricia A. Nolan, MD, MPH
Executive Director

April 27, 1994

Mr. Russell Edge
U.S. Department of Energy
Albuquerque Operations Office
2155 Louisiana Blvd. NE, Suite 10000
Albuquerque, NM 87110

Dear Mr. Edge:

Please find enclosed comments from the Colorado Department of Health following review of the preliminary final draft of the Remedial Action Plan for the Slick Rock UMTRAP Site.

It should not be inferred that our lack of comment on the proposed use of supplemental standards for the area on the east bank of the Dolores River near the UC site implies concurrence. The Colorado Department of Health will consider such an application when received. Please refer to the Supplemental Standards Justification Checklist, dated July 20, 1992, incorporated in the Vicinity Property Management and Implementation manual. This guidance lists the minimum information that must be supplied to assure a timely review by the Colorado Department of Health.

In addition to the formal comments, we call your attention to the following minor error:

> Attachment 3, Figure 3-3, page 3-7: The water table contour for the NC site has been mislabeled. The contour should read "5440".

As the date for the start of remediation at Slick Rock approaches, we anticipate a safe and cost effective project. Do not hesitate to contact me at 303-248-7167 or at the address printed above.

Sincerely,

Dennis Willis

Dennis Willis
Hazardous Materials and
Waste Management Division

DW:ae

Enclosures

cc: J. Deckler, w/enclosures
File

Printed on Recycled Paper

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Slick Rock, Colorado
DOCUMENT:	Preliminary Final RAP
COMMENT NO:	Appendix C to Attachment 3, Calculation SRK-11-93-12-06-00
COMMENTOR:	Colorado Department of Health
DATE:	April 27, 1994

Our comments may suggest the excavation of the disposal cell to a depth greater than that assumed by the seepage calculation. What is the break-even point between additional excavation and the construction of a clay liner as proposed in the original design?

RESPONSE

RESPONSE BY:
DATE:

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Slick Rock, Colorado
DOCUMENT:	Preliminary Final RAP
COMMENT:	Appendix C to Attachment 3, Calculation SRK-11 93-12-06-00
COMMENTOR:	Colorado Department of Health
Date:	April 27, 1994

There does not appear to be any data related to a study of the "rip ability" of the claystones into which the disposal cell will be excavated. Increased costs may be expected if the claystones cannot be ripped to the proper depth and must be excavated by other means. Can the "rip ability" of this material be inferred from any existing data? If not, thought should be given to acquiring data adequate to demonstrate the physical characteristics of this material.

RESPONSE

RESPONSE BY:
DATE:

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Slick Rock, Colorado
DOCUMENT:	Preliminary Final RAP
COMMENT NO:	Attachment 3, Figure 3-1, Page 3-3
COMMENTOR:	Colorado Department of Health
DATE:	April 27, 1994

Figure 3-1 has been revised to show locations of both privately-owned wells and lysimeters. In addition, wells identified as #684 and #685 north of the UC site have been added. These wells are labeled privately owned but are noted as on-site DOE monitor wells in Table 3.2. Water level measurements for these wells are included in Table 3.3. However, water quality data for these wells are not provided even though the data are mentioned in the text on page 3-37, Section 3.1.9. Please clarify ownership of wells #684 and #685 and provide the water quality data.

RESPONSE

RESPONSE BY:
DATE:

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock, Colorado
DOCUMENT: Preliminary Final RAP
COMMENT NO: Appendix C to Attachment 3, Calculation SRK-11-93-12-06-00
COMMENTOR: Colorado Department of Health
DATE: April, 27, 1994

The range of permeabilities for the Burro Canyon formation is stated on page 10 as 1.8 X 1.0 X 10^{-4} to 1.0 X 10^{-8} cm/sec. Lab permeabilities as low as 4.4 X 10^{-11} are reported. If these permeabilities are representative of the Burro Canyon formation, a model employing a lower permeability, perhaps 1.0 X 10^{-8}, should be analyzed. We assume the model will be sensitive to this parameter and conclude the case used to predict 1.5 meters of saturation may not be representative of conditions at the site.

RESPONSE

RESPONSE BY:
DATE:

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Slick Rock, Colorado
DOCUMENT:	Preliminary Final RAP
COMMENT NO:	Appendix C to Attachment 3, Calculation SRK-11-93-12-06-00
COMMENTOR:	Colorado Department of Health
DATE:	April 27, 1994

The seepage analysis describes a placement sequence not specified in the subcontract documents. If a more moist material is placed lower in the cell, the depth of the saturated zone may increase. To assure that modeling efforts account for this possibility, other placement sequences should be analyzed. Alternatively, the modeled sequence should be stipulated in the specifications.

RESPONSE

RESPONSE BY:
DATE:

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Slick Rock, Colorado
DOCUMENT:	Preliminary Final RAP
COMMENT NO:	Appendix C to Attachment 3, Calculation SRK-11-93-12-06-00
COMMENTOR:	Colorado Department of Health
DATE	April 27, 1994

The conclusions of the seepage analysis depend on the assumption additional water will not be required for compaction. The case assuming only in-situ moisture content concludes that 1.5 meters of saturation will result. However, addition of water may be necessary for dust control as experienced at other Colorado UMTRA sites. In our opinion, it would be a violation of ALARA principles if the project were forced to accept increased exposure to the workers and public in order to avoid violating the logic for eliminating the clay liner. We are not convinced the "in-situ" case is representative of the conditions that will occur during construction. Worker and public safety must not be compromised in order to minimize the amount of saturation that may occur. Our preference is to construct the cell to such a depth that water applied for dust control can be accommodated without compromising the integrity of the cell.

RESPONSE

RESPONSE BY:
DATE:

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE	Slick Rock, Colorado
DOCUMENT:	Preliminary Final RAP
COMMENT NO:	Appendix C to Attachment 3, Calculation SRK-11-93-12-06-00
COMMENTOR	Colorado Department of Health
DATE:	April 27, 1994

The results of the model appear to be very sensitive to the initial moisture content of the material. CDH would like to review the initial assumptions in more detail. The calculation presents aggregate values for the various materials but the documentation for these aggregate values is absent. Please provide more detailed documentation describing how the initial moisture content values used in the model were derived.

