Naturita Remedial Action Plan
DOE Responses to Comments from
U.S. Nuclear Regulatory Commission (Letter dated 21 Jul. 98)
and Colorado Department of Public Health and Environment (Letter dated 14 Aug. 98)

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I. U.S. NUCLEAR REGULATORY COMMISSION STAFF REVIEW COMMENTS

1. Concentration Limit for Strontium and Tin at Upper Burbank Disposal Site

Comment: RAP Table 3.1 of Appendix C identifies groundwater quality concentration limits for strontium and tin at the Upper Burbank Disposal site. According to this table, these limits were derived from ground water quality samples collected at the disposal site from Wells CM-93-1 and CM-93-2. However, data on strontium and tin concentrations are not reported in the tables of site water quality data (i.e., tables of "Groundwater Analyses, CM-93-1, CM-93-2, Burbank Repository," Appendix B). Therefore, it is not clear how concentration limits for these parameters were derived.

Response: Concentration limits for strontium and tin will be determined during routine sampling of CM 93-1 and CM 93-2 during long-term site surveillance activities. Footnote (d) has been added to RAP Appendix C, Section 3.1.1, Table 3.1. Footnote (d) reads as follows: "^d Concentration limits for Strontium and Tin will be determined during routine sampling of wells CM 93-1 and CM 93-2 during long-term site surveillance activities."

Instructions:

- Remove Appendix C, page C3-3.
- Insert new Appendix C, page C3-3.

2. Delineation of Drainage Areas

Comment: Based on the NRC staff's review of information provided by DOE in Construction Resolution Revision (CRR) No. 25 and recent site visits to the Upper Burbank disposal cell, it appears there may be some potential for drainage areas of the various drainage channels to be different from that assumed in DOE's flood analyses. It is not apparent that the drainage areas assumed in DOE's present calculations are correct, or would be so in the future (i.e., if grading modifications occur). This issue is important for the following reasons: 1) DOE intends to use smaller rock in the channels, but the flows in these channels could actually be larger, depending on the drainage area; 2) DOE assumes that the interceptor ditch could overtop (if filled by sediments), whereby any increases in overtopping flow could affect the toe design of the downstream drainage ditches, and 3) flows could be larger at various locations entering the diversion channel, resulting in the need to design an interceptor channel and large sandstone riprap for flow concentrations.

Response: In response to the NRCs concern that the cell design needs to be reevaluated based on consideration of the potential that the current design drainage areas may change

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in the future, the following evaluation is provided. This response is taken from the Morrison Knudsen Corporation Inter-Office Correspondence (IOC) titled, "UMTRA Project - Naturita, Upper Burbank Drainage Subbasin Areas Assessment," and dated October 28, 1998.

"This IOC presents our evaluation in response to NRC's comments Nos. 2 & 3 of the Naturita RAP dated July 21, 1998 on delineation of drainage areas at the Upper Burbank disposal site. The evaluation consists of (1) interpretation of aerial photos taken on September 18, 1998, emphasis on site drainage areas and patterns, (2) delimitation of drainage subbasin areas, (3) definition of creeks and gullies patterns and drainage patterns, (4) comparison of the latest subbasin drainage areas and patterns (figure 1) shown on the aerial photos with those used in the final design (figure 2), and (5) recheck the adequacy of design sandstones and riprap sizes based on the above findings.

"Figure 1 shows the topography and the delineation of the drainage patterns of the upland areas from the aerial photos following the most recent site construction activities. figure 2 depicts the drainage areas and patterns used in the design. Table 1 tabulates the subbasin drainage areas used in the design and those delineated from the aerial photos and other pertinent data.

"A comparison of Figures 1 and 2 indicated the following: 1) The drainage subbasins used in the design phase encompassed all upland drainage areas located above and draining into the Interceptor Channel and diversion Channel Nos. 1 & 2. 2) Except for the subbasin drainage area of BSND5 plus BSND6, the remaining subbasin drainage areas (runoff contributing areas) are compatible between the two conditions. The minor differences are primarily due to judgement applied in the interpretation of topographic features. 3) The runoff from the subbasin drainage area of BSND5 (Club Mesa borrow area) was not included in the final design calculation for the Interceptor Channel (between stations 7+80 and 11+00). The runoff was assumed draining toward County Road EE22 instead of the Interceptor Channel as currently graded.

"Based on the subbasin drainage areas delineated from the aerial photos, we calculated the required minimum D50 rock sizes using the same methods presented in the final design calculations. The results are tabulated in Table 1. A comparison of the calculated D50 rock sizes between the two cases indicates that the design rock sizes are adequate for erosion protection."

Since the rock design for the channels is at capacity at several drainage sub-basin areas, the Naturita Long-Term Surveillance Plan will include a requirement for the Long-Term Surveillance and Maintenance Program to monitor upland drainage capture areas. These areas will be inspected to ensure that no new terrain modifications are made that will increase the drainage from these areas and impact the channels around the disposal cell.

Instructions:

- None.

