DOE/AL/62350-197
REV. 2

United States Department of Energy

COMMENT AND RESPONSE DOCUMENT FOR THE FINAL REMEDIAL ACTION PLAN AND SITE DESIGN FOR STABILIZATION OF THE INACTIVE URANIUM MILL TAILINGS SITES AT SLICK ROCK, COLORADO

May 1996

Uranium Mill Tailings Remedial Action Project

INTENDED FOR PUBLIC RELEASE

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May 1996

Prepared for
U.S. Department of Energy
Environmental Restoration Division
UMTRA Project Team
Albuquerque, New Mexico

Prepared by
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Albuquerque, New Mexico

UMTRA DOCUMENT REVIEW FORM **(33)**

COMMENT

Site: Slick Rock, Colorado Date: 1 April 1996
Document: Final Remedial Action Plan
Reviewer: C. Abrams
U.S. Nuclear Regulatory Commission (NRC)
Comment: 25

DOE needs to show that the Big Gypsum and Lisbon faults are noncapable (reference Moab faults).

RESPONSE

Page: ___ By: G. Lindsey Date: 4 April 1996

Faults in salt anticline structures and their relationship to the underlying aligned tectonic system

The most significant inferred faults of the site area are the northwest trending basement faults on which the salt anticlines are aligned in the folded belt of the Paradox Basin (see Figures 2.5 and 2.6). No known studies provide evidence that the Paradox salt beds of the northwest trending structures of the salt core anticlines are cut by faults in the pre-Paradox strata. There is compelling evidence that the post-primary displacement on these surface faults is the result of collapse of the salt anticline structure due to dissolution and salt flowage and that the basement faults have no surface expression within this folded belt of the Paradox Basin. There is also strong evidence that the ages of movement on these faults is pre-Quaternary. Valley chains aligned along salt anticline collapsed structures within the Paradox Basin folded belt include northeast-to-southwest alignments of Salt Valley-Onion Creek-Fisher Valley, Castle Valley-Paradox Valley, and Seven Mile Valley-Moab Valley-Spanish Valley-Gypsum Valley. Other salt anticline structures near the site where salt anticline collapse valleys merge into uncollapsed anticline structures are the chain alignment of Big Flat Valley-Cane Creek Lisbon Valley-Dolores anticline.

Studies that have examined these surface faults and the relationship to underlying basement faults were conducted by Shawe (1970); Cater (1970); Freidman and Simpson (1978); Hite (1978); Woodward-Clyde, ONWI-290 (W-C, 1982a) and ONWI-92 (W-C, 1983); McCleary and Romie (1986); Wong and Humphrey (1989); Doelling et al. (1995); Huffmann (1995); and Woodward-Clyde (Kitcho et al., 1986; Atlas Corporation, 1996). These studies are summarized below.

- Shawe (1970) reports evidence that indicates the Dolores fault is probably early to Middle Tertiary age. That study also observes that precise dating of the faults in the region is impossible. The salt anticline folded belt is interrupted by a cross trending belt of igneous intrusions consisting of the exhumed 11,000 ft (3,352 m) high La Sal Mountains on the alignments of the northwest trending Castle Valley-Paradox Valley and Spanish Valley-Big Gypsum Valley salt anticline (see Figure 2.5b). Other evidence of regional magmatic invasion that occurred in early to Middle Tertiary time (Shawe, 1976; 1970; W-C, 1982a) are the 11,300 ft (3,444 m) elevation Abajo Mountains laccolith, south of the La Sal Mountains and the uranium-vanadium mineralization of the Slick Rock region. The timing of this major Middle Tertiary thermal pulse that coincided with the uplift of the Colorado Plateau province (W-C, 1982a) suggests this intrusive event, which separated the northern Paradox Basin from the southern part where the Slick Rock site is located, may have been the last significant movement of the northwest-trending basement fault system. Any subsequent movements on these northwest trending faults that underlie the salt anticline belt would dissect the mountains and would be observed easily and not go undetected.

- Cater (1970) shows a series of generalized cross sections that depict the origin of the salt core anticline and their collapse. The sections clearly separate the underlying tectonic system from the faults related to the anticline collapse in the Paradox salt beds (see Figure 2.5c).

- In the study by Woodward-Clyde (W-C, 1982a), which reviews available data of the Lisbon Valley salt anticline in Utah, the authors cited the study by Hite (1978) that used an extensive borehole database. They concluded that the prominent northwest trending fault features, Lisbon Valley fault and the parallel system of the Moab Valley fault, are disassociated with basement faults and are the result of collapse of the salt cored anticline (see Figure 2.5c). The cross sections presented in ONWI-290 all show the lack of penetration and continuity of both basement faults and surficial collapse faults through the Paradox salt beds. The authors conclude that disharmonic structural conditions are present; structures above and below the Paradox salt do not coincide spatially. Given these conditions, surface structures such as the Lisbon Valley fault probably do not extend downward through the deformed salt zone. The study also reports that no events greater than magnitude ML 1.0 have been observed in the vicinity of Lisbon Valley and no earthquakes were recorded from 1850 to 1979.

- In another study, Woodward-Clyde (W-C, 1983) also shows the same relationship between pre-salt basement faults and faults associated with salt flowage structures in the Paradox Basin with the findings of Kitcho et al. (1986).

- Reports by Woodward-Clyde show available data are consistent with the hypothesis that the Lisbon graben faults do not penetrate the Paradox salt layer and also that the basement Precambrian faults that underlie the graben faults are separate and penetrate no strata younger than the Mississippian strata that underlie the Paradox salt beds (Kitcho et al., 1986; W-C, 1982a).

- The report by McCleary and Romie (1986) shows in cross section that the faults do not penetrate the Paradox beds in the northwest end of the Lisbon-Dolores anticline fault. This 41-mi (61-km)-long Lisbon fault was reported (after Hite and Lohman [1973]) to be a salt collapse structure rather than tectonic structure Woodward-Clyde (W-C, 1983).

- Wong and Humphrey (1989) observed that the only faults known to exhibit Quaternary displacement within the Canyonlands region, including the Paradox Basin, are the Shay Graben faults (see Figure 2.5b). Although microearthquakes have been observed in the vicinity of these faults, the study concludes that it has not been resolved whether the displacement is of tectonic origin or salt flowage activity, and their association with the faults is unclear due to epicenter location uncertainties and lack of focal mechanisms determination.

- Huffman (1995) has studied the structural relationships of the salt anticline region and reviewed numerous seismic line surveys across the region. He has concluded that the salt collapse features are separate from underlying old tectonic systems although hard evidence is difficult to verify; his conclusions are unpublished.

- Doelling et al. (1995) shows the Moab-Spanish Valley salt anticline (northwest of the interruption of the La Sal Mountain intrusion, but aligned with Big Gypsum Valley anticline southeast of the intrusive mountain) similarly does not show activation of the basement fault (Figures 2.5a and 2.5b). Doelling et al. (1995) observe that no faults indicating evidence of Holocene movement have been found within the northern Paradox Basin. It was also noted that the Big Gypsum Valley anticline lies between Lisbon-Dolores and the Paradox Valley anticlines. This information is in agreement with the cross sections of Cater (1970) showing the Paradox Valley salt anticline.

- The 1996 Atlas Corporation report concludes that the Moab fault system in Moab Valley and the Lisbon Valley fault system are not capable. The Moab fault, which is a 54-km-long system, extends along Moab Canyon and Moab-Spanish Valley and was reported by Doelling et al. (1995) to be a result of salt tectonism of the Moab salt anticline (Figures 2.4 and 2.5b). In the southern section of this system, the faults do not offset the overlying Quaternary alluvium. The report cites several studies that demonstrate many lines of evidence that suggest salt dissolution collapse postdates the primary displacement on the fault. The Lisbon Valley fault system, which is along the alignment of a parallel salt anticline to the southwest, similarly does not offset Quaternary deposits that overlie the fault (Figures 2.4 and 2.5b). Based on drill hole data and structural relations, the Lisbon fault does not appear to extend through the Paradox salt and converge with faults in the pre-Paradox strata (Figure 2.5c).

- Cooksley Geophysics conducted a seismic survey and interpretation across the Moab fault (Atlas Corporation, 1996). The conclusion of this survey was that the faults in the Paradox salt did not dissect the underlying formations and did not

converge with faults in pre-Paradox strata as shown by the cross section models from the data.

Conclusion of origin and age of salt anticline faults

The preponderance of evidence cited above indicates that the Moab and Lisbon faults are not capable fault systems. This assessment is considered, by the continuity of these same structures, to also extend to Big Gypsum Valley faults and the Lisbon-Dolores faults, respectively. Therefore, there is no basis for determining that the surficial salt anticline faults or the hidden northwest-trending basement faults that underlie the Paradox Basin anticline/folded belt are capable.