RESPONSE

RESPONSE BY:
DATE:

PLANS FOR IMPLEMENTATION

RESPONSE TO CDH COMMENT NO. 1

When the seepage report was written, there was a debate between the TAC and RAC geologists over the depth below the surface of the Dakota-Burro Canyon contact. By further reviewing existing bore hole and test pit data and conducting an additional field investigation in November 1993, the TAC and RAC established the specific location of the Dakota-Burro Canyon contact at the disposal site.

Both the TAC and RAC technical staffs concluded that all the mudstone and most, if not all, of the siltstone of the Dakota Formation can be ripped with a large bulldozer dragging a hook. Because of weathering, the mudstone/claystone of the Burro Canyon Formation near the interface of the Dakota and Burro Canyons Formations is probably rippable as well. The unweathered mudstone and claystone of the Burro Canyon Formation beginning a few feet below the interface is not rippable and blasting is required to excavate into the unweathered zones of the Burro Canyon Formation.

The current excavation depth extends to, or just below, the Dakota-Burro Canyon interface and all the strata above the interface, with the possible exception of two thick sandstone layers at the southern end of the disposal cell, are rippable. Regardless, the intent of eliminating the clay liner is to reduce the overall cost of the remedial action and reduce the disturbance to surrounding areas by eliminating the need for the fine-grained soil required to construct the liner. Thus, the TAC did not evaluate other design features for controlling lateral seepage.

PLANS FOR IMPLEMENTATION

None. As currently proposed, the bottom of the disposal cell excavation terminates on, or just above, the unrippable, unweathered mudstone/claystone of the Burro Canyon Formation

RESPONSE TO CDH COMMENT NO. 2

Numerous field investigations were conducted at the Burro Canyon disposal site by the TAC and RAC - the latest completed in November 1993. Although sonic tests (ASTM D2845-90) of core samples were not performed to determine engineering parameters of the rock layers, the site geologists and engineers concluded that most of the Dakota Formation, regardless of the lithology, and the weather mudstone and claystone of the Burro Canyon Formation can be ripped with a bulldozer.

The previous judgement by TAC and RAC personnel is based of field observations; among the relevant observations are: 1) a small backhoe can penetrate the mudstone and shale; and 2) most of the siltstone is a facies variant of the shale and mudstone and therefore rippable.

Estimates of the volume of rippable and non rippable materials are presented in MKES Calculation 11-333-02-00. To estimate the quantities of ripple and non-rippable material, the RAC assumed conservatively that none of the sandstone is rippable. The TAC believes, however, that sections of the sandstone layers, especially lenses that are 3-4 feet-thick or less, can be ripped once a large enough area is clear to allow access by a large bulldozer. The previous assertion is based on the following field observations: 1) a small backhoe can penetrate the thinner lenses of the sandstone layers; 2) at several mining claims downdip of the disposal mesa, small backhoes and bulldozers were used to rip the unweathered sandstone layers. As stated in the response to CDH comment number 1, the unweathered claystone and mudstone of the Burro Canyon Formation cannot be ripped.

To avoid confusion, the layers of the Dakota Formation and Burro Canyon Formation alternately referred as mudstone, claystone, and siltstone in the seepage report will be called fine-grained strata (of the applicable Formation) in the final version of the report. The designations of the various strata are based primarily on field observation and visual inspection of core samples. In order to precisely differentiate among siltstone, mudstone, and claystone; the mineral content of the rock has to be determined through laboratory analyses.

PLANS FOR IMPLEMENTATION

Comment acknowledged. Based on the currently available information, the DOE is reasonably certain which materials at the disposal site can be ripped and which materials cannot. Thus, further geotechnical characterization of the disposal site is unnecessary.

RESPONSE TO CDH COMMENT NO. 3

The very low permeabilities presented in the draft seepage report were determined from laboratory tests of unweathered rock samples obtained, in most cases, well below the interface of the Dakota Formation and the Burro Canyon Formation. As the current excavation will not be advanced into the unweathered Burro Canyon Formation, all references to the laboratory determined permeabilities will be deleted from the seepage report. The 10^{-8} cm/sec conductivity reported in the document was determined from a packer test of a zone of the Burro Canyon Formation also located considerably below the planned excavation depth.

The higher values of conductivity, those in the 10^{-4} to 10^{-6} cm/sec range, were determined by packer tests of the fine-grained strata of the Dakota Formation and Burro Canyon Formation (weathered layers) near the interface of the two Formations. As the bottom of the disposal cell is located near the interface of the Dakota and Burro Canyon Formations, selecting a lower boundary flux of 10^{-6} cm/sec as a model input parameter is appropriate, and the simulated results are suitably conservative for disposal cell design purposes.

PLANS FOR IMPLEMENTATION

Comment acknowledged: The very low values of conductivity are not representative of the expected hydraulic characteristics of the foundation material of the disposal cell, and those values and associated text are to be deleted from the seepage report.

RESPONSE TO CDH COMMENT NO. 4

A contaminated material placement sequence is specified in the SubContract Documents, Section 02200 Rev. B - Earthwork, Item 3.5, B., 6 (a-i), page 24. The placement sequence described on page 10 of the seepage report and depicted in Figure A-1 of the Appendix is identical to the placement sequence of contaminated material specified in the Subcontract Documents.

There are different material types within the three specified contaminated material layers; for example, the NC tailings are sand, but the NC contaminated subpile soil is mostly silty-clayey sand with gravel. Regardless of whether there is mixing of the two NC materials during excavation, hauling and placement or whether the materials remain segregated; the assumed volume of drainable water in the materials is a constant, and the heights and durations of the saturated zone at the foundation of the disposal cell as simulated by the computer model should not change significantly.

PLANS FOR IMPLEMENTATION

Comment acknowledged. The placement sequence for contaminated materials is specified in the Subcontract Documents, and the sequential arrangement of layers in the model profile is identical.

RESPONSE TO CDH COMMENT NO. 5

The DOE did not imply that air quality would be compromised in order to reduce the volume of water added to contaminated material. To date, sixteen UMTRA disposal cells have been completed or are in the process of being completed, and from that experience with disposal cell construction, the DOE has concluded that fugitive dust can be controlled without significantly increasing the moisture content of contaminated material being relocated. Nonetheless, air quality will be monitored continuously and DOE will comply with all applicable federal and state guidelines for controlling fugitive dust during t he remedial action.

The seepage report is currently in the draft stage, and the rationale for selecting specific model parameter needs to be explained further. Additionally, a thorough interpretation of the curves presented on Figure A-3 through A-7 provides further justification of the design recommendations presented in the report.