TABLE 1
UMTRA PROJECT - UPPER BURBANK DISPOSAL SITE
COMPARISON OF UPLAND DRAINAGE SUB-BASIN AREAS
DURING DESIGN AND POST-CONSTRUCTION PHASES
AND EVALUATION OF DESIGN ROCK SIZES

DRAINAGE SUB-BASIN DESIGNATION	DIV. CHANNEL NO. RELATED TO SUBBASIN DRAINAGE AREAS	APPROXIMATELY LOCATION (STATIONS)	DRAINAGE BASIN AREAS		SANDSTONE SIZE FOR BENCH/APRON		RIPRAP SIZE FOR CHANNELS	
			POST CONSTRUCTION PHASE (ACRES)	DESIGN PHASE (ACRES) (1)	REQUIRED MINIMUM D50 (INCHES)	DESIGN D50 (INCHES) (1)	REQUIRED MINIMUM D50 (INCHES)	DESIGN D50 (INCHES) (1)
BSNE1	NO. 1	0+00 TO 2+65	0.87 (APRON 0.51) (2)	0.90	11.80	36.00	3.40	5.60
BSNE2	NO. 1	2+65 TO 3+53	0.44 (APRON 0.28)	2.06	36.00	36.00	3.80	5.60
BSNE3	NO. 1	3+53 TO 7+06	0.74 (APRON 0.46)	2.40	8.90	36.00	3.8 TO 5.4	5.60
BSNE4	NO. 1	7+06 TO 11+40	0.53	1.30	6.70	36.00	4.3 TO 7.0	7.00
BSNW1	NO. 2	0+00 TO 2+20	1.37 (APRON 0.56)	1.26	11.80	36.00	4.00	5.60
BSNW2	NO. 2	2+20 TO 4+20	1.47 (APRON 0.28)	1.71	10.00	36.00	4.00	5.60
BSNW5-1	NO. 2	4+20 TO 5+50	1.36 (APRON 0.27)	1.28	8.5 TO 10.0	36.00	4.80	5.60
BSND1 + BSNW5-2	NO. 2	5+50 TO 6+50	6.22 (APRON 0.08)	5.92	33.40	36.00	5.50	5.60
BSNW3 + BSNW4-1	NO. 2	6+50 TO 8+50	5.86 (APRON 0.36)	5.52	14.3 TO 23.2	36.00	5.60	5.60
BSNW4-2	NO. 2	8+50 TO 12+00	4.15 (APRON 0.45)	4.88	20.4 TO 36.0	36.00	5.9 TO 6.8	7.00
BSNW6	NO. 2	12+00 TO 14+00	0.81	0.90	19.30	36.00	6.80	7.00
BSND2	INTERCEPTOR	2+66 TO 4+00	19.30	21.70	36.00	36.00	5.40	5.60
BSND3	INTERCEPTOR	4+00 TO 7+80	4.21	5.10	32.00	36.00	4.40	5.60
BSND5 + BSND6	INTERCEPTOR	7+80 TO 11+00	14.87	10.10	36.00	36.00	5.60	5.60
BSND7	INTERCEPTOR	7+00 TO 11+00	3.81	4.05	36.00	36.00	5.60	5.60

NOTES:

(1) MKES, "EVALUATION OF EROSION PROTECTION DESIGN AND SEDIMENT INFLOW/OUTFLOW EVALUATION FOR CHANNEL NOS. 1 AND 2 INTERCEPTOR CHANNEL", CALC. NO. 17-739-08-01, JUNE 1998

(2) NUMBERS WITHIN THE PARENTHESIS INDICATE THE DRAINAGE AREA FROM THE APRON

**FIGURE 1 UMTRA PROJECT
UPPER BURBANK DISPOSAL
UPLAND DRAINAGE SUBBASIN
(POST-CONSTRUCTION)**

CT
AL SITE
ASIN AREAS

**FIGURE 2 UMTRA PROJECT
(UPPER BURBANK) DISPOSAL SITE
UPLAND DRAINAGE SUBBASIN AREAS
(DESIGN)**

3. Design of Sandstone Benches

Comment: Based on NRC staff review of CRR No. 25, site visit observations at the Upper Burbank disposal cell, and discussions with DOE and contractor personnel, the sandstone bench area on the upstream side of the interceptor channel will need some design modifications to prevent undesirable flow patterns from occurring (e.g., sudden drop-offs). It appears that if the sandstone bench is placed as currently designed, flood flows will not transition smoothly onto the side slope riprap, and there is a potential for erosion of the riprap to occur.

Response: The design of the sandstone benches was revised by CRR 28 to address comments received from NRC personnel. These changes were incorporated and constructed as shown in the latest revised drawings.

Instructions:

- None.

4. Long-Term Moisture Value of Windblown Materials

Comment: RAP Section 6.2.1 of the Naturita Remedial Action Selection (RAS) Report (Processing Site) indicates that the long-term moisture value of windblown material was not measured, but was assumed to be similar to mill yard material (i.e., the same value of 12 percent was used). However, RAP Calc-010 of Appendix F indicates that four samples of windblown material were measured to have a long-term moisture value of 13 percent. RAP Sections 6.2.2 and 6.2.4 also mention radon model values that are obsolete.

Response: The Section 6 of the Remedial Action Selection (RAS) Reports for the Processing Site and for the Disposal Site have been corrected to reflect the long-term moisture values of windblown material as listed in RAP Calc-010 of Appendix F.

Processing Site RAS Section 6.2.1, paragraph 2, 2nd sentence, has been changed to read: "Minus 15 bar moisture measurements of radiologically contaminated material from the former tailings pile area (five samples) averaged 5.89 percent by weight for radiologically contaminated material."