UMTRA DOCUMENT REVIEW FORM

(34)

COMMENT

Site: Slick Rock, Colorado
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Date: 27 April 1994 and 7 November 1994

Comment: 1; Appendix C to Attachment 3, Calculation No. SRK-11-93-12-06-00

Our comment may suggest that the excavation of this 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? (4/27/94)

The DOE's (initial draft) response to CDPHE's Comment No. 1 of 4/27/94, stated that "... blasting is required to excavate into the unweathered zones of the Burro Canyon Formation." In addition, the response said, "The current excavation depth extends to, or just below, the Dakota-Burro Canyon interface..." However, a NW to SE section of the Burro Canyon site provided to CDPHE by the DOE in November 1994 (attached), indicated an excavation depth of 23-28 feet below this interface. CDPHE went on to comment, "Does DOE expect this depth can be reached by ripping or will blasting be required? If the use of explosives is required, CDPHE believes a careful analysis of the costs of drilling and blasting to the currently designed depth must be weighted against the cost of a clay liner, underdrain system or other mean of preventing migration of leachate from the cell. CDPHE also wishes to minimize the overall cost of remedial action while reducing to a minimum the overall the disturbance to surrounding areas. How will DOE reduce the height and footprint of the permanent spoil pile by excavating a larger amount of material from the cell? Please provide CDPHE with a cost-benefit analysis of a cell design utilizing a liner or underdrain to restrict the migration of leachate into the Dakota Sandstone stringers versus the current design."

RESPONSE

Page ___ By: A. Banani (RAC); J. Crain, M. B. Leaf (TAC) Date: 2 June 1995

In the draft RAP, the cell excavation was proposed as about 30 feet (ft) (9 meters [m] throughout, to elevation 5835 at the deep end of the cell. The design included the 8-ft (2-m)-thick clay liner and the cell sideslopes were about 1 to 2.5. The depth below the lower Dakota Sandstone and into the Burro Canyon Formation in this shallower cell formerly averaged about 3 to 19 ft (1 to 6 m). This area is considered part of the "weathered" zone.

The UNSAT-2 model analysis in the seepage report (Calculation No. SRK-11-93-12-06-00) prepared in the fall of 1993 considered the shallower draft RAP design and recommended a minimal depth of excavation in the impermeable mudstone/claystone to create a sidewall liner height of 5 ft (1.5 m) or greater. To add a reasonable factor of safety to account for greater than assumed placement moisture content of the RRM and for lower assumed cell bottom permeability, the excavation was recommended at preferably 7 to 8 ft (2 to 2.5 m). Also, it determined a permissible range of saturated hydraulic conductivities for the radon/infiltration barrier as 1.0E-6 to 1.7E-7, and an average value of 5.0E-7. The cell bottom flux for the Burro Canyon disposal cell of 3.0E-6 is thought to be most representative of the drainage rate that will occur at the tailings/foundation interface, based on existing packer test information.

The TAC seepage report recommended deleting the clay liner and steepening the cell sidewall. The design in the March 1994 preliminary final RAP deleted the clay liner and steepened the sideslopes to 1 to 1. The total excavation depth in the revised design ranged from about 30 ft (9 m) at the shallow end to about 45 to 50 ft (14 to 15 m) at the deep end of the cell. It resulted in a proposed cell floor ranging from about 10 ft (3 m) (core #531) to 20 to 36 ft (6 to 11 m) (cores #606 and 607) below the Dakota Sandstone and into the Burro Canyon Formation at the deep end of the cell, and 2 to 13 ft (1 to 4 m) at the shallow end of the cell. With the Remedial Action Contractor (RAC) commitment to use a field geologist to direct the excavation to a minimum of 7 ft (2 m) below the Dakota/Burro Canyon interface, this will create a minimum 7 ft (2 m) (core #531 area) sidewall liner throughout the cell, and upwards of a 20 to 39 ft (6 to 12 m) "natural sidewall liner" at the deep end of the cell. This excavation is still considered to be mostly in the "weathered" zone, with perhaps some portions of the extreme southern or deepest end of the cell venturing into the "unweathered" Burro Canyon Formation at depths greater than 45 to 50 ft (11 to 15 m).

The subsequent TAC water balance calculation (Calculation No. SRK-09-94-12-01-00), which supersedes the seepage report (Calculation No. SRK-11-93-12-06-00), addressed the deeper preliminary final RAP cell design, and determined again that lateral drainage through the Dakota Sandstone was not an issue.

The disposal cell will extend through the Dakota Sandstone/Burro Canyon Formation interface and through portions of the Burro Canyon Formation that core logs indicate is fractured and weathered. Portions of the deepest part of the cell may be excavated into more unweathered portions of the Burro Canyon Formation. Most of the Dakota Sandstone and Burro Canyon Formation material is considered to be rippable by large bulldozers such as a DC-10. Some portions of the 2- to 5-ft (1- to 2-m)-thick Dakota Sandstone lenses exposed in the cell excavation and perhaps some limited portions of the Burro Canyon Formation in the deepest portions of the cell may require limited blasting.

Finally, eliminating the clay liner will reduce the overall cost of the remedial action and reduce the disturbance to surrounding areas by eliminating the need for a separate borrow source for the fine-grained soil required to construct the liner. Thus, the TAC did not evaluate other design features for controlling lateral seepage. In addition, the DOE is aware that excavating deeper in the Burro Canyon Formation will greatly increase the volume of unusable (spoil) material. For aesthetics, as well as to reduce the area permanently withdrawn from public use, the DOE wants to minimize both the footprint and height of the permanent spoil pile.

The disposal cell at the Burro Canyon disposal site is on a small mesa and will contain approximately 620,000 cubic yards (yd^3) of contaminated material.

The size of site boundary is restricted by the following:

- The area of archaeological significance to the east.
- The crest of the mesa to the north and west.
- The crest of the mesa to the south.
- The potential for gully development in the Burro Canyon Formation to the south.

To avoid adverse effects of surface water drainage and to ensure the long-term stability of the disposal cell, the footprint of the cell is limited to 12 acres (ac) (5 hectares [ha]).

Due to these space limitations, to ensure some contingency, and to minimize the height of the disposal cell, the excavation at the site was designed to hold approximately 500,000 yd^3 of material. Approximately 150,000 yd^3 of excavated materials from the disposal cell foundation will be used for final site grading and cover construction. The remaining 350,000 yd^3 will be placed in a permanent spoil pile. The spoil pile will be graded and seeded to blend with the surrounding terrain.

Using suitable portions of the excavation materials for the radon barrier eliminates the need for using the Disappointment Valley borrow source and for placing an extended overlay on the state highway between it and the disposal site.

Plans for Implementation

An on-site RAC geologist will evaluate conditions in the cell excavation to limit the amount of blasting needed. In addition, the areal extent of blasting will be limited for cost, for safety and control reasons, and to limit adverse cracking of the rock of the cell floor and walls. The bottom and sideslopes will be inspected before fill emplacement, as agreed with the Colorado Department of Public Health and Environment (CDPHE).

The RAP will be reviewed and references to depth of excavation and the need for blasting and ripping will be made consistent throughout.

UMTRA DOCUMENT REVIEW FORM (35)

COMMENT

Site: Slick Rock, Colorado Date: 27 April 1994
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Comment: 2: Appendix C to Attachment 3, Calculation No. SRK-11-93-12-06-00

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: Page ___ By: J. Crain, M. B. Leaf (JAC) Date: 2 June 1995

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 the engineering parameters of the rock layers, site geologists and engineers concluded that most of the Dakota Sandstone, regardless of the lithology, and the weathered mudstone and claystone of the Burro Canyon Formation can be ripped with a bulldozer. The previous judgment by TAC and RAC personnel is based on field observations, including the following: 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 nonrippable materials are presented in MK-ES Calculation No. 11-333-02-00. To estimate the quantities of ripple and nonrippable material, the RAC assumed conservatively that none of the sandstone is rippable. However, sections of the sandstone layers, especially lenses that are 3 to 4 ft (approximately 1 m) thick or less, can be ripped when a large enough area is cleared to allow access by a large bulldozer. This previous assertion is based on the following field observations: 1) a small backhoe can penetrate the thinner lenses of the sandstone layers, and 2) at several mining claims downdip of the disposal site, small backhoes and bulldozers were used to rip the unweathered sandstone layers. As stated in the response to CDPHE Comment No. 1, some localized areas of both formations may not be rippable and may need limited blasting to complete the cell excavation.

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. As stated in the response to CDPHE Comment No. 1, an on-site geologist will determine the need for blasting and limit it to just these areas determined to be unrippable.