As described in the report, the insitu moisture condition for each material layer is the volume weighted average moisture content, plus the standard error of the mean, plus two percent by volume water added to the contaminated material. Thus, the insitu water contents used in the computer simulations are three to four percent greater than the reported insitu moisture condition of contaminated materials at the processing sites.

Reviewers should consider both the predicted depth and the predicted duration of the saturated zone when assessing the relative conservativeness of the seepage analysis results. With respect to the lateral movement of pore fluid in the sandstone layers, the persistence of the saturated zone at the bottom of the disposal cell likely is just as significant as the height the zone eventually reaches. Investigators from PNL found that the greatest extent of lateral seepage occurred when the initially partially sandstone became saturated and remained saturated throughout a nearly 30 year period. With a low permeability cover placed over the Slick Rock tailings, the duration of the saturated zone at the foundation of the disposal cell is not long enough for tailing's pore fluid to laterally traverse more than a few meters into the sandstone.

Engineering procedures can be used to both control dust and minimize the volume of water added to contaminated material, and these mitigative procedures can be specified in the subcontract documents. Some of the specifications for controlling water use during disposal cell construction include: 1) fine-spray nozzles on water-truck - mist suppresses dust without increasing the moisture content of a material layer; 2) water shall not be added to tailings in order to meet compaction densities; 3) the placement moisture content of a contaminated material shall not be increased more than two or three percent, and 4) a contaminated material shall be compacted at drier than its optimum moisture content. All of the previous specifications are found either in part, or in entirety, in approved subcontract documents for other UMTRA sites, e.g. Subcontract Documents - Specifications, Gunnison, Colorado.

PLANS FOR IMPLEMENTATION

Add text to seepage report discussing the expected duration of the saturated zone at the bottom of the disposal cell and its impact on lateral movement of water through the partially saturated sandstone layers.

The DOE will ensure that dust releases are mitigated during the remedial action and that the volume of water added to the tailings is limited - by adding specifications to the Subcontract Documents clearly delineating what engineering measures and construction procedures will be used to both control fugitive dust and the amount of water added to the contaminated materials.

RESPONSE TO CDH COMMENT NO. 6

Aggregate values of moisture content for the different classes of contaminated material

are presented in MKES Calculations 11-250-04-03, Embankment Material Properties and 11-321-01-00. The field notes (sheets) and laboratory data sheets are found in Information for Bidders, Volume I. The TAC also used qualitative information to bolster conclusions and design recommendations presented in the seepage report; the following qualitative details are relevant:

- The DOE placed suction lysimeters in the UC tailings pile in 1987, 1988, and 1991; however, no pore fluid could be extracted during the sampling efforts. The site hydrologists assumed that the lysimeters were installed and sampled correctly, and concluded that the moisture content of the insitu UC tailings was very low.

- Both the TAC and RAC performed numerous sieve analyses of the NC and UC tailings. In addition, Merritt (Merritt, 1971) and other investigators reported that the tailings were discharged from the UC mill, and the older NC mill, into segregated fine-grained and coarse-grained piles. The fine-grained tailings from both the UC and NC sites were subsequently excavated and transported to the New Rifle mill. Thus, there is little uncertainty about the physical characteristic of UC and NC tailings. The tailings at both sites are poorly graded sand and the hydraulic properties of uniform sand are well documented. The very low insitu moisture content and high conductivity of the UC and NC tailings are consistent with the established properties of a sandy material.

- The model results are also sensitive to parameters other than the assumed initial moisture content. For example, the predicted depth and persistence of the saturated zone is sensitive to the saturated conductivity of the radon barrier. Both the conductivity of the radon barrier and the placement moisture content of a contaminated material layer are reasonably assumed to be controllable through specified construction techniques and practices, however. Additionally, one-dimensional (profile) flow model results are conservative, because predicted the depths of a saturated zone are exaggerated by the dimensional constraint of flow occurring only in two directions.

PLANS FOR IMPLEMENTATION

The applicable calculations, field notes and laboratory reports and data sheets should be available to reviewers already. If not, DOE will forward copies of the Calculation Volumes and Information for Bidders to interested personnel.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 1A

COMMENTOR: NRC

DOE should update the earthquake database (at least through 1993) and use more recent techniques in the determination of horizontal acceleration.

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

Comment Acknowledged

The data base in the document was dated 1989. An earthquake data base has been ordered that will be incorporated in Attachment 2.

PLANS FOR IMPLEMENTATION

Figure 2.6, "Epicentral compilation of all recorded earthquakes...."; Table 2.4, Earthquakes of M> = since 1960 in the Colorado Plateau"; and Section 2.4 SEISMOTECTONICS, "Review of seismic data for the Colorado Plateau." Will be revised accordingly.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 1B

COMMENTOR: NRC

DOE should update the earthquake database (at least through 1993) and use more recent techniques in the determination of horizontal acceleration.

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

Comment Acknowledged

PLANS FOR IMPLEMENTATION

Section 1.0 page 1-1 will be revised to include the following:
"In a recent study by Keaton (1994), the attenuation relationship of Campbell (1981) which has been used for UMTRA seismic hazard analysis through 1993, was compared with more recent relationships to determine if it is still applicable with the current state of the art. Other comparative studies were consulted, such as Campbell (1985), Joyner and Bore (1988, and Johnston et al (1992). Keaton interviewed several key authors and assessed comparisons of methodology and conservatism with more recent relationships that included Boore and Joyner (1994), Frankel et al (1994). There are differences in the philosophical approaches of these studies such as Boore et al believe that the shape of the attenuation relationship is independent of earthquake magnitude whereas Campbell and Bozorgnia (1994) believe that the shape is magnitude dependent. The conclusion of this comparison, supported by attenuation curves of each study, is that Campbell (1981) is reasonable and appropriate even though the data base was smaller. However, because of the history of support for Campbell in DOE, NRC and TAC, it is appropriate that DOE adapt the enhancements and refinements contained in Campbell and Bozorgnia (1994). A copy of the study and conclusions by Keaton is available from the Albuquerque Office of DOE."

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 2

COMMENTOR: NRC

DOE should provide support for the demonstration of the absence of Quaternary faulting and demonstrate (through existing references) a definitive age (years before present) of Pleistocene and/or Holocene for the Quaternary deposits not offset by the underlying non-tectonic faults.