Processing Site RAS Section 6.2.1, paragraph 2, 4th sentence, has been changed to read: "The minus 15 bar value of 5.89 percent by weight was conservatively selected for the former tailings pile subsoil."

Processing Site RAS Section 6.2.1, paragraph 3, has been changed to read: "Similar testing of mill yard materials yielded the average value of 13 percent moisture content by weight was selected as representative of the mill yard materials."

Processing Site RAS Section 6.2.1, paragraph 4, 2nd sentence, has been changed to read: "Since the geotechnical properties of these materials are similar to those of the tested mill yard soils, a value of 13 percent by weight was also assumed for the windblown, vicinity property, and ore storage materials."

Processing Site RAS Section 6.2.2, 6th sentence, has been changed to read: "Each diffusion coefficient value selected corresponds to the individual estimate long-term moisture content of 13 percent by weight"

Disposal Site RAS Section 6.3.1, paragraph 2, 2nd sentence, has been changed to read: "Minus 15 bar moisture measurements of radiologically contaminated material from the former tailings pile area (five samples) averaged 5.89 percent by weight for radiologically contaminated material."

Disposal Site RAS Section 6.3.1, paragraph 2, 4th sentence, has been changed to read: "The minus 15 bar value of 5.89 percent by weight was conservatively selected"

Disposal Site RAS Section 6.3.1, paragraph 3, has been changed to read: "Similar testing of mill yard materials averaged 13 percent moisture content by weight and was selected as representative of the mill yard materials."

Disposal Site RAS Section 6.3.1, paragraph 4, 2nd sentence, has been changed to read: "Since the geotechnical properties a value of 13 percent by weight was"

Disposal Site RAS Section 6.3.2, paragraph 2, 6th sentence, has been changed to read: "Each diffusion coefficient long-term moisture content of 13 percent by weight"

Instructions:

- Remove Processing Site RAS pages 6-1 and 6-2.
- Insert new Processing Site RAS pages 6-1 and 6-2.
- Remove Disposal Site RAS pages 6-2 and 6-3.
- Insert new Disposal Site RAS pages 6-2 and 6-3.

5. Missing Information in Section 6.3 of the RAS (Processing Site)

Comment: RAP Section 6.3, page 6-4 of the RAS (Processing Site) is titled "Evaluation of Radon Barrier," however, there is no evaluation. Also, this section does not refer to another part of the RAP as to where the evaluation can be found.

Response: The requested information is presented in Section 6.4 (page 6-5) of the Disposal Site RAS. The information, as presented in Section 6.3 of the Processing Site RAS, is not correct and will be deleted.

Instructions:

- Remove Processing Site RAS pages 6-3 and 6-4.
- Insert new Processing Site RAS pages 6-3 and 6-4.

6. Missing Information in Attachment 4

Comment: In Attachment 4 (Processing Site) the title pages for the sections labeled "Soil Verification Using Cobbles-to-Fines Correction" (OP-003-4) and "Uranium Cleanup and Verification at Naturita" (RAC-OP-007) indicate the inclusion of DOE/NRC correspondence; however, this information was not included.

Response: It was not the intent of the RAP to include all of the communications between DOE, NRC and CDPHE concerning "Soil Verification Using Cobbles-to-Fines Correction" (OP-003-4) and "Uranium Cleanup and Verification at Naturita" (RAC-OP-007). Therefore, the blue divider page for the two above mentioned documents will indicate that only the listed correspondence is included in the RAP.

Instructions:

- Remove the blue divider page for the sections labeled "Soil Verification Using Cobbles-to-Fines Correction" (OP-003-4) and "Uranium Cleanup and Verification at Naturita" (RAC-OP-007).
- Insert new blue divider page for the sections labeled "Soil Verification Using Cobbles-to-Fines Correction" (OP-003-4) and "Uranium Cleanup and Verification at Naturita" (RAC-OP-007).

7. Conflicting Data in Attachments 1 and 4

Comment: Both Attachments 1 and 4 (Processing Site) contain conflicting data in the sections labeled "Contaminated Material Excavation – Cobbles-to-Fine Ratio" (Calc. 17-730-03-02) and "Cobbles-to-Fine Test Pit Analysis," respectively. Specifically, both sections contain Calc. 17-730-03-02; however, Sheet 7 of Attachment 4 was not updated from the previous version of the calculation.

Response: Attachments 1 and 4 of the Processing Site RAP contain conflicting cobbles-to-fines data. Since the data presented in Attachment 1, Calc. 17-730-03-02, is the current data set, the data in Attachment 4 is not required and will be removed.

Instructions:

- Remove the data set titled, "Cobbles-to-Fines Test Pit Analysis" from Processing Site RAS, Attachment 4.
- Remove Sheet 7, Table 1 of Calc. No. 17-730-03-02, "Cobbles To Fines Analysis" in Attachment 1 of Processing Site RAP..
- Insert revised Sheet 7, Table 1 of Calc. No. 17-730-03-02, "Cobbles To Fines Analysis" in Attachment 1 of Processing Site RAP.