UMTRA DOCUMENT REVIEW FORM (36)

COMMENT

Site: Slick Rock, Colorado
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Date: 27 April 1994 and 7 November 1994

Comment: 3; Appendix C to Attachment 3, Calculation No. SRK-11-93-12-06-00

The range of permeabilities for the Burro Canyon Formation is stated on page 10 as $1.8 \times 1.0 \times 10^{-4}$ to 1.0×10^{-8} cm/s. Lab permeabilities as low as 4.4×10^{-11} are reported. If these permeabilities are representative of the Burro Canyon Formation, a model employing a lower permeability, perhaps 1.0×10^{-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: Page ___ By: J. Crain, M. B. Leaf (TAC); A. Banani (RAC) Date: 1 April 1995

The DOE cannot support CDPHE's request for a more conservative cell floor permeability of 1.0E-6 cm/s. While the DOE has acknowledged that the revised preliminary final RAP design has resulted in the bottom of the cell extending at ranges of 10 to 36 ft (3 to 11 m) into the Burro Canyon Formation, core data collected to date do not support the CDPHE's assertion that the entire cell is emplaced in "unweathered" Burro Canyon Formation material. Packer tests conducted on core from #531 indicate values of 2.2E-6 to 2.5E-6 cm/s. The seepage report determined that a conservative value of 3.0E-06 cm/s is representative for analysis of the shallower design, and data do not support that the strata become much more impermeable in the design for a cell about 15 ft (5 m) deeper.

The seepage report data presenting very low values were taken from laboratory tests of unweathered rock samples obtained in most cases well below this level. The packer test result of 1.0E-8 cm/s was determined from a test on a zone also located considerably below the planned excavation depth. The seepage report's higher values in the 1.0E-4 to 1.0E-6 cm/s range were determined by packer tests of the fine-grained material at the interface of the Dakota Sandstone and Burro Canyon Formation. The bottom of the cell presented in the draft RAP design was closer to this interface, and the more conservative use of the 1.0E-6 cm/s value as the model input parameter was appropriate. The simulated results were suitably conservative for disposal cell design purposes. The preliminary final RAP design excavation is somewhat deeper, but the parameter selected is still representative of actual field

conditions and the result is still suitably conservative for disposal cell design purposes.

The seepage report also determined the permissible range of saturated hydraulic conductivities for the radon/infiltration barrier is 1.0E-6 to 1.7E-7 cm/s; an average value of 5.0E-7 cm/s was determined appropriate for the cover material. In light of the DOE's accepted cover and cell floor flux values, the recently tested Burro Canyon excavation material results indicate that the material is still suitable from an infiltration perspective and will resolve long-term "bathtub" effects. Careful attention to selection and compaction of the material in the field will guarantee its effectiveness as a cover material.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (37)

COMMENT

Site: Slick Rock, Colorado Date: 27 April 1994
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Comment: 4; Appendix C to Attachment 3, Calculation No. SRK-11-93-12-06-00

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: Page ___ By: J. Crain (TAC) Date: 1 April 1995

A contaminated material placement sequence is specified in *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 *Subcontract Documents*.

The three specified contaminated material layers contain different material types; for example, the NC tailings are sand, but the NC-contaminated subpile soil is mostly silty-clayey sand with gravel. Regardless of whether the two NC materials are mixed 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 computer-simulated heights and durations of the saturated zone at the foundation of the disposal cell should not change significantly.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (38)

COMMENT

Site: Slick Rock, Colorado Date: 27 April 1994
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Comment: 5: Appendix C to Attachment 3, Calculation No. SRK-11-93-12-06-00

The conclusions of the seepage analysis depend on the assumption that 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: Page ___ By: A. M. Banani (RAC) Date: 31 March 1995

See Section 00800, Special Conditions, Article SC-3, and Section 01560, Temporary Controls, Article 1.4 of the *Subcontract Document*, Final Design for Construction (June 1994), for dust control measures during construction of the disposal cell (attached). These restrictions will be implemented and monitored by the RAC site manager, who is aware of the need to minimize the use of construction water. The subcontractor must also be informed of these restrictions. In addition, four stand pipes will be installed in the cell and will be used to monitor any water buildup during construction. If necessary, the stand pipes will be used to remove any water that accumulates before the radon/infiltration barrier is emplaced.

Plans for Implementation

None. A copy of the specifications were sent to CDPHE on 19 April 1994.

UMTRA DOCUMENT REVIEW FORM (39)

COMMENT

Site: Slick Rock, Colorado Date: 27 April 1994
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Comment: 6: Appendix C to Attachment 3, Calculation No. SRK-11-93-12-06-00

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: Page ___ By: J. Crain (TAC) Date: 1 May 1995

Aggregate values of moisture content for the different classes of contaminated material are presented in MK-ES Calculation Nos. 11-250-04-03, Embankment Material Properties, and 11-321-01-00, Radon Barrier Design-RAECOM Input Data. 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, pore fluid could not 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 *in situ* UC tailings was very low.

- Both the TAC and RAC performed numerous sieve analyses of the NC and UC tailings. In addition, 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 subsequently were excavated and transported to the New Rifle mill. Thus, there is little uncertainty about the physical characteristics 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 *in situ* 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 are sensitive to the saturated conductivity of the radon barrier. However, 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. Additionally, one-dimensional (profile) flow model results are conservative, because the predicted depths of a saturated zone are exaggerated by the dimensional constraint of flow occurring only in two directions.

Plans for Implementation

No action required.

UMTRA DOCUMENT REVIEW FORM (40)

COMMENT

Site: Slick Rock, Colorado Date: 27 April 1994
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Comment: 7

1. RASR, page ES-1, Final Paragraph: "The mudstone/claystone will provide a natural impermeable barrier from the base of the pit to approximately 1.5 meters up to the side wall to form a continuous saucer-shaped bottom and side liner."

2. RASR, page 5-27, 4th bullet: "The disposal cell design calls for excavating approximately 2.0 to 2.5 meters into the claystones and mudstone at the base of the Dakota Sandstone Formation and Burro Canyon upper mudstone unit."

3. Attachment 4, Page 2-6, First Paragraph: "Based on the UNSAT2 model results, the maximum height of the saturated zone would be less than 1.5 m. However, the disposal cell has been designed to take advantage of the low-permeability foundation materials. Excavated mudstone and claystone will provide an impermeable layer for a "liner effect" from the base of the pit to approximately 2.0 to 2.5 m up the sidewall. Thus, the design is conservative in that the height of the "sidewall liner" (i.e. naturally occurring low permeability mudstone and claystone) is approximately 1 m above the predicted height of the saturated zone (1.5 m)."

   The RAP text does not seem to agree with the design drawings provided us by DOE which indicate a depth of excavation considerably greater than 1.5 to 2.5 meters into the Burro Canyon Formation. Please clarify this apparent discrepancy.

   As a side note, RASR, Table 1.2, Page 1-13, listed under "Remarks" for "Geotechnical": Based on a simplified approach, there is potential for cover cracking at the north edge of the pile." All other references to cover cracking (i.e., Section 3.3.3, Page 3-7) claim that no cracking is expected. This contradiction should be resolved.

RESPONSE

Response: Page ___ By: A. Banani (RAC); J. Crain, M. B. Leaf (TAC) Date: 1 May 1995

See response to Comment No. 1.

The RAP depth of excavation/sidewall liner inconsistencies noted in CDPHE Comment No. 7 resulted from recommendation language from the seepage report being inconsistent with the results of the preliminary final RAP design change of removing the liner and steepening the cell sideslopes. The design change resulted in an overall deeper excavation: 20 to 39 ft (6 to 11 m), though as shallow as 5 to 8 ft (2 to 25 m) in the core #531 area, with a minimum of a 7 ft (2 m) of natural liner. However, the "natural sidewall liner" formed by the Burro Canyon Formation material is mostly "higher" than recommended in the seepage report, ensuring no lateral seepage through the Dakota Sandstone.

Plans for Implementation

All language referring to the excavation depth in relation to the formations of discussion and the effective creation of a "natural sidewall liner" will be checked and made consistent, as described above.

In addition, the language referring to "cover cracking" will be removed based on the revised cover cracking calculation.

UMTRA DOCUMENT REVIEW FORM (41)

COMMENT

Site: Slick Rock, Colorado Date: 27 April 1994
Document: Final Remedial Action Plan
Reviewer: Colorado Department of Public Health and Environment (CDPHE)

Comment: 8: Appendix C to Attachment 3, Figure 3.1, Page 3-3

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: Page ___ By: K. Lambert (TAC) Date: 19 April 1995

Wells #684 and #685 are downgradient alluvial DOE monitor wells. Requested water quality data were transmitted to CDPHE in April 1995. Figure 3.1 was revised to show these wells as alluvial DOE monitor wells. Table 3.2 (Appendix to Attachment 3) was revised to indicate these wells are downgradient (north) of the UC site. A new Table 3.54 was added to the Appendix A of Attachment 3, showing the water quality data for these wells.