RESPONSE

Comment Acknowledged

RESPONSE BY: GLindsey DATE: August, 9, 1994

PLANS FOR IMPLEMENTATION

Section 4.2, page 4-8, of Attachment 2 has been revised to provide a discussion on the evidence for Quaternary faulting and includes published references regarding the age of the deposits overlying the salt core collapse features.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 3A

COMMENTOR: NRC

DOE should clarify the manner of assignment of different magnitudes (5.7 for the Burro Canyon site and 7.0 for the Naturita site) for the same structure (Big Gypsum valley) and the determination as to which ME should be used. DOE should provide a technical basis for the statement that the 6.2 earthquake is the threshold magnitude at which ground rupture occurs. DOE should discuss the methodology used to describe how the maximum earthquake values in Figure 2-7 were drawn.

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

The confusion arises from two characteristics of the salt core anticlines: 1) different interpretations of the continuity of mapped fault segments lengths within the non-tectonic structure of the collapsed salt core anticline; and 2) as discussed in the Naturita and Slick Rock RAPs, all of the nontectonic salt core collapse features mask an underlying basement fault whose last known movement was probably during deposition of the Permian aged Paradox salt.

The fault segments are largely interred from the relief and configuration of the graben because the actual trace is buried below valley colluvium. The different interpretation of fault lengths based on aerial photographic interpretation, as well as from published maps, is shown on the respective fault maps (Plate 2.1 or Plate 1) of the respective documents. The possible Quaternary age of the fault traces that are exposed lead to the more conservative approach in the Naturita RAP that the inferred mapped fault traces are included in the total length of the segments.

As stated in Section 4.1 of both the Naturita and Slick Rock RAPs, the procedure of determining fault magnitude by the fault length is based on Bonilla et al 1984. As discussed on page 4-4 of the Naturita RAP, the magnitude was based on the fault lengths as an expression of the (underlying) tectonic features for the criticality assessment performed in Figure 4.1. This was a more conservative approach than was taken the Slick Rock RAP (also page 4-4) that considered the faults as nontectonic features and considered only their mapped lengths in estimating the potential magnitudes. Both approaches are valid but inconsistent within UMTRA documentation.

Conclusion

A more practical approach is a third method which uses the assessment of Kirkham and Rogers (1981) that it is unlikely that the salt core anticline collapse features are capable of generating more than a 4 or 5 magnitude earthquake. This assessment is supported by a theory of Campbell

(1984) that where rupture of the crystalline basement rock is not involved, the maximum magnitude of such events is very likely M = 5.5 or less. Campbell concludes that the basement rock provides the primary seismogenic source in larger earthquakes, and it is unlikely that stresses within the sedimentary material contribute any substantial energy to ground motion. This approach concludes that the basement faults of the Paradox Basin are not capable in the present seismotectonic regime and that fault length relationships are not applicable to nontectonic structures.

PLANS FOR IMPLEMENTATION

Section 2.4 of the Slick Rock RAP has been revised to include this discussion and show a maximum earthquake magnitude of all faults related to the Paradox Basin salt core collapse features of M = 5.0 regardless of mapped fault length. For consistency, the Naturita RAP will be similarly revised.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 3B

COMMENTOR: NRC

DOE should provide a technical basis for the statement that the 6.2 earthquake is the threshold magnitude at which ground rupture occurs.

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

Comment Acknowledged

PLANS FOR IMPLEMENTATION

Section 1.1 (page 1-3) of the RAP text which discusses the determination of the floating earthquake has been revised to clarify the technical basis for the use of magnitude 6.2 as the floating earthquake. The 1985 UMTRA Project documentation citing the DOE-NRC agreement to adopt the 6.2 earthquake as a floating earthquake magnitude has been included in the references.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.. 3C

COMMENTOR: NRC

DOE should discuss the methodology used to describe how the maximum earthquake values in Figure 2-7 were drawn.

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

Comment Acknowledged

PLANS FOR IMPLEMENTATION

The paragraph on Graphical determination of ME in Section 2.4, page 2-37, has been revised to clarify the determination of the maximum earthquake. The intent of Figure 2.7, to show that the historic data is inadequate for this determination, is unnecessary and has been deleted.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 4A

COMMENTOR: NRC

DOE should discuss and provide figures, as appropriate, regarding the RAP statement that hydrocarbon exploration has occurred adjacent to the site. The potential for hydrocarbon production in the site area and the effect of such production on the integrity of the disposal cell should be addressed, including the potential for collapse of the strata overlying the production horizon(s).

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

Comment Acknowledged

PLANS FOR IMPLEMENTATION

Section 2.5, on mineral resources, has been revised to include a discussion on the findings of the nearby exploratory gas well, the potential for finding petroleum resources and the possible effects of production of nearby oil and gas.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Site Design, Slick Rock, Colorado
COMMENT NO.: 4B

COMMENTOR: NRC

DOE should provide an oil/gas well location map and text to include both exploration and exploitation wells, as well as seismic surveys within a 9.3 mi (km) radius of the site.

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

Comment Acknowledged

PLANS FOR IMPLEMENTATION

The location of know oil and gas exploration wells within a nine mile site radius has been included in Section 2.5 of the fRAP, as well as a discussion of related data available from the state Geological Survey of Mines and Mineral Resources.

The potential for subsidence due to production of hydrocarbons in the near vicinity of the site will also be of similar negligible impact because of the integrity of the bedrock formations overlying potential production zones. The potential production zones would be expected to be within the Permian or Pennsylvanian strata, or older rocks, which are not exposed on the surface within this folded belt region. Since there are no faults in the immediate vicinity of the site that would be the focus of differential displacement, any subsidence resulting from oil or gas production would be fairly uniformly distributed over the surrounding area. Other factors that would mitigate effects of subsidence due to any nearby production is the relatively small acreage of the disposal site, compared to the area of a production zone, and the thickness of the cell cover that is designed to provide protection against cover cracking.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Site Design, Slick Rock, Colorado
COMMENT NO.: 5

COMMENTOR: NRC

DOE should adopt those natural resource portions (potash, natural brines) of the Naturita RAP (DOE, 1993) that are equally applicable to the Burro Canyon site.

RESPONSE

RESPONSE BY: GLindsey DATE: August, 9, 1994

Comment Acknowledged

PLANS FOR IMPLEMENTATION

Section 2.5, page 2-41, -45, of the Slick Rock fRAP will be revised to include a discussion of the potential for potash and natural brines mineral resources of the Paradox Salt Basin relative to the site. Figure 2.5, which is used to demonstrate geologic structure, also shows the limits of the potash deposits and will be referenced.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 6

COMMENTOR: NRC

DOE should include the planned additional consolidation testing of off-pile and subpile materials.