8. Incomplete Historical Information and Missing Evaluation in Attachment 4

Comment: The section labeled "Cobbles-to-Fine Test Pit Analysis" in Attachment 4 (Processing Site) contains a table of uranium and radium data from the cobbles-to-fines test pits. This data sheet was also provided to the NRC in 1996 as part of a response to Issue 19 regarding the characterization of uranium and Th-230. However, DOE's evaluation of the data was not provided. Based on its review, the NRC staff determined the data demonstrates that tailings material exists at 6 to 9 feet deep, or that the in-situ mineralized material is not in equilibrium. Additionally, Appendix B of the "Cobbles-to-Fine Test Pit Analysis" section contains data (see Sheet B-9) showing Th-230 concentrations from the test pits; however, there is no indication of the sample depth or the corresponding Ra-226 value.

Response: Since Attachment 1, Calculation 17-730-03-02 and as additional information in Attachment 4 contain conflicting cobbles-to-fine data, the data set titled, "Cobbles-to-Fines Test Pit Analysis" was removed from Attachment 4 of the Processing Site RAS. See response to NRC Comment #7.

Using the 4:1 Ra-226 to U-238 ratio, the uranium data provided at the front of Attachment 4 indicates that tailings materials occur from 6 to 9 feet in depth. However, site geology does not indicate the existence of naturally occurring ore materials on the processing site.

Since little is known about the location of the site of the various crushing, roasting, or quenching processes, the Remedial Action Contractor randomly located test pits across the mill site and adjacent vicinity properties for soil extraction and radioactive characterization. Other than the location of the two remaining roasters, there was no site process history used in the selection test pit locations. During remediation of the processing site, remnants of the past milling operation were discovered and properly removed.

In order to provide adequate characterization of uranium at the processing site, an uranium sampling protocol was established prior to remediation. The sampling protocol required 10% sampling in all mill yard and subpile areas. If elevated uranium was found in the absence of elevated Ra-226, 100% of the surrounding grid locations were sampled for uranium. This sampling protocol ensured that no large areas of uranium contamination would be overlooked.

Attachment 1, Calculation 17-730-03-02, Sheets B-4 through B-9, provide laboratory results for Th-230 sampling of the test pits. The Th-230 concentrations, depth and corresponding Ra-226 concentrations are provided in the test pit logs (Attachment 1, Calculation 17-730-03-02, Sheets A-1 through A-34). The test pit data along with Bendix characterization data indicated that Th-230 was not out of equilibrium with Ra-226 at the Naturita site. Therefore, only 10% of all processing site samples were analyzed for Th-230.

Instructions:

- None.

9. Incomplete Data and Missing Supplemental Standard Application

Comment: The section labeled "Radiological Data Collected During Excavation of Uranium Under Former Mill Site" in Attachment 4 (Processing Site) consists of a DOE trip report, dated July 28, 1997, that includes some analytical data indicating Area 2 was excavated to the water table; however, elevated uranium levels were still present. Additional testing is recommended in the report. Mention is also made in the report where State of Colorado staff feel that adapting the generic thorium protocol for uranium is inadequate.

Response: The commitment to develop a supplemental standard for uranium contained in Section 6 of the RAS did not indicate that the information would be included in the RAP. The supplemental standards for uranium at the Naturita processing site will be submitted in the Naturita Site Completion Report, which will be provided to the NRC following approval of the RAP. Submission of supplemental standards information in this manner will expedite the RAP approval process so that the completion report can be submitted to the NRC as scheduled. Also, the adoption of the thorium protocol for uranium can be found in Attachment 4, "RAC-OP-007, Uranium Cleanup and Verification at Naturita".

Instructions:

- Remove Processing Site RAS pages 1-5, and 6-5 through 6-8.
- Insert new Processing Site RAS pages 1-5, and 6-5 through 6-8. Changes made to DOE's commitment to provide supplemental standards applications with the completion report instead of the RAP.

10. Calculation 17-730-01-02 (Excavation Extent & Depth, Volume, Ra-226) in Attachment 1

Comment: Appendix D of Attachment 1 (Processing Site) contains estimated Ra-226 concentrations for windblown Areas F and G. However, there are elevated levels (32 to 213 pCi/g) at depths of 12 to 42 inches. Based on these depths, this does not appear to be windblown.

Response: The data contained in the Processing Site RAP, Appendix D, Attachment 1 was from a vicinity property Remedial Surveillance Assessment (RSA) report which provides an estimate of the extent, depth and volume of contamination for contracting purposes. The area is called a windblown area because the material was assumed to be primarily windblown contamination. However, other mechanisms of contamination distribution may have been in effect. The depth of contamination was fully characterized to the extent possible using the standard field boring equipment. However, circumstances (such as buried rock, sloughing materials, etc.) may limit the depth at which samples may be collected. The RSA provides an estimated depth only and does not provide absolute determination of depth of contamination. During remediation, excavation control is used to establish actual depth of contamination.

Instructions:

- None.

11. Calculation 17-730-02-04 (Proposed Supplemental Standards Areas) in Attachment 1

Comment: The summary of proposed areas for Supplemental Standards is on Sheets 2 and 3 in Attachment 1 (Processing Site). Comparison to the previous version of this calculation indicates that windblown Area B is no longer mentioned.

Response: Windblown area B, steep slopes along the highway, is now part of VP NT-058 (right-of-way for State Highway 141). The impacts of Supplemental Standards on this area will be discussed in the completion report for this vicinity property.

Instructions:

- None.