Plans for Implementation

Text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (42)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A.M. Barani (RAC)

Comment: 1: Remedial Action Selection Report, Introduction

Page 1-4, Section 1.2.3, Contaminated Materials

Revise contaminated material quantities in Table 1.1 as follows:

Location/Source	Volume (yd^3)	Volume (m^3)
UC Site		
Tailings	296,000	226,000
Contaminated materials	237,500	181,600
Demolition debris	2,850	2,180
Subtotal	536,350	409,780
NC Site		
Contaminated soil/tailings	84,800	64,800
Demolition debris	155	119
Subtotal	84,955	64,919
Total (rounded)	621,300	474,700

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Comment acknowledged.

Plans for Implementation

The material quantities in the table and text were revised as requested.

UMTRA DOCUMENT REVIEW FORM (43)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 2: Remedial Action Selection Report, Introduction

Page 1-8, Figure 1.5, Disposal Cell for the Slick Rock Tailings

The bar scale showing the scale in meters is not correct. Change "90" to "30" and "180" to "60."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Comment acknowledged.

Plans for Implementation

The bar scale was corrected as requested.

UMTRA DOCUMENT REVIEW FORM (44)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 3: Remedial Action Selection Report, Introduction

Page 1-9, Fig. 1.6, Detail 2

Delete the first dashed line from top.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Comment acknowledged.

Plans for Implementation

The first dashed line from the top was deleted from the figure as requested.

UMTRA DOCUMENT REVIEW FORM (45)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 4; Remedial Action Selection Report, Geotechnical Engineering

Page 3-2, Borrow areas: Suggested adding "Currently, laboratory testing is being conducted to determine if fine-grained material from excavations at the Burro Canyon disposal site is suitable as radon barrier material."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Comment acknowledged.

Plans for Implementation

The text was revised to reflect the results of the laboratory testing, which indicated that the Burro Canyon material is suitable for use as the radon barrier source.

UMTRA DOCUMENT REVIEW FORM (46)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 5: Remedial Action Selection Report, Geotechnical Engineering

Page 3-9, Section 3.4.1, 7th bullet, 2nd line: Suggest changing "... at or near the optimum moisture content, ..." to "at, or above optimum moisture content, ..."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Because of CDPHE concerns about the depth of the saturated zone that may form at the bottom of the excavation, the TAC recommends that the contaminated material be placed at or below optimum water content. Given the material types found at the sites (i.e., sand tailings and sandy-gravely soils), specified compaction densities probably can be achieved at less than optimum moisture contents.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (47)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 6: Remedial Action Selection Report, Geotechnical Engineering

Page 3-13, Schedule

1. After first sentence, add: "major office trailers and access control will be installed at the BC site beginning October 1994."

2. Add the construction schedule (attached).

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Comments acknowledged. However, subsequent delays in accessing the Burro Canyon disposal site resulted in a change in office location to the UC site. Installation of these facilities commenced in late 1994. Access control facilities at the BC site commenced in spring 1995.

Plans for Implementation

The requested text revision is not necessary and was not made. The construction schedule was included in the RAP as requested.

UMTRA DOCUMENT REVIEW FORM (48)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 7: Remedial Action Selection Report, Radon Attenuation and Site Cleanup

Page 6-2, 2nd Paragraph

There are no plans for additional field investigations and laboratory testing for Disappointment Valley radon barrier material prior to construction. However, currently laboratory tests are being performed on in-situ fine grained materials from BC site to find out if the material is suitable to be used for radon barrier.

Revise the paragraph accordingly.

RESPONSE

Response: Page ___ By: J. Cr.ıin (TAC) Date: 1 June 1994

The Burro Canyon material was subsequently determined to be acceptable for use as a radon barrier source, so no further testing of the Disappointment Valley material was conducted.

Plans for Implementation

The text was revised to reflect the selection of the Burro Canyon disposal cell excavation material as the radon barrier borrow source.

UMTRA DOCUMENT REVIEW FORM (49)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 8: Remedial Action Selection Report, Radon Attenuation and Site Cleanup

Page 6-2, Section 6.3.2, Radon Diffusion

1. 6th Line: Suggest revising "....Were made, each at a different moisture content within the moisture content range. "to "...were made, each at a different moisture content, above and below the long-term moisture content estimates."

2. 10th Line: Diffusion coefficient of 1.1E-02 cm^2 per second does not correspond to moisture saturation of 54 percent. This diffusion coefficient is the average of the diffusion coefficients of tested samples at their estimated long-term moisture content.

   Revise the paragraph accordingly.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (50)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 9; Remedial Action Selection Report, Radon Attenuation and Site Cleanup

Page 6-3, Section 6.3.4, Dry Densities and Porosities

2nd Paragraph: The first sentence is not clear. Number of samples mentioned is not correct. Refer to Radon Barrier Calculations and revise the paragraph accordingly.

RESPONSE

Response: Page ___ By: M. Brennan (TAC) Date: 31 August 1995

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (51)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 10: Remedial Action Selection Report, Geotechnical Engineering

Page 3-9, Section 3.4.1, Construction Methods and Features, 3rd, 6th, and 7th bullets: Suggest changing "(ASTM D698) (ASTM, 1991)" to (ASTM D698-90)".

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1993

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (52)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 11: Remedial Action Selection Report, Geotechnical Engineering

Page 3-10, Section 3.4.3, 3rd Paragraph

3rd Line: Suggest changing "...contaminated runoff at the UC site to the retention basin for...." to "...contaminated runoff at the UC and BC sites to the retention basins for..."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 1 June 1994

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (53)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 12: Remedial Action Selection Report, Geotechnical Engineering

Page 3-10, Section 3.4.3

1. 4th Paragraph, 4th Sentence: Suggest changing "in conjunction with the volume in the basin due to the average ..." to "... in conjunction with the maximum accumulated runoff volume in the basin due to the average..."

2. 5th Paragraph, 3rd Sentence: Suggest changing "....and the water surface." to "....and the maximum water surface."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 2 June 1994

The text was modified previously based on comments by Fang Wu and Josanthe Randeni.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (54)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 13: Remedial Action Selection Report

Page 5-6, Figure 5.3, and Page 5-7, Figure 5.4

Suggest adding corehole and test pit locations and numbers from 1993 field investigations to these figures (see Subcontract Drawing No. SRK-DS-10-0338).

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 10 June 1994

The main purpose is to show the location of ground water monitor wells. For clarity, the locations of a few test pits and boreholes were added to Figure 5.3. No new coreholes (1993) are located on cross section A-A'.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (55)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 14; Remedial Action Selection Report, Introduction

Page 1-10, Section 1.2.4, Remedial Action

1. 4th Line from top: "Perimeter" is not shown in Figure 1.5.

2. 2nd paragraph, 6th sentence: My understanding is that the "buffer area" is the area covered from the edge of the tailings in the disposal cell to the edge of the mesa which shall be no less than 100 ft. If this is correct, change "31 ac (13 ha)" to "6 ac (2.5 ha)" and "43 ac (17 ha)" to "18 ac (7.3 ha)". If not, please explain what you mean by "buffer area".

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

The buffer area is defined as the difference between the area occupied by the disposal cell and the area permanently withdrawn from public use.

Plans for Implementation

The phrase "nor will it extend outside...." was deleted in response to the first comment. No revision was made in response to the second comment.

UMTRA DOCUMENT REVIEW FORM (56)

COMMENT

Site: Slick Rock, Colorado Date: 7 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 15: Remedial Action Selection Report, Surface Water Hydrology and Erosion Protection

Page 4-5, Section 4.4.3 Toe and Sides of the Embankment

3rd Line: Change "...a 1-ft-(0.3-m)-thick sand/gravel bedding layer..." to "...a 6-inch-(150-mm)-thick sand/gravel bedding layer..."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (57)

COMMENT

Site: Slick Rock, Colorado Date: 8 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 16: Attachment 4, Water Resources Protection Strategy, Design Considerations

Page 2-2, Section 2.1.3., Subsurface Drainage

2nd Paragraph, 5th line from bottom: Disposal cell is founded on Burro Canyon Formation below the sandstone strata of Dakota formation. Delete word "foundation" in "...Dakota Sandstone foundation..."

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 30 August 1995

Comment unclear. "Foundation" not found as indicated.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (58)

COMMENT

Site: Slick Rock, Colorado Date: 8 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 17: Attachment 4, Water Resources Protection Strategy, Design Features

Page 2-3, Figure 2.1: Same as Comment No. 2.