RESPONSE

RESPONSE BY: Ali M. Banani DATE: August, 9, 1994

Comment Acknowledged

Off-pile and subpile contaminated materials from NC and UC sites are low plasticity silt, clay and sandy clayey silt (ML, CL, SM, SC). These materials along with UC and NC tailings (which are sand) will be placed in the disposal cell at least 90% of the maximum dry density and at dry of optimum moisture content. The degree of saturation of compacted nontailings material will be about 45%. The consolidation parameters selected in the settlement calculation (Calc. No. 11-323-01-01) are from one consolidation test on a saturated sample and therefore yields very conservative results. Actually, a major part of the settlement will be due to immediate (elastic) settlement which will occur before placement of the cover. In addition since all contaminated materials will be compacted, the differential settlement will be minimal. Since the materials will be unsaturated and compacted, consolidation test results do not reflect the actual conditions. Therefore, no additional consolidation testing is required and the statement in the calculation will be deleted.

PLANS FOR IMPLEMENTATION

None required.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 7

COMMENTOR: NRC

Paragraph 3 of Section 3.3.3 in the Remedial Action Selection Report is confusing and should be re-written to more clearly address long-term differential settlement gradients.

RESPONSE

RESPONSE BY: JCrain DATE: August 1, 1994

Comment Acknowledged

The details of the settlement and cover cracking analysis, including CONSOL output files are presented in Attachment 1, Calculation 11-323-01-01.

PLANS FOR IMPLEMENTATION

The confusing statements has been deleted from the third paragraph of Section 3.3.3.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 8.1

COMMENTOR: NRC

Section 02200 of the Specification Article 2.2.B.1.b - Maximum particle size should not exceed 1/2 the compacted lift thickness. As written, the specification allows particle sizes as thick as the compacted lift. This specification is inconductive to achieving compaction.

RESPONSE

RESPONSE BY: Ali H. Banani DATE: August 9, 1994

Comment Acknowledged

Adequate compaction will be achieved if the maximum particle is up to 12 inches. This has been demonstrated in all the UMTRA sites completed to date. Contaminated materials often have particle sizes larger than 1/2 layer thickness. Having a size requirements of 1/2 the layer thickness will unnecessarily require crushing and processing of the materials. Adequate compaction will be achieved with the current specification and no changes are required.

The compaction requirement is to compact each lift of materials to at least the minimum densities specified in Article 3.8 of Section 0200 of the specifications. Compaction results will be obtained in the field. Adequate compaction will be achieved with particle sizes as thick as the compacted lift.

PLANS FOR IMPLEMENTATION

None required.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 8.2

COMMENTOR: NRC

Section 0200 of the Specification, Article 2.2.B.2.b - The paragraph would permit the placement of radon barrier material that has only 30 percent fines. DOE needs to provide additional assurance that radon barrier soils will meet or exceed the quality of those in the radon attenuation model.

RESPONSE

RESPONSE BY: Ali H. Banani DATE: August 9, 1994

Comment Acknowledged

Sieve analysis performed on seven radon barrier samples from Disappointment Valley shows that two samples RB2 (3-1/2 ft to 9 ft) and RB-6 (0 ft to 3 ft) are 38% and 30% finer than sieve #200, and the remaining samples are more than 50% finer than sieve #200. The two samples RB2 (3-1/2 ft to 9 ft) and RB-6 (0 ft to 3 ft) were tested for 15 bar moisture content, diffusion coefficient, specific gravity etc. These samples were among the samples whose properties were used in the radon attenuation model. Calc. No. 11-321-01-00 (Sheet B-3) shows that the diffusion coefficients, and long-term moisture contents of these samples are not significantly different from the average properties of all samples used in the radon attenuation model. Therefore, it is not expected that placing radon barrier materials with 30% finer than sieve #200 will change the design radon barrier thickness.

Laboratory testing was conducted on the fine-grained materials from an alternate borrow source at the Burro Canyon disposal site to determine if this material is suitable as radon barrier material. The data is currently being analyzed, and corresponding calculations and specifications will be revised. Preliminary results indicate the Burro Canyon material is suitable for use as a radon barrier source.

PLANS FOR IMPLEMENTATION

None required.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 8.3

COMMENTOR: NRC

Section 0200 of the Specification, Article 3.5.C.6 - If the "routing of hauling and spreading units" is insufficient to achieve proper compaction, additional mechanical compaction with alternate equipment will be necessary.

RESPONSE:

RESPONSE BY: Ali H. Banani DATE: August 9, 1994

The permanent stockpile areas are not supporting any load beyond their own weights, nor does the stockpile location have any impact on the disposal cell performance. The compaction achieved by routing of hauling and spreading equipment units is sufficient to prevent any excessive settlement. In addition, requiring denser compaction may inhibit plant growth and eventual site vegetation.

PLANS FOR IMPLEMENTATION

None required.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 8.4

COMMENTOR: NRC

Section 02200 of the Specification, Article 3.5.C.7.b - References to 90% and 95% compaction should refer to "assumed" or "equivalent" compaction since the actual value cannot be determined.

RESPONSE

RESPONSE BY: Ali H. Banani DATE: August 9, 1994

The DOE concurs with the comments. The intent was for compacting large size materials placed within zones requiring 90% or 95% compaction.

PLANS FOR IMPLEMENTATION

In the next revision to specifications in the fRAP, the title will refer to "equivalent" compaction.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 8.5

COMMENTOR: NRC

Section 02200 of the Specification, Article 3.7.A - Areas excavated to bedrock or to cobbles/gravel should not require subgrade preparation provided that they are judged to be free of loose, compressible, or otherwise unsatisfactory materials. Additional language should be added to require confirmation of the integrity of bedrock and cobbles/gravel subgrades.

RESPONSE

RESPONSE BY: Ali H. Banani DATE: August 9, 1994

All areas excavated to bedrock or to cobbles/gravel, except as noted in Section 3.7., C, will be in off-pile areas. Backfill and compaction in these areas will not affect the performance of the cell.

PLANS FOR IMPLEMENTATION

Prior to placing fill over areas excavated to bedrock or cobbles/gavels, the exposed surface shall be inspected by the Contractor. Areas that require subgrade preparation shall be compacted as specified in Section 3.7.B.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 9

COMMENTOR: NRC

DOE needs to provide the Remedial Action Inspection Plan for NRC review and concurrence.