12. Conflicting Supplemental Standards Information in Attachments 1 and 4

Comment: The proposed Supplemental Standards area (Processing Site) for vicinity property (VP) NT-065 on sheet 16 of Attachment 1 (Calc. 17-730-02-03) do not match the same Supplemental Standards area delineated on the map in Attachment 4. It is not clear which map is correct.

Response: The map in Attachment 4 shows the approximate final supplemental standards areas after much of the cleanup has been done. The sketch on Sheet 16 of Attachment 1 shows the original design calculation with some interim revisions. The map in Attachment 4 should be removed so the RAP more accurately reflects the conditions at the time the cleanup was initiated or planned.

Instructions:

- Remove information set, "Supplemental Standards Areas for Naturita Processing Site and Surrounding Vicinity Properties," located in Attachment 4 (Processing Site).

13. Missing Supplemental Standards Information in Attachment 4

Comment: The section labeled "Supplemental Standards Areas for Naturita Processing Site and Surrounding Vicinity Properties" in Attachment 4 (Processing Site) contains a map indicating areas proposed for Supplemental Standards – one of which includes a small area around power poles near the gas line within the former tailings area. The associated calculation does not address this area.

Response: The area around the power poles was found during remediation and was not part of the original plan (RAP). The calculations and discussion of this area will appear in the Completion Report. Deletion of the map in Attachment 4 will lessen the confusion.

Instructions:

- Remove information set, "Supplemental Standards Areas for Naturita Processing Site and Surrounding Vicinity Properties," located in Attachment 4 (Processing Site). (Same instructions as NRC Comment #12.)

14. Missing Supplemental Standards Information in Attachment 1

Comment: In Appendix C of Attachment 1 (Processing Site), Sheets C-17 and C-20 indicate that VP NT-065 Areas E and G contain windblown contamination that averages 111 and 46 pCi/g Ra-226, respectively. Additional Ra-226 data for Areas E, F, and G are in Calculation 17-730-01-02, which indicates contamination extends to 42 inches in depth or beyond.

Response: Information on Areas E and G will appear in the Completion Report for Vicinity Property NT-065.

Instructions:

- None.

15. Missing and Conflicting Supplemental Standards Information in Attachment 1

Comment: Sheets 9 and 10 of Attachment 1 (Processing Site) indicate that Supplemental Standards are proposed within 5 feet of the gas line in Area E. Area E appears to be part of VP NT-065, but the gas line is not listed under this property. Also, Sheet B-21 of Appendix B indicates that there will be no excavation within 10 feet of the gas line. In contrast, Sheet F-2 of Appendix F (phone record dated November 11, 1992) indicates that excavation must be by hand 3 feet on either side of the line.

Response: The gas line is in Area E but is a separate vicinity property. The discussion on Sheets 9 and 10 is dated September 1997 which supersedes the previous citation on Sheet B-21, dated October 1996. The earlier telephone record of 1992 was superseded by the two above. The gas line will be discussed in the NT-065 VP completion report.

Instructions:

- None.

16. Missing and Conflicting Data in the RAS and Attachment 4

Comment: Table 1.1 of the RAS (Disposal Site) lists contaminated material types and volumes at the Naturita site. The section labeled "Site-Specific Hazardous Constituents" in Attachment 4 (Processing Site) provides a more comprehensive list of hazardous materials at the Naturita site. There appears to be a discrepancy in volume amounts for some hazardous constituents between the two sections of the RAP. Also, DOE has provided little or no discussion in either RAP section as to how disposal of this contaminated material has met regulatory, safety, and environmental requirements.

Response: The Naturita Materials Matrix, Attachment 4, Site Specific Hazardous Constituents, Processing Site RAS, dated 5/10/96, was developed while further characterization of selected materials was in progress. The information listed in Table 1.1, Contaminated Materials Volume at the Naturita Site, Colorado, page 1-4 of the Disposal Site RAS was extracted from the incomplete matrix and the initial characterization performed in May 1989. Attachment 4 and Table 1.1 have been revised.

Revision 7 of the Naturita Materials Matrix lists 72 drums. Fifty-two drums of mixed wastes were placed in the disposal cell. Out of the remaining 20 drums or non-radiologically contaminated wastes, 11 drums were returned to Cyprus Foote for disposal and nine were accepted by chemical recyclers.

The amended Table 1.1 lists 990 gallons of oils, 125 gallons of ignitables, 65 gallons of herbicides, 1400 pounds of batteries, 2595 pounds of corrosives, 2530 pounds of sludges/soils, and 100 pounds of other materials. Additionally, 682 bags or wraps of asbestos and fiber glass are cataloged.

The DOE worked closely with the Remedial Action Contractor and the Colorado Department of Public Health and Environment (administrator of the EPA approved State Environmental Protection Programs) to complete waste characterizations, determine appropriate off-site disposal options for non-radiologically contaminated waste, and identify suitable disposal methods for mixed wastes (in-cell neutralization and encapsulation).

The 15 drums of powders were emptied, spread, and mixed with tailings in a selected, surveyed area of the cell. Due to the low pH of the contents of B55 and B56, the specifications mandated a pH greater than 5 for the blended materials. The contents of the remaining 37 drums were consolidated to fill voids (B69 into B8 and B10), grouted in the drum to fill voids (batteries and oil contaminated soils), or mixed with an absorbent material, overpacked and grouted to fill voids (liquids). The 37 drums were placed two feet apart in trenches in a selected, surveyed area of the cell. Tailings were compacted between and over the drums.