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 30 August 1995

Comment acknowledged. See response to Comment No. 2.

Plans for Implementation

Bar scale was corrected.

UMTRA DOCUMENT REVIEW FORM (59)

COMMENT

Site: Slick Rock, Colorado Date: 8 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 18; Attachment 4, Water Resources Protection Strategy, Design Features

Page 2-5, Figure 2.2: Same as Comment No. 3.

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 30 August 1995

Comment acknowledged. See response to Comment No. 3.

Plans for !mplementation

The figure was corrected as requested.

UMTRA DOCUMENT REVIEW FORM (60)

COMMENT

Site: Slick Rock, Colorado Date: 8 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 19: Attachment 4, Water Resources Protection Strategy

Page 2-4, 2nd sentence from top of the page: Same as Comment No. 14

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

The buffer area is defined as the difference between the area occupied by the disposal cell and the area permanently withdrawn from public use.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (61)

COMMENT

Site: Slick Rock, Colorado Date: 8 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 20. Attachment 4, Water Resources Protection Strategy

Page 3-9, Figure 3.2: Add an arrow and show the "TOP OF BURRO CANYON FM. AND BASE OF DAKOTA SANDSTONE"

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 30 August 1995

The diagrammatic figure shows the Burro Canyon Formation exposure along the Dolores River Canyon. Dakota Sandstone does not appear in this area.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (62)

COMMENT

Site: Slick Rock, Colorado Date: 8 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 21: Appendix B to Attachment 3, Lithologic Logs

Add test pit and corehole logs from 1993 field investigations at Burro Canyon disposal site to this appendix.

RESPONSE

Response: Page ___ By: G. Lindsey (TAC) Date: 25 May 1994

Comment acknowledged.

Plans for Implementation

The logs were entered into the TAC "Gint" log file and have been included in the appendix.

UMTRA DOCUMENT REVIEW FORM (63)

COMMENT

Site: Slick Rock, Colorado Date: 8 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 22: Attachment 2, Geology Report

Page 3-7, Figure 3.6: Coreholes 604 and 606 are also located along cross Section D-D in Figure 3.3. Please add these coreholes to geologic cross Section D-D in Figure 3.6.

RESPONSE

Response: Page ___ By: G. Lindsey (TAC) Date: 25 May 1994

Comment acknowledged.

Plans for Implementation

The coreholes were added to Section D-D as requested.

UMTRA DOCUMENT REVIEW FORM (64)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 23; Remedial Action Selection Report, Introduction

Page 1-2, History

Suggest adding the following to this section "The first uranium concentrating plant in the world was constructed at the UC site in 1898 by two French chemical scientists, Pouilot and Voilique. The plant was in operation for only a few years before being abandoned.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Although some contaminants from the "Curie" mill probably are present at the UC site, the history section of the RAP is primarily about prior activities that created the present conditions at the designated sites. Most of the contamination of the sites by RRM occurred when the mills were operated by Umetco and Shattuck Chemical Company.

Plans for Implementation

Text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (65)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 24, Remedial Action Selection Report

Page 1-5, Figure 1.2: Site boundary is not the same as limits of windblown and waterborne contamination. There is a contaminated area across the river that is not shown. Show separately, the limits of contaminated and site boundary with two different symbols.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The label "limits of windblown and waterborne contamination" was deleted from Figure 1.2. The RAP text was revised accordingly.

UMTRA DOCUMENT REVIEW FORM **(66)**

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 25. Remedial Action Selection Report

Page 1-6, Figure 1.3:

Site boundary is not the same as limits of windblown and waterborne contamination. Show the two areas with two different symbols.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The label "limits of windblown and waterborne contamination" was deleted from Figure 1.3, and the RAP text was revised accordingly.

UMTRA DOCUMENT REVIEW FORM (67)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 26. Remedial Action Selection Report

Page 1-7, Figure 1.4: Suggest showing NC and UC sites also.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

Figure 1.4 (Figure 1.3 of final RAP) was revised to show the approximate locations of the UC and NC sites.

UMTRA DOCUMENT REVIEW FORM (68)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 27. Remedial Action Selection Report, Introduction

Page 1-10, fourth paragraph, first and second line: Suggest changing "The remedial action is expected to take 19 months. During the summer of the first year, the sites ..." to "The remedial action is expected to take 25 months. During the first summer, the sites ..."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM **(69)**

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 28. Remedial Action Selection Report, Geology

Page 2-5, Section 2.3.1, Bedrock Geology

7th Line: Suggest changing "...and claystone strata of the Burro Canyon Formation." to "... and claystone strata of the lower Dakota Formation and the top of Burro Canyon Formation."

RESPONSE

Response: Page ___ By: G. Lindsey (TAC) Date: 25 May 1994

Comment acknowledged.

Plans for Implementation

The paragraph was revised as requested.

UMTRA DOCUMENT REVIEW FORM (70)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 29. Remedial Action Selection Report, Geology

Page 2-7, Section 2.4.1 Geomorphic Stability

1st Paragraph: There are no plans to provide erosion protection at the mesa against encroachment or headward advance. The conditions described in 2nd and 3rd sentences do not require additional erosion protection. Please delete these sentences.

RESPONSE

Response: Page ___ By: G. Lindsey (TAC) Date: 25 May 1994

The statement is still applicable even though the design may not require it. No change to the statement is needed.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (71)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 30. Remedial Action Selection Report, Geotechnical Engineering

Page 3-4, Section 3.2.4, Site Stratigraphy
Disposal Site, 4th Sentence: Same as Comment No. 28.

RESPONSE

Response: Page ___ By: J. Crain Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (72)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 31. Remedial Action Selection Report, Geotechnical Evaluation

Page 3-6, Table 3.1

1. "Results of slop stability analysis" are not specified by TAD. Please delete superscript "a" from the title of this table.

2. Add a column for "Required Factors of Safety" with superscript "a."

3. Delete footnote "NA - not applicable."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The table was revised as requested.

UMTRA DOCUMENT REVIEW FORM (73)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 32. Remedial Action Selection Report

Page 5-8, Section 5.1.2, Hydraulic and Transport Properties

Last line: Change 8.5×10^{-4} cm/s to 8.5×10^{-6} cm/s.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The hydraulic conductivity value was revised as requested.

UMTRA DOCUMENT REVIEW FORM (74)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 33. Remedial Action Selection Report

Page 5-31, Section 5.7, Water Resources Protection Strategy Summary

2nd bullet, last sentence: There will not be any liner on side walls of the excavation. Delete this sentence.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 31 August 1995

Comment acknowledged.

Plans for Implementation

Sentence has been deleted from text as requested.

UMTRA DOCUMENT REVIEW FORM (75)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 34, Remedial Action Selection Report, Geology

Page 2-1, Section 2.1, Scope of Work, 8th Line: We are not sure if refraction seismic surveys were done. Please check, if not, delete from text.

RESPONSE

Response: Page ___ By: G. Lindsey (TAC) Date: 25 May 1994

The seismic survey was performed at the UC site, not at the Burro Canyon site.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (76)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 35. Remedial Action Selection Report

Page 3-10, Section 3.4.3, Construction activities and construction sequence

1. General, 2nd Paragraph, 2nd Sentence: Revise to read "...therefore, collection ditches and waste water retention basin will not be required."

2. Wastewater treatment, 1st Paragraph, 2nd Sentence: Revise to read "Any water remaining in the retention basin may be treated further if a discharge is required."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The text was changed as requested.

UMTRA DOCUMENT REVIEW FORM (77)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 36, Remedial Action Selection Report

Page 4-4, Section 4.3.2, Drainage Ditches

1st Paragraph, 3rd Line: Revise to read ". . . and graded (10 percent max.) to facilitate. . ."

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (78)

COMMENT

Site: Slick Rock, Colorado Date: 13 April 1994
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 37. Remedial Action Selection Report, Radon Attenuation and Site Cleanup

Page 6-6, Figure 6.1

Extent of contamination due to mill tailings shown is incorrect. There is no windblown/waterborne contamination downstream from the UC site or across the river from the NC site. The contaminated area across the river from the UC site is smaller than shown. Please revise the contaminated areas accordingly (see attached figure).

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 13 June 1994

The areal extent of contamination depicted on Figure 6.1 is based on results of a 1982 survey conducted by EG&G. All radiological contamination in the vicinity of the sites, regardless of its source, is shown on Figure 6.1. The purpose of the figure is to show locations where soil concentrations of Ra-226 are greater than 5 pCi/g. Some of the areas shown on Figure 6.1 have not been contaminated by milling or by windblown or waterborne tailings (see Section 6.5).