RESPONSE

RESPONSE BY: MB Leaf DATE: October 21, 1994

Comment Acknowledge

PLANS FOR IMPLEMENTATION

The RAIP has been included in the fRAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock, Colorado
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 10

COMMENTOR: NRC

DOE must demonstrate compliance with EPA's final ground water clean-up standards in 40 CFR 192, Subparts B and C.

RESPONSE

RESPONSE BY: KMonks DATE: August 2, 1994

The DOE has deferred groundwater cleanup to a separate phase of the program. During surface remediation, the tailings and other residual radioactive materials (RRM) will be removed from the processing sites, thereby removing the source of contamination. The DOE is responsible for demonstrating that cleanup or control of existing processing related ground water contamination at the existing Slick Rock processing sites comply with the proposed EPA ground water protection standards in Subpart B of 40 CFR Part 192. The DOE has decided that ground water compliance will be addressed under a separate DOE program, which will comply with the requirements of the National Environmental Policy Act. Future site characterization investigations will be conducted as necessary to determine the appropriate ground water compliance strategy. Decoupling the surface remedial action phase of the UMTRA Project (Subpart A) from the ground water compliance phase (Subpart B) will not adversely affect human health and the environment, because the source of contamination will be removed.

Information on the current and future water uses in the vicinity of the processing sites is provided in the response to NRC Open Issue 12.

PLANS FOR IMPLEMENTATION

None. Decoupling the surface remedial action program (Subpart A) with the ground water compliance program (Subparts B and C) is discussed in Attachment 4, Section 4.0, as well as in Sections 5.6, 5.6.1, and 5.6.2 of the Remedial Action Selection Report.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 11

COMMENTOR: NRC

DOE has indicated that additional laboratory experiments (batch and/or column leaching tests) are needed to evaluate adsorption reactions in soils beneath the disposal cell.

RESPONSE

RESPONSE BY: Armand Groffman/Jim Crain DATE: August 22, 1994

Reevaluation of batch and column tests indicates the existing data provides sufficient information to characterize the subsurface with respect to the interaction of tailings pore fluids and solid phases of the Burro Canyon Formation. Results from three point sorption batch experiments performed with synthetic leachate, spiked with cadmium, molybdenum, selenium and uranium, and Burro Canyon fine-grained material were used to calculate partitioning coefficients (K_d), contaminant specific retardation velocities and travel times through the subsurface. The above constituents have been identified as constituent of potential concern in the Base Line Risk Assessment for the Slick Rock sites (DOE, 1994). Partitioning coefficient values for more mobile constituents such as chloride, sulfate and nitrate have also been derived. These data provide information about migration of cations and anionic species including oxyanions of redox sensitive elements, i.e., sulfate, selenate and molybdate in the environment beneath the proposed cell.

Furthermore, results from composite column tests constructed to reflect the stratigraphy beneath the site has also been evaluated. Although equilibrium conditions were never attained in the columns, this information provides valuable insight into predicting the transport and behavior of individual contaminants in the subsurface.

A thorough analysis of solid phases in the Burro Canyon Formation has also been performed in order to illuminate some of the possible rock/solute interactions. Data such as mineral identification, ion exchange capacity and composition of mineral surface coating were used in the final analysis of solid phase/solute interaction in the subsurface.

In addition to geochemical parameters, BET surface area measurements of the clay fraction of the Burro Canyon Formation material has been determined. This data has been used to evaluate the potential surface area that may come into contact with fluids in the subsurface.

In summary, the Burro Canyon Formation in the vicinity of the site has been adequately characterized with respect to the behavior and attenuation of constituents germane to uranium mill tailings leachate. Geochemical analysis along with results from batch and column sorption tests performed in the past are sufficient to provide input to hydrological models and to assess the potential for the migration of contaminants beneath the disposal cell.

PLANS FOR IMPLEMENTATION

None required.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock, Colorado
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 12

COMMENTOR: NRC

DOE must provide information on the current source(s) of municipal and domestic water supply for the town of Slick Rock and the vicinity surrounding the processing sites. This information should be in the form of a text description of the municipal water supply and a map showing the locations of the identified private wells within a 2-mile radius of the sites. DOE must also provide an evaluation of the future projected water use in the vicinity of the processing sites.

RESPONSE

RESPONSE BY: KMonks DATE: August 2, 1994

No municipal water supplies exist for the community of Slick Rock, which consists of a combination post office/restaurant/general store. No one is currently living at or close to (within 0.25 mile [mi] [1.6 kilometer {km}]) the UC or NC sites. About 10 people, including residents in two trailers in the vicinity of the post office, live within 10 mi (16 km) of the UC and NC sites. There are no schools in the town of Slick Rock.

Two domestic wells are currently used within a 2-mi (3-km) radius of the former processing sites, as discussed in Attachment 3, Section 3.1.9. The approximate locations of all private wells (active and inactive) are shown in Figure 3.1 (Attachment 3).

Water use in the vicinity of the former processing sites is anticipated to increase during remedial action construction. M-K Environmental Services (MKES) reports that most of the construction water from the retention basin will be used for dust control within the UC site and that approximately 1.2 acre-feet (ac-ft) (9.7×10^{-4} cubic meters [m^3]) of water a month will be used during construction at the UC site, based on the actual water consumption for dust control of some previously constructed UMTRA sites. Remedial action construction is scheduled to occur from April to November and will be shut-down during winter.

Water use is anticipated to decrease significantly following remedial action construction. A detailed evaluation of projected water use has been deferred until the UMTRA Project ground water compliance program for Slick Rock is under way.

PLANS FOR IMPLEMENTATION

A paragraph will be added to the beginning of Section 5.1.5 in the Remedial Action Selection Report and Section 3.1.9 of Attachment 3 stating that there is no municipal water supply for the town of Slick Rock. The locations of the identified private wells are shown on Figure 3.1 in Attachment 3.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock, Colorado
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 13

COMMENTOR: NRC

DOE must provide evidence through water-quality measurements or potentiometric measurements in the vicinity of the NC site to support the assumption that the Dolores River provides a hydraulic barrier between the tailings site and the identified private wells on the opposite side of the river.