Instructions:

- Remove "Naturita Materials Matrix" from the Site Specific Hazardous Constituents information in the Processing Site RAS, Attachment 4.
- Insert revised "Naturita Materials Matrix" to the Site Specific Hazardous Constituents information in the Processing Site RAS, Attachment 4.

- Remove Table 1.1, Contaminated Materials Volume at the Naturita Site, Colorado, page 1-4, in the Disposal Site RAS.
- Insert revised Table 1.1, Contaminated Materials Volume at the Naturita Site, Colorado, page 1-4, in the Disposal Site RAS.

17. Conflicting Information in Sections 6.2 and 6.4 of RAS

Comment: In Section 6.2 of the RAS (Disposal Site), it is unclear in the fourth paragraph as to what thickness of radon barrier will be placed on the top slope of the disposal cell (Section 6.4 states there will be the same thickness on the top and sides).

Response: The thickness of the radon barrier on the top slope and the side slopes of the repository are both to be placed at 36 inches (0.91 meters). RAP Section 6.2, Design, is changed to read as follows: "A compacted (95 percent Standard Proctor) earthen radon barrier 36 inches (0.91 meters) thick will be placed on both the top slope and the side slopes (see Appendix F, NAT-CALC-010)."

Instructions:

- Remove page 6-1, Section 6.2., Disposal Site RAS.
- Insert new page 6.1, Disposal Site RAS.

18. Incorrect References in Sections 6.3 and 7.0 of the RAS

Comment: In Section 6.3 of the RAS (Disposal Site), the second line indicates the wrong reference for the RADON code. It should appropriately reference "NRC 1989." Also, Section 7.0 of the RAS should be revised to replace the NRC 1984 reference with "Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers," NRC Regulatory Guide 3.64, July 1989. The 1984 document discusses the RAECOM code.

Response: The correct reference will be cited. RAP Section 6.3, Radon Barrier Parameters, second line of first sentence has been changed to read: "NRC 1989". And RAP Section 7.0, References, the tenth reference has been changed to read: "U.S. Nuclear Regulatory Commission (NRC), 1989, *Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers*, NRC Regulatory Guide 3.64, 1989."

Instructions:

- Page 6-2 of Section 6.0, was replaced as part of response to NRC Comment #4..
- Remove page 7-2 of Section 7.0.
- Insert new page 7-2.

19. Inconsistent Radon Attenuation Data

Comment: In Section 6.3 of the RAS (Disposal Site), the last sentence indicates that radon flux code input parameters are presented in Appendix F, NAT-CALC-010. However, Section 6.3.4 presents densities and specific gravity input values for the former tailings pile area and the windblown material that don't match the values used in NAT-CALC-010.

Response: RAP Section 6.3.4 is revised to reference the table titled, "Summary of Input Parameters for "RADON" Model presented as page 5 of NAT-CALC-010, Rev. 3." The two paragraphs in RAP Section 6.3.4, Dry Densities and Porosities, are deleted and replaced with the following paragraph: "The dry densities and porosities for the earthen radon barrier and various types of contaminated materials were determined using Standard tests and procedures assuming a design compaction of 95 and 90 percent, respectively, in accordance with ASTM D 698. Material properties used for the Radon diffusion-modeling calculations are presented in the table titled, "Summary of Input Parameters for "RADON" Model, page 5 of Appendix F, NAT-CALC-010, Rev. 3."

Instructions:

- Remove Disposal Site RAS Table of Contents pages ii and iii
- Insert new Table of Contents pages ii and iii to Disposal Site RAS.
- Remove Disposal Site RAS pages 6-4 and 6-5, Section 6.0.
- Insert new pages 6-4 and 6-5, to Disposal Site RAS, Section 6.0.

20. Unreadable Map in Appendix I

Comment: Sheet 10 of RAP Appendix I (Disposal Site) is a Xerox copy of a folded map. The copy of this map is unreadable in this state.

Response: A full size map is provided.

Instructions:

- Remove folded copy of Appendix I, Sheet 10 from Disposal Site, Appendix I.
- Insert new full size copy of Appendix I, Sheet 10 to Disposal Site, Appendix I.

II. COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT STAFF REVIEW COMMENTS

1. Part A, RAS Report, Section 1.2, Remedial Action

Comment: Part A Remedial Action Selection Report, Section 1.2, "Remedial Action," page 1-7, 2nd paragraph. "After the removal of contaminated materials, the excavated areas in and around the Naturita processing site will be restored by placing fill, grading, seeding, and restoration of a Blessing Ditch bench as shown in Figure 1.4." There is no Figure 1.4, please provide this figure.

Response: There is no need to include a new figure in the RAS report showing the final, negotiated grade elevation at the processing site. The original plan is included in the as-built drawing NAT-PS-10-1755, Final Grading Plan and Site Restoration, located in Appendix G – Construction Documents. The final plan was not agreed upon until July 1998 and will be included in the Completion Report. The reference to Figure 1.4 is deleted.

Instructions:

- Remove Processing Site RAS page 1-7.
- Insert new Processing Site RAS page 1-7.