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (79)

COMMENT

Site: Slick Rock, Colorado Date: 18 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 38. Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-16, Background Groundwater Quality in the Alluvium-North Continent Site

1st Paragraph: As stated in review Comment No. 49 on Draft RAP, Wells 501 and 686 were used as background wells, but according to Figure 3.1, these two wells are at the edge of the processing site and therefore do not qualify as background wells. Revise accordingly.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

Wells 501 and 686 (screened on the alluvium) are upgradient and/or crossgradient of the tailings and are expected to be the most representative existing background monitor wells. Additional ground water characterization is not required for the proposed surface remediation (relocation off the site), but may be necessary for the ground water cleanup phase of the UMTRA Project.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (80)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 39, Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-17, Background Groundwater Quality in the Alluvium-Union Carbide Site

1st Paragraph: As stated in review Comment No. 50 on Draft RAP, Mo and Cr samples were taken from Monitor Well 505 which, according to Figure 3.3, is downgradient of the UC processing site and therefore cannot be qualified as a background well. Revise accordingly.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

Monitor well 505 is upgradient (southeast) of the tailings. The direction of ground water flow, as shown on Figure 3.3, is to the north. For additional information, see response to Comment No. 49.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (81)

COMMENT

Site: Slick Rock, Colorado Date: 18 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 40. Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-41, 3rd Paragraph under Section 3.2.2 (Geology and Hydrostratigraphy).

As stated in review Comment No. 51 on Draft RAP, the text mentions that there are significant upward vertical gradients in the middle and lower sandstone units underneath the disposal site. Also, on Page 3-45, under Burro Canyon Middle Sandstone Unit it is stated that "groundwater occurs under confined conditions and has an upward hydraulic gradient; the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit". This means that the potentiometric surface is still somewhere in the aquitard separating the upper and middle sandstone units. Additionally, according to Figures 3.12 and 3.18, there is a downward hydraulic gradient between the upper and middle sandstone units contrary to what the text says. Please clarify the inconsistency.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

In *Groundwater* (Freeze & Cherry, 1979), a confined aquifer is defined as "an aquifer that is confined between two aquitards . . . In a confined aquifer, the water level usually rises above the top of the aquifer." This is the case for the middle sandstone unit of the Burro Canyon Formation. As stated in the Slick Rock RAP, the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit (in the middle mudstone unit of the Burro Canyon Formation). Since the water levels are above the top of the middle sandstone unit, an upward hydraulic gradient exists. Approximately 60 to 70 ft of low-permeability mudstone separates the upper and middle sandstone units, forming a confining layer to prohibit downward migration of ground water from the upper sandstone unit.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (82)

COMMENT

Site: Slick Rock, Colorado Date: 18 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 41, Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-45, Under Burro Canyon Middle Sandstone Unit

As stated in review Comment No. 52 on Draft RAP, the text mentions that "Groundwater elevations have remained constant, as shown in Figure 3.19". However, in the figure, for Well 516, there appears to be a significant change in water level elevation between January and April of 1990. The same inconsistency occurs in Figure 3.21 when the text on Page 3-45 under Burro Canyon Lower Sandstone Unit says that "Groundwater elevations have remained constant, as shown in Figure 3.21". Correct text or figures for consistency.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

The "significant change in water level elevation between January and April 1990" results from slow ground water level recovery following monitor well construction and exemplifies the low hydraulic conductivity of the Burro Canyon Formation sandstone units.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM **(83)**

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 42. Attachment 4, Water Resources Protection Strategy, Water Resources Protection Strategy Summary

Page 1-1 (5th Paragraph), Page 3-1 (2nd Paragraph) and Page 3-11 (3rd Paragraph):

As stated in review Comment No. 54 on Draft RAP, the text mentions upward vertical hydraulic gradient in the middle sandstone unit beneath the disposal site. This is inconsistent with what Figures 3.16 and 3.18 show in Attachment 3. (See Comment No. 40).

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

In *Groundwater* (Freeze & Cherry, 1979), a confined aquifer is defined as "an aquifer that is confined between two aquitards...In a confined aquifer, the water level usually rises above the top of the aquifer." This is the case for the middle sandstone unit of the Burro Canyon Formation. As stated in Attachment 3 of the Slick Rock RAP, the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit (in the middle mudstone unit of the Burro Canyon Formation). Since the water levels are above the top of the middle sandstone unit, an upward hydraulic gradient exists.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (84)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 43. Remedial Action Selection Report, Water Resources Protection

Page 5-5, 5th Paragraph, Page 5-18 (4th Paragraph), and Page 5-21 (under proposed concentration limits):

As stated in review Comment No. 55 on Draft RAP, upward gradient in the middle sandstone is questionable. (See Comment No. 40.)

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

In *Groundwater* (Freeze & Cherry, 1979), a confined aquifer is defined as "an aquifer that is confined between two aquitards...In a confined aquifer, the water level usually rises above the top of the aquifer." This is the case for the middle sandstone unit of the Burro Canyon Formation. As stated in Attachment 3 of the Slick Rock RAP, the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit (in the middle mudstone unit of the Burro Canyon Formation). Since the water levels are above the top of the middle sandstone unit, an upward hydraulic gradient exists.

Plans for Implementation

None required.

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UMTRA DOCUMENT REVIEW FORM (85)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 48. Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-6, Groundwater Conditions in the Entrada Formation

1st sentence should refer to the Union Carbide processing site only.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

Comment acknowledged.

Plans for Implementation

The text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (86)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 49. Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-12, Background Groundwater Quality in the Alluvium North Continent Site

1st paragraph: Wells 501 and 686 were used as background wells, but according to Figure 3.1, these two wells are at the edge of the processing site and therefore do not qualify as background wells. Revise accordingly.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

Wells 501 and 686 (screened in the alluvium) are upgradient and/or crossgradient of the tailings and are expected to be the most representative existing background monitor wells. Additional ground water characterization is not required for the proposed surface remediation (relocation off the site) but may be necessary for the ground water cleanup phase of the UMTRA Project.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (87)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Karn (MK-F)

Comment: 50. Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-13, Background Groundwater Quality in the Alluvium - Union Carbide Site

1st paragraph: Mo and Cr samples were taken from Monitor Well 505 which, according to Figure 3.3, is downgradient of the UC processing site and therefore cannot be qualified as a background well. Revise accordingly.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

Monitor well 505 is upgradient (southeast) of the tailings. The direction of ground water flow, as shown on Figure 3.3, is to the north. For additional information, see response to Comment No. 49.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM **(88)**

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 51, Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-36, 3rd Paragraph under Section 3.2.2 (Geology and Hydrostratigraphy)

The text mentions that there are significant upward vertical gradients in the middle and lower sandstone units underneath the disposal site. Also, on Page 3-38, under Burro Canyon Middle Sandstone Unit it is stated that "groundwater occurs under confined conditions and has an upward hydraulic gradient; the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit". This means that the potentiometric surface is still somewhere in the aquitard separating the upper and middle sandstone units. Additionally, according to Figures 3.12 and 3.14, there is a downward hydraulic gradient between the upper and middle sandstone units contrary to what the text says. Please clarify the inconsistency.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

In *Groundwater* (Freeze & Cherry, 1979), a confined aquifer is defined as "an aquifer that is confined between two aquitards . . . In a confined aquifer, the water level usually rises above the top of the aquifer." This is the case for the middle sandstone unit of the Burro Canyon Formation. As stated in the Slick Rock RAP, the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit (in the middle mudstone unit of the Burro Canyon Formation). Since the water levels are above the top of the middle sandstone unit, an upward hydraulic gradient exists. Approximately 60 to 70 ft of low-permeability mudstone separates the upper and middle sandstone units, forming a confining layer to prohibit downward migration of ground water from the upper sandstone unit.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (89)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 52. Attachment 3, Groundwater Hydrology Report, Groundwater Investigations

Page 3-38, Under Burro Canyon Middle Sandstone Unit

The text mentioned that "Groundwater elevations have remained constant, as shown in Figure 3.15". However, in the Figure, for Well 516, there appears to be a significant change in water level elevation between January and April of 1990. The same inconsistency occurs in Figure 3.17 when the text on Page 3-38 under Burro Canyon Lower Sandstone Unit says that "Groundwater elevations have remained constant, as shown in Figure 3.17". Correct text or figures for consistency.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

The "significant change in water level elevation between January and April 1990" results from slow ground water level recovery following monitor well construction and exemplifies the low hydraulic conductivity of the Burro Canyon Formation sandstone units.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (90)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 53. Attachment 3. Groundwater Hydrology Report. Groundwater Investigations

Page 3-47, under Burro Canyon Upper Sandstone Unit

Figure 3.11 referred to in the 2nd sentence should have been Figure 3.12. Likewise on Page 3-48, Figure 3.11 under Burro Canyon Middle Sandstone Unit should have been Figure 3.14 and Figure 3.11 under Burro Canyon Lower Sandstone unit should have been Figure 3.16.