RESPONSE

RESPONSE BY: KMonks DATE: August 2, 1994

The DOE has determined that the level of characterization at the former processing sites is adequate for surface remedial action since the tailings are being relocated to the Burro Canyon disposal site. The DOE agrees with the NRC that additional site characterization (water level and quality measurements) will be necessary to support the assumption that the private wells on the north side of the Dolores River are hydrologically separated from residual ground water contamination from the NC tailings; not enough information currently is available to definitively support this assumption. However, these additional site characterization activities are not necessary for the surface remedial action program (Subpart A of 40 CFR 192) and will be deferred to the ground water compliance program (Subparts B and C of 40 CFR 192) of the UMTRA Project.

Only one private well is useable, of the three wells located across the Dolores River from the NC site. The ground water quality of this well was tested in February 1994; the results showed that all of the potentially hazardous constituents measured (arsenic, barium, cadmium, chromium, lead, molybdenum, net gross alpha, nitrate, radium-226 plus radium-228, selenium, and uranium) were below their respective maximum concentration limits (MCLs).

PLANS FOR IMPLEMENTATION

None.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 14

COMMENTOR: NRC

DOE should reference documentation, such as State or Dolores County studies on population projections, that support the statement in Attachment 3 of the RAP that "Groundwater development in the vicinity of the disposal site should not increase over the next 50 years."

RESPONSE

RESPONSE BY: Malu Gawthrop DATE:

According to the Colorado Department of Local Affairs, Division of Local Government, the population projections for San Miguel County, Colorado are as follows:

1990	3682
1995	3977
2000	4441
2005	4881
2010	5346
2015	5835
2020	6333

This is a projected increase of 2356 people from 1995 to 2020, or a 60% increase over the next 15 years.

There is no information available about where the population would increase within the county. This population projection neither supports nor denys the statement about groundwater development in the vicinity of the disposal site. However, land use around the cell (i.e., BLM grazing land) better support this conclusion.

PLANS FOR IMPLEMENTATION

None

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: Open issue 15

COMMENTOR: NRC

DOE should recalculate the seepage flux analysis in Calculation No. 11-93-12-06-00, using a realistic and conservative estimate for the bottom seepage rate. The analysis does not mention how the $1x10^{-6}$ cm/sec value was deemed representative. It appears that the value was deemed representative. It apnears that the value was selected as the median of packer test permeabilities. Borehole packer tests are designed to measure the horizontal component of permeability. The analysis utilizes the vertical permeability component. Layered earth materials commonly exhibit a distinct anisotropy between the horizontal (K_h) and vertical (K_v) permeability components, with the horizontal component generally being the larger. The anisotropy ratio K_h/K_v can be 10:1 in some materials, and as high as 100:1 in other. A reevaluation of this calculation must also address any impacts to long-term moisture accumulation scenario and potential adverse impacts to seepage through the sandstone layers exposed in the excavation sidewalls.

RESPONSE

RESPONSE BY: Jim Crain DATE: August 4, 1994

The very low permeabilities presented in the draft seepage report were determined from laboratory tests of unweathered rock samples obtained, in most cases, well below the interface of the Dakota Formation and the Burro Canyon Formation. As the current excavation will not be advanced into the unweathered Burro Canyon Formation, all references to the laboratory determined permeabilities will be deleted from the seepage report. The 10^{-8} cm/sec conductivity reported in the document was determined from a packer test of a zone of the Burro Canyon Formation also located considerably below the planned excavation depth.

The higher values of conductivity,; those i the 10^{-4} to 10^{-6} cm/sec range, were determined by packer tests of the fine-grained strata of the Dakota Formation and Burro Canyon Formation (weathered layers) near the interface of the two formations. As the bottom of the disposal cell will be located near the interface of the Dakota and Burro Canyon Formations, selecting a lower boundary flux of 10^{-6} cm/sec as a model input parameter is appropriate, and the simulated results are suitably conservative for disposal cell design purposes.

The representative section (for the computer simulation) is a profile of the southern end of the disposal cell where both the excavation depth and the thickness of contaminated materials is greatest. As the NC and UC tailings are mostly uniform sand and sandy-clayey gravel and the disposal cell bottom slope is descending from north to south, the conjecture is, that if a saturated zone develops, it will develop at the lowpoint (southern end) of the disposal cell excavation. Because the fine-grained strata of the Dakota and Burro Canyon at the bottom of the excavation are not exposed downdip of the site, a surface expression (seep) caused by water moving laterally from the disposal cell will not develop. Thus, contaminated water can move laterally through the fine-grained strata Dakota and Burro Canyon without impacting human health and the environment. As to the predicted height of the saturated zone, even if the bottom of model profile was coded as a no-flow boundary, and side nodes near the bottom of the profile were coded to allow water to exit horizontally, the height and duration of the saturated zone would be unchanged.

At the time the seepage report was written, the precise depths of the locally uniform sandstone layers of the Dakota Formation (designated Kd1 and Kd2) were unknown. A more complete characterization of the disposal site stratigraphy was established using the data collected during a November 1993 drilling and test-pit program, and the precise depths of Kd1 and Kd2 were determined using both the November 1993 data and data collected during previous field efforts. The bottom of the lowest sandstone layer (Kd1) is over 10 meters above the bottom of the excavation at the southern end of the disposal cell. If all the contaminated materials were placed at optimum water content (see seepage report) the predicted height of the saturated zone would be up to 6 m (20 ft) below the Kd1 layer.

Additional calculation was performed by the TAC (SRK-09-94-12-01-00) to further demonstrate the conservatism inherent in the planned excavation depth. Also, the RAC, in accord with DOE direction, is modifying the design plans and specification to ensure that water addition to the material is strictly controlled. Changes to the plans and design specifications include 1) the use of fine-spray nozzles on all water trucks to control dust without raising the moisture content of contaminated material; 2) no water addition to sand tailings for compaction (60-70 percent of the disposal cell volume is sand tailings); 3) fine-grained contaminated material will be placed at drier than optimum moisture content; and 4) installation of a water collection system (likely a standpipe and pump) at the lowest (southern) end of the disposal cell.

PLANS FOR IMPLEMENTATION

The seepage report (Calculation SRK-11-93-12-06-00) will be amended to include the information presented above. Calculation SRK-09-94-12-01-00 will be included in Appendix C of Attachment 3 of the fRAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock, Colorado
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 16

COMMENTOR: NRC

DOE should provide the stated numerical simulation (Attachment 3, page 3-51) of the upper sandstone as a calculation set in the RAP, and reference it as the demonstration that the uppermost aquifer at the disposal site cannot provide a sustained yield of 150 gpd.

RESPONSE

RESPONSE BY: KMonks DATE: August 2, 1994

Comment acknowledged.