2. Part A, Naturita Processing Site, Attachment 1 Calculations, Calculation No. 17-730-02-04, Proposed Supplemental Standards Areas

Comment: In this section for supplemental standards areas, there appears to be several areas that are not included. They are 1) the area around the power poles, 2) the area along the San Miguel River on the mill site, and 3) the uranium lenses area. Please provide these additional changes.

Response: The areas identified are areas which were found to be contaminated to a degree which was not feasibly able to be remediated. These areas were identified late in the remedial activity and their disposition will be described in the Completion Report. It is only because the RAP is being revised and reviewed out of the normal time phase that information on such areas is available at this time. If the RAP had been prepared prior to remediation, the existence of these areas would not have been known and, therefore, not discussed at this time.

Instructions:

- None.

3. Appendix B, Attachment 4, Supplemental Information, "Radiological Data Collected Along Gas Pipeline"

Comment: The soil sample data sheets provide data for thirteen grids for what appears to be a possible thirty four grids to totally represent the full length of the gas line. Please provide the following additional soil sample grids. D-22-17, D-22-12, D-22-7, D-22-6, D-22-1, D-21-5, D-13-25, D-13-24, D-13-20, D-13-19, D-13-14, D-13-13, D-13-8, D-13-7, D-13-3, D-13-2, D-5-22, D-5-21, D-5-16, D-5-15, and D-5-11.

Response: These samples were apparently taken near the end of the pipeline adjacent to the pressure station. They were also in the area considered to be part of the main process site while the area further down the pipeline corridor was in the vicinity property belonging to Cypress Foote. As a part of this vicinity property, it will be discussed in the Completion Report for the vicinity property.

Instructions:

- None.

4. Part B, Remedial Action Plan for Uravan Site, Section 5.3.3, Appendix C, Water Resource Protection Strategy, Section 3.1.3

Comment: Both have "Point of Compliance" sections. The paragraphs read "Wingate well CM93-2 is designated as the POC for the proposed Upper Burbank disposal site. This well is immediately downgradient of the disposal cell as shown on Figure 1.1 in Appendix B." In reviewing Appendix B, there is no Figure 1.1 depicting this POC well, please correct this sentence or provide the appropriate figure.

Response: The correct Appendix B reference is Figure 3.13. The second sentence of RAP Section 5.3.3 is changed to read as follows: "The well is immediately down gradient of the disposal cell as shown on Figure 3.13 in Appendix B."

Instructions:

- Remove RAP page 5-8, Section 5.0.
- Insert new RAP page 5-8, Section 5.0.

5. Part B, Remedial Action Plan for Uravan Site, Section 5.6

Comment: In 1st sentence there is a typo error. "The DOE is required by the EPA groundwater standards in 40 CRP," this should be changed to CFR.

Response: The typographic error is corrected.

Instructions:

- Remove RAP page 5-9 of Section 5.0.
- Insert new RAP page 5-9, Section 5.0.

6. Appendix B, Groundwater Hydrology Report, Section 3.0, Disposal Site Characterization

Comment: In reviewing this section, there are two pages missing. They are B3-9 and B3-15, please provide these pages. (In talking to Wendy Naugle, she had these pages, but they were out of order.)

Response: The referenced pages are provided.

Instructions:

- Insert attached pages B3-9 and B3-15 in Appendix B.

7. Appendix C, Water Resources Protection Strategy, Section 3.2.1, Figure 3.1

Comment: The calculations for the Upper Kayenta ft/year (0.124) and cm/sec (1.3×10^{-7}) and Wingate Formation ft/year (43) and cm/sec (1.2×10^{-7}). It appears the value for ft/sec is incorrect for the Wingate Formation.

Response: The correct hydraulic conductivity for the Wingate Formation expressed in units of cm/sec is 4.2×10^{-5} cm/sec. The hydraulic conductivity for the Wingate Formation, expressed in units of cm/sec has been changed from 1.2×10^{-7} to 4.2×10^{-5} on Figure 3.1 of Appendix C.

Instructions:

- Remove Appendix C, Figure 3.1, page C3-7.
- Insert new Appendix C, Figure 3.1, page C3-7.

8. Appendix H, Modifications During Construction

Comment: Appendix H contains all of the "Modifications During Construction" which, for this project, were divided into separate types of modifications – the traditional Project Interface Documents (PIDs) and Construction Resolution Revisions (CRRs). PIDs are typically classified as to the degree of modification and if the modification is significant, it is classified as Class I and NRC and CDPHE approval is required. It is unclear why the CRRs were not similarly classified and it is also unclear if NRC approval was granted. (CDPHE approval was not requested routinely.) The RAP should clarify what approvals were required and the status of those approvals.

Response: CRRs are revisions applying only to the disposal cell and were identified as such in order to differentiate them from the traditional PIDs. They were classified similarly to PIDs in that all CRRs having criteria changes which impacted the design of the disposal cell were required to be approved by the DOE and were marked accordingly on the form. It is the option of the DOE to pass these CRRs and PIDs on to the NRC and state of Colorado for concurrence. This again points out a problem with this particular RAP in that the CRRs and PIDs have been listed. Normally, those PIDs having impact on the cell design (Class I) are described in the completion report. Construction modifications to the design are usually unknown at this stage of the Project and would not be discussed until later in the completion report. Those CRRs and PIDs having impact on the cell design at Naturita will be fully described in the completion report.

Instructions:

- None.