RESPONSE

Response: Page ___ By: K Monks (TAC) Date: 2 February 1994

Comment acknowledged.

Plans for Implementation

The figure numbers were modified as requested.

UMTRA DOCUMENT REVIEW FORM (91)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 54. Attachment 4, Water Resources Protection Strategy, Water Resources Protection Strategy Summary

Page 1-1, (5th Paragraph), Page 3.1 (2nd Paragraph) and Page 3-10 (3rd Paragraph).

The text mentions upward vertical gradients in the middle sandstone unit beneath the disposal site. This is inconsistent with what Figures 3.12 and 3.14 show in Attachment 3 (see Comment 51).

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

In *Groundwater* (Freeze & Cherry, 1979), a confined aquifer is defined as "an aquifer that is confined between two aquitards...In a confined aquifer, the water level usually rises above the top of the aquifer." This is the case for the middle sandstone unit of the Burro Canyon Formation. As stated in Attachment 3 of the Slick Rock RAP, the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit (in the middle mudstone unit of the Burro Canyon Formation). Since the water levels are above the top of the middle sandstone unit, an upward hydraulic gradient exists.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (92)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 55. Attachment 4, Water Resources Protection Strategy, Water Resources Protection Strategy Summary

Page 5-5, 4th Paragraph, Page 5.18 (2nd Paragraph), and Page 5-21 (under proposed concentration limits), upward gradient in the middle sandstone is questionable. See Comment 51.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

In *Groundwater* (Freeze & Cherry, 1979), a confined aquifer is defined as "an aquifer that is confined between two aquitards...In a confined aquifer, the water level usually rises above the top of the aquifer." This is the case for the middle sandstone unit of the Burro Canyon Formation. As stated in Attachment 3 of the Slick Rock RAP, the potentiometric surface is approximately 40 ft above the top of the middle sandstone unit (in the middle mudstone unit of the Burro Canyon Formation). Since the water levels are above the top of the middle sandstone unit, an upward hydraulic gradient exists.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (93)

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 56. Attachment 4, Water Resources Protection Strategy, Conceptual Design Considerations and Features for Water Resources Protection

On Page 2-4, Section 2.2.2 mentions the tailings have a saturated hydraulic conductivity of about 5×10^{-2} cm/s and that the Dakota Sandstone foundation has a saturated K of about 1.5×10^{-4} cm/s (page 2-2 under Section 2.1.3). Based on these values, there is a potential for water to back up in the bottom of the cell during transient drainage of construction water trapped in the tailings. Suggest that a performance assessment be conducted to evaluate the flooding possibility.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

Comment acknowledged. The results have been presented in a water balance calculation which is included in Appendix C to Attachment 3, Calculation No. SRK-11-94-14-09-00.

Plans for Implementation

Attachment 4, Section 3.3, was modified to summarize the results of the seepage report.

UMTRA DOCUMENT REVIEW FORM **(94)**

COMMENT

Site: Slick Rock, Colorado Date: 19 April 1994
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 57. Attachment 4, Water Resources Protection Strategy, Disposal and Control of Radioactive Materials and Nonradioactive Contaminants

According to Figure 3.1 on Page 3-8, not the entire stretch of the Joe Davis Canyon is crossgradient from the Burro Canyon disposal cell as mentioned on Page 3-7 under Surface Points of Exposure. A section through the disposal cell and the Joe Davis Canyon probably would help to clarify the picture.

RESPONSE

Response: Page ___ By: K. Monks (TAC) Date: 2 February 1994

The RAC and TAC have conducted several field investigations (i.e., installation of coreholes, monitor wells, and test pits) at the Burro Canyon disposal site; however, these do not extend a mile away from the site to Joe Davis Canyon. As a result, Figures 3.1 and 3.2 were modified from a USGS professional paper (Shawe, 1968), based on his investigation and research, and must be presented in that context. The upper sandstone unit is discontinuous, as shown in Figure 3.2. However, since the subsurface extent of the upper sandstone unit has not been fully investigated and mapped by the RAC or TAC, we must rely on the USGS report.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM (95)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 58. General Comment

1. Radon barrier materials come from the Burro Canyon disposal cell excavation. Laboratory test results for this material is presented in MKES Calculation Nos. 11-340-01-00 and 11-340-02-00. Disappointment Valley borrow source is no longer a source for radon barrier material. Please delete all references to the Disappointment Valley borrow source found in the document.

2. According to MKES Calculation No. 11-340-02-00, the thickness of radon barrier material is 1.5 ft. The new design thickness is based on the physical and radiological properties of the materials from the required excavation at the BC site. Please change the thickness of the radon barrier from 2' to 1.5' throughout the document.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (96)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 59. Remedial Action Selection Report

Page 3-9, Section 3.4.1, 8th bullet:

Change "...at or near the optimum moisture content,..." to "at or above optimum moisture content,..."

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (97)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 60. Remedial Action Selection Report

Page 3-9, Section 3.4.1, 4th, 7th, and 8th bullet:

Delete "(ASTM, 1991)."

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (98)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 61. Remedial Action Selection Report

Page 6-2, 1st paragraph.

See Comment No. 1.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (99)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 62. Remedial Action Selection Report

Page 3-10, Section 3.4.3:

1. 4th paragraph, 4th sentence: Change "in conjunction with the volume in the basin due to the average..." to "in conjunction with the maximum accumulated runoff volume in the basin due to the average..."

2. 5th paragraph, 3rd sentence: Change "...and the water surface." to "...and the maximum water surface."

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM **(100)**

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 63. Remedial Action Selection Report

Page ES-1, Remedial Action

3rd paragraph, 6th sentence: There is no plan to excavate 39 feet into mudstone of the Burro Canyon Formation. Revise the sentence to read "The mudstone/claystone of the Burro Canyon Formation will provide a natural impermeable barrier from the base of the disposal cell to at least 7 ft up the side wall to form a continuous...."

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 13 August 1995

As stated in the response to CDPHE Comment No. 1, the DOE has agreed to a 45- to 50-ft excavation at the deep end of the cell that is 20 to 36 ft below the Dakota Sandstone/Burro Canyon Formation interface. This will result in a minimum 7-ft sidewall liner throughout the cell and a 20- to 39-ft "liner effect" at the deep end of the cell.

Plans for Implementation

None.

UMTRA DOCUMENT REVIEW FORM **(101)**

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 64. Remedial Action Selection Report

Page 1-12, Table 1.2

1. Calculation Nos. 11-321-01-00 and 11-321-02-01 have been superseded. Replace with Calculation Nos. 11-340-01-00 and 11-340-02-00 respectively. These new calculations are for radon barrier design using materials from required excavation at BC site.

2. Change Calculation No. "11-320-01-00" to "11-310-01-00."

3. Under "Remark," for settlement and cover cracking, add "There is no potential or cover cracking due to differential settlement."

4. Change radon barrier thickness from 2 ft to 1.5 ft.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 26 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM **(102)**

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 65. Remedial Action Selection Report, Radon Attentuation and Site Cleanup

Page 3-2, Borrow areas:

Delete 6th sentence. See Comment No. 1.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (103)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 66. Remedial Action Selection Report

Page 5-31, 2nd bullet, last sentence.

Same as Comment No. 7.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (104)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 67, Attachment 3, Ground Water Hydrology Report

Page 3-36, under 3.1.8 Geochemical Conditions

In the 5th paragraph, monitor well 503 is right at the tailings pile of the NC site rather than in the immediately downgradient of the tailings piles (See Figure 3.3).

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (105)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 68. Attachment 3, Ground Water Hydrology Report

Page 3-40

Figure 3.14 does not have a directional north arrow. Same problem occurs in Figures 3.16, 3.18 and 3.20 on Pages 3-44, 3-46 and 3-48, respectively.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM **(106)**

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Ranani (RAC)

Comment: 69. Remedial Action Selection Report

Page 6-4, Evaluation of Radon Barrier

The data presented here are for radon barrier material using Disappointment Valley borrow source. See Comment No. 1 and revise accordingly.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (107)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 70. Attachment 4, Water Resources Protection Strategy

Page 2-2

1. 2nd Paragraph, 6th Sentence: Add "is" after "Dakota Sandstone."