PLANS FOR IMPLEMENTATION

Additional information will be provided in Attachment 3.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock, Colorado
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 17

COMMENTOR: NRC

NRC staff considers that visual inspections of potential seeps is inadequate to demonstrate that the cell is performing as designed. Visual inspection of potential seeps at a distance of potentially 100 meters of more from the disposal cell does not provide the earliest practicable verification of cell performance. DOE should develop a monitoring plan that demonstrates cell performance in a more direct manner. An approach, such as monitoring the saturation level in the tailings through standpipes, would provide the earliest verification of cell performance.

RESPONSE

RESPONSE BY: KMonks DATE: August 2, 1994

Comment acknowledged.

PLANS FOR IMPLEMENTATION

(To be resolved).

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 18

COMMENTOR: NRC

DOE must provide minus 15 bar capillary suction measurements of the UC offpile and subpile material to confirm that a conservative long-term moisture value has been chosen for the model.

RESPONSE

RESPONSE BY: Ali M. Banani DATE: August 9, 1994

The UC subpile and offpile materials are low plasticity silt, clay and clayey silty sand materials. 47% of the material is finer than sieve #200 (Calc. No. 11-250-04-03). The volume weighted average in-situ moisture content of these materials from 28 tests is 9.4% with SEN of about 2.

In general long-term moisture content can be estimated either by minus 15 bar capillary suction measurements or by empirical correlations. Minus 15 bar moisture contents for UC subpile and offpile materials are not available. However, minus 15 bar moisture contents for similar soils are usually higher than 9.4%. For example minus 15 bar moisture content of radon barrier material which has physical properties very similar to UC subpile and offpile material is 15.5% (Calc. No. 11-321-D1-00). Empirical relationship using rainfall data and soil type show that the estimated long-term moisture content of UC subpile and offpile materials is the same as average in-situ moisture content, i.e. 9.4% (see next sheet).

A sensitivity analysis was performed to determine the effects of variations of the long-term moisture contents of subpile and offpile materials on radon barrier thickness. This analysis shows that decreasing the long-term moisture content of UC subpile and offpile materials to 6%, and using corresponding diffusion coefficient (from sheets 27-30 of Calc. No. 11-321 01-00) increases the radon barrier thickness from 61 cm to 62 cm. Therefore, thickness of radon barrier is only slightly sensitive to variations in long-term moisture contents of UC subpile and offpile materials (see attached sheets).

PLANS FOR IMPLEMENTATION

No further action is required.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 19

COMMENTOR: NRC

DOE must commit to providing additional radon diffusion coefficient measurements on the UC offpile and subpile material for the final RAECOM analysis (radon flux estimation).

RESPONSE

RESPONSE BY: Ali M. Banani DATE: August 9, 1994

Additional radon diffusion coefficients and emanation fraction measurements will be obtained on UC subpile and offpile materials during construction. These data along with the actual thickness and radium concentrations of placed contaminated materials will be used to re-calculate or more precisly define the radon barrier thickness in the final RAECON analysis.

PLANS FOR IMPLEMENTATION

Radon diffusion coefficient and emanation fraction measurements will be obtained during construction and incorporated into the final analysis RAECOM.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 20

COMMENTOR: NRC

DOE must commit to using a measured or conservative (default) value for the UC subpile material radon emanation fraction in the final RAECOM analysis.

RESPONSE

See response to Comment No. 19.

RESPONSE BY: Ali M. Banani DATE: August 9, 1994

PLANS FOR IMPLEMENTATION

See response to Comment No. 19.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 21

COMMENTOR: NRC

DOE must provide Ra-226 concentration data for the radon barrier soil.

RESPONSE

RESPONSE BY: Martin Brennan DATE: September 8, 1994

Since the background Ra-226 values average 1.5 pCi/g Ra-226 and uranium mining has not occurred in the area, this background value appears valid for the soils of the borrow area. Using 1.5 pCi/g in a RAECOM calculation with a reasonable emanation fraction for the cover and all other values as taken from Table 6.1 of the NRC RAP evaluation yields an acceptable flux.

However, it should not be too expensive or labor intensive to take soil samples from the borrow area for Ra-226 measurements. If the DOE commits to sampling, other representativeness must be assured. Among other points to resolve is final choice of a borrow area and, if only part of the soils at the borrow location are suitable, that the samples reflect only the chosen fraction. The DOE and its contractors have not had an opportunity to complete their analysis of the recently completed Burro Canyon diffusion coefficient analysis data, but based on an informal perusal there may be justification for segregating acceptable soil from soil with higher diffusion coefficients along with other less desirable parametric values.

A radon emanation fraction value would need to be determined for completeness of data for the cover layer. This could be estimated and possibly justified, based on the measured values for related parameters. Measurements could be made on soils collected for the radium determination. A third approach would be to go with the default value which I feel is unrealistically conservative.

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 22

COMMENTOR: NRC

DOE must revise the specifications or the Remedial Action Selection Report (Section 5) concerning the placement compaction of the radon barrier soil to be consistent.

RESPONSE

RESPONSE BY: Ali M. Banani DATE: August 9, 1994

Compaction requirements for radon barrier material calls for 95% of Standard Proctor maximum dry density which is in agreement with Remedial Action Selection Report. Please refer to Subcontract Document for Final Design for Construction.

PLANS FOR IMPLEMENTATION

No action required.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 23

COMMENTOR: NRC

DOE must provide additional characterization data for Th-230 in the areas of boreholes 214 and 226, and at grid point 58550N 63400E or plan verification sampling for Th-230 in these areas.

RESPONSE

RESPONSE BY: M.B. Brenna.) DATE: August 9, 1994

In those areas where elevated Th-230 values have been found, the final verification will most assuredly include Th-230 analyses. Final cleanup in such areas will be conducted in accordance with the UMTRA Thorium Protocol.

PLANS FOR IMPLEMENTATION

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Slick Rock
DOCUMENT: Preliminary Final Remedial Action Plan, Slick Rock, Colorado
COMMENT NO.: 24

COMMENTOR: NRC

DOE must provide additional characterization of this property for the supplemental standards application.

RESPONSE

RESPONSE BY: M.B. Brennan DATE: August 9, 1994

The TAC does not believe that additional information is needed in the RAP. The DOE does, however, concur that additional information will be needed for the formal Application for Supplemental Standards.

PLANS FOR IMPLEMENTATION

None required.