2. Section 2.2, Design Features: Same as Comment No. 7.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (108)

COMMENT

Site: Slick Rock, Colorado Date: 7 August 1995
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 71. Attachment 3. Ground Water Hydrology Report

Page 3-15 under Navajo Sandstone Formation

The calculated average linear ground water velocity in the Navajo Sandstone should be 5.8×10^{-1} ft/year instead of 1 ft/year, based on an average hydraulic conductivity of 2.4×10^{-2} ft/day under a hydraulic gradient of 0.02 and an estimated effective porosity of 0.30.

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 21 August 1995

Comment acknowledged.

Plans for Implementation

Text was corrected as requested.

UMTRA DOCUMENT REVIEW FORM (109)

COMMENT

Site: Slick Rock, Colorado Date: 7 August 1995
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 72. Attachment 3, Ground Water Hydrology Report

Page 3-41 under 3.2.2, Geology and Hydrostratigraphy

End of 3rd paragraph states "even if seepage from the disposal cell occurred, the upward vertical gradients would prohibit potential seepage from migrating below the upper sandstone unit." This statement is not true because the potentiometric surface of the middle sandstone unit is lower than that of the upper sandstone unit (see 4th paragraph on Page 3-52) and therefore, there is a potential for leakage from the upper to lower sandstone unit. This differential head is also reflected by comparing the potentiometric heads of the upper and middle sandstone units in Figures 3.16 and 3.18.

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 29 August 1995

Comment acknowledged.

Plans for Implementation

Text was amended to indicate that low-permeability mudstone inhibits the potential downward migration of ground water from the upper sandstone unit.

UMTRA DOCUMENT REVIEW FORM **(110)**

COMMENT

Site: Slick Rock, Colorado Date: 7 August 1995
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 73, Attachment 3, Ground Water Hydrology Report

Page 3-42

Figure 3.15 does not include the location of the tailings piles and also does not refer to where this x-section is cutting through, for example, in Figure 3.14.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (111)

COMMENT

Site: Slick Rock, Colorado Date: 7 August 1995
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 74. Attachment 3, Ground Water Hydrology Report

Pages 3-50 and 3-51, under Burro Canyon Upper Sandstone Unit

The following questions are posed regarding hydraulic testing of the upper sandstone unit:

1. Is wellbore storage effect taken into consideration in the analysis?

2. How was the storage coefficient of 0.1 derived since there were no drawdown at any observation wells? Was this assumed?

3. The storage coefficient of 0.1 indicates that an unconfined condition exists. Was the Theis nonequilibrium well equation adjusted in the analysis to accommodate the unconfined condition?

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 21 August 1995

See Calculation No. SRK-06-91-14-03-00 in Appendix C to Attachment 3, for method and procedures, and assumptions.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (112)

COMMENT

Site: Slick Rock, Colorado Date: 7 August 1995
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 75. Attachment 3, Ground Water Hydrology Report

Page 3.52 under Burro Canyon Lower Sandstone Unit

Was borehole storage considered during the analysis of aquifer testing for the lower sandstone unit?

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 21 August 1995

See response to Comment No. 74.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (113)

COMMENT

Site: Slick Rock, Colorado Date: 7 August 1995
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 76. Response to Previous Comment Nos. 51, 54, and 55, Attachment 3, Ground Water Hydrology Report

Page 48

The significance of mentioning a vertical gradient here is to assess the potential of downward migration of groundwater between the upper and middle sandstone units. The argument is not on the gradient within the aquifer itself but between aquifers. There may be local upward gradient within the middle sandstone, but in a global view, there is a downward hydraulic gradient between the upper and middle sandstone units. This implies a potential of leakage from the upper to the middle units. However, we may say there is a tendency for the low-permeability mudstone to prohibit downward migration of groundwater from the upper sandstone unit.

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 21 August 1995

See response to Comment No. 72.

Plans for Implementation

None required.

UMTRA DOCUMENT REVIEW FORM (114)

COMMENT

Site: Slick Rock, Colorado Date: 7 August 1995
Document: Final Remedial Action Plan
Reviewer: J. T. Kam (MK-F)

Comment: 77. Response to Previous Comment No. 52, Attachment 3, Ground Water Hydrology Report

Page 3-43, under Burro Canyon Middle Sandstone Unit

Sentence should be modified to "Ground water elevations have remained constant except between January and April 1990, when a significant change in water level elevation resulted from slow ground water level recovery following monitor well construction and exemplified the low hydraulic conductivity of the Burro Canyon Sandstone Unit.

RESPONSE

Response: Page ___ By: K. Lambert (TAC) Date: 21 August 1995

Comment acknowledged.

Plans for Implementation

Text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (115)

COMMENT

Site: Slick Rock, Colorado Date: 8 August 1995
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 78. Response to Previous Comment. Remedial Action Report Selection Report

Page 5-16, Section 5.1.5, Water Use at Processing Site

1st paragraph - There is no longer a post office at Slick Rock. In addition the water supply for the restaurant and trailers is from a private well.

RESPONSE

Response: Page ___ By: M. B. Leaf Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Text was revised as requested.

UMTRA DOCUMENT REVIEW FORM **(116)**

COMMENT

Site: Slick Rock, Colorado Date: 8 August 1995
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 79, Response to Previous Comment, Remedial Action Report Selection Report

Page 5-6, Figure 5.3

Add MK boreholes to plan.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (117)

COMMENT

Site: Slick Rock, Colorado Date: 8 August 1995
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 80. Response to Previous Comment, Water Resources Protection Strategy

Page 2-6, Section 2.2.2

Prior to the last sentence add "The final depth of the excavation and height of the impermeable layer will be verified by geologist prior to placing tailings."

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Change was made as requested.

UMTRA DOCUMENT REVIEW FORM **(118)**

COMMENT

Site: Slick Rock, Colorado Date: 8 August 1995
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 81. Remedial Action Selection Report

Page 2-7, Section 2.4.1, Geomorphic Stability

1st paragraph. Replace the last sentence with the following:

> "The central drainage exit at the south side of the mesa should not be overlapped by the cell. The gully should be backfilled with material from the cell excavation to provide additional protection against headward advance of this tributary."

The above reflects what the actual design is and does not leave an open issue as to what kind or type of erosion protection is required.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (119)

COMMENT

Site: Slick Rock, Colorado Date: 8 August 1995
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 82. Response to Previous Comment, Remedial Action Selection Report

Page 1-2, Section 1.2.1, History, Add

Add "Prior to the 1957 operations, one of the first uranium mills was in operation around the turn of the century. While there are no tailings, there is some radiological contamination associated with this mill."

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 27 August 1995

Comment acknowledged.

Plans for Implementation

Text was revised.

UMTRA DOCUMENT REVIEW FORM (120)

COMMENT

Site: Slick Rock, Colorado Date: 8 August 1995
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 83. Response to Previous Comment, Remedial Action Selection Report

1. Page ES-2, Ground Water Compliance, 17th line: The stand pipes will not be installed at the toe of the disposal cell. Revise to read: "...stand pipes will be installed to the bottom of the disposal cell..."

2. Page 5-29, Ground Water Monitoring, 15th line: Same as No. 1 above.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 12 August 1995

Comment acknowledged.

Plans for Implementation

Comment was incorporated as requested.

UMTRA DOCUMENT REVIEW FORM (121)

COMMENT

Site: Slick Rock, Colorado Date: 1 August 1995
Document: Final Remedial Action Plan
Reviewer: A. M. Banani (RAC)

Comment: 84. Remedial Action Selection Report

Page 6-2, Section 6.3.2, Radon Diffusion

The data presented for radon barrier in this section is for the material from Disappointment Valley borrow source. Use the data for the material from excavation in BC site. See Comment No. 1.

RESPONSE

Response: Page ___ By: M. B. Leaf (TAC) Date: 25 August 1995

Comment acknowledged.

Plans for Implementation

Text was revised as requested.

UMTRA DOCUMENT REVIEW FORM (122)

COMMENT

Site: Slick Rock, Colorado Date: 8 August 1995
Document: Final Remedial Action Plan
Reviewer: R. F. Claire (RAC)

Comment: 85, Attachment 2, Geology Report, Appendix A

After Page 6-11

The calculation should be checked and approved and all pages should be titled, dated and initialed. Suggest the calculation be removed from the Geology Report and inserted in the calculation volumes or elsewhere.

RESPONSE

Response: Page ___ By: J. Crain (TAC) Date: 30 August 1995

Comment acknowledged.

Plans for Implementation

The calculation was written, checked, and approved in accordance with the procedure in place in 1990. Through error of omission, the original approval sheet was not included in the preliminary final document, but has been included in this revision of the document. The present location of Calculation No. SRK-04-90-03-03-00 (the appendix to Attachment 2, Geology Report) will remain unchanged as the calculation was prepared in response to a comment regarding the geology section of the document, not ground water hydrology, where the document's other calculations are presently located.