Naturita Remedial Action Plan

Additional Instructions to Update Naturita Processing Site Remedial Action Selection Report

1. Replace cover pages: change made to the date of this document.
2. Replace Table of Contents, page ii, changes made to list of items contained in Attachment 4.
3. Replace page iv: correction made to definition for $\text{pCi/m}^2\text{s}$.
4. Replace page v: update on change history.
5. Page 1-7, RAS Introduction was replaced at CDPHE Comment #1: New information on page 1-7 is the Attachment 4 scope added to paragraph 1.3 "Scope and Content".
6. Replace page 3-6: updates section 3.3.2, paragraph 1, sentence 1: updates verb tense of sentence.
7. Replace page 7-1: updates list of contributors.

Table 3.1 Hazardous Constituents and Concentration Limits for Disposal at the Upper Burbank Site, Uravan, Colorado

Constituent	Concentration Limit ^a
Aluminum	0.1 (background)
Antimony	0.1 (background)
Arsenic	0.05 (MCL)
Barium	1.0 (MCL)
Beryllium	0.05 (background)
Cadmium	0.01 (MCL)
Chromium	0.05 (MCL)
Copper	0.02 (background)
Cyanide	0.01 (background)
Fluoride	5.9 (background) ^c
Gross alpha ^b	44.7 pCi/L (background) ^c
Lead	0.05 (MCL)
Mercury	0.002 (MCL)
Molybdenum	0.1 (MCL)
Nickel	0.05 (background)
Nitrate (as N)	10 (MCL)
Radium-226 and -228	5.0 pCi/L (MCL)
Selenium	0.01 (MCL)
Silver	0.05 (MCL)
Strontium	0.1 (background) ^d
Thallium	0.01 (background)
Tin	0.005 (background) ^d
Uranium	0.044 (MCL)
Vanadium	0.05 (background)
Zinc	15.5 (background) ^c

- a) In milligrams per liter, unless otherwise designated; pCi/L = picocuries per liter. Background is statistical maximum at 97.5 percent confidence or the laboratory detection limit. Background concentrations derived from Wingate wells CM93-1 and CM93-2.
- b) Excludes radon and uranium.
- c) Exceeds MCL naturally.
- d) Concentration limits for strontium and tin will be determined during routine sampling of CM93-1 and CM93-2 during long-term site surveillance activities.

6.0 RADON ATTENUATION AND SITE CLEANUP

6.1 INTRODUCTION

This section summarizes the radiation survey plan with respect to reasonable assurance that compliance with EPA standards outlined in 40 CFR Part 192 will be achieved. Parametric data for contaminated material is also provided for the contingency of performing radon flux calculations as needed.

6.2 MATERIAL CHARACTERIZATION DATA

The proposed remedial action will remove contaminated materials from the former tailings pile, mill yard, and ore storage areas along with an estimated 8000 cubic yards (6100 cubic meters) of contaminated demolition debris from the office building, 11 other site structures, and a large quantity of on-site scrap metal and milling equipment within the designated Naturita site boundary. Windblown and waterborne material distributed over adjacent vicinity properties, as well as approximately 300 cubic yards (230 cubic meters) of contaminated material from remote vicinity properties in the Naturita community, will also be included in cleanup.

The EPA has determined that the primary health risk associated with these materials is radon. Any final disposal plans may need to consider some form of engineered radon barrier. Radon barrier design parameter data and support calculations have been developed to facilitate use of the RAECOM model (NRC, 1984) to determine the cover thickness necessary to control radon flux. Radon barrier thickness may be determined based on methods specified in the TAD (DOE, 1989).

Specific parameters discussed include 1) long-term moisture content, 2) radon diffusion coefficient, 3) radon emanations, 4) dry density, 5) specific gravity, 6) porosity, 7) layer thickness, and 8) average radium-226 concentrations.

6.2.1 Long-term moisture

The average long-term moisture content for the contaminated material was determined by sample testing to assess minus 15 bar capillary moisture content. In general, the average value obtained from a series of individual sample tests was selected to characterize the media.

Separate sample sets were tested for the former tailings area (eight samples) and the mill yard (three samples) to determine their respective long-term moisture contents. Minus 15 bar moisture measurements of radiologically contaminated material from the former tailings pile area (five samples) averaged 5.89 percent by weight for radiologically contaminated material. On the other hand, similar tests of three samples of uncontaminated soil from the former tailings pile area yielded values of 10.48, 7.48, and 4.22 percent by weight and averaged 7.39. The minus 15 bar value of 5.89 percent by weight was conservatively selected for the former tailings pile subsoil.

Similar testing of mill yard materials yielded the average value of 13 percent moisture content by weight was selected as representative of the mill yard materials.

Capillary moisture testing of the windblown, vicinity property, and ore storage soils was not performed. Since the geotechnical properties of these materials are similar to those of the tested mill yard soils, a value of 13 percent by weight was also assumed for the windblown, vicinity property, and ore storage materials.

6.2.2 Radon diffusion

Average radon diffusion coefficients for contaminated mill yard, ore storage, and off-site material (windblown areas) were determined using a single soil sample from each contaminated area. Radon diffusion for each type of material was measured in the laboratory as a function of moisture content ranging from 3.5 to 20 percent by weight. For each soil sample, approximately five diffusion measurements were made, each at a different moisture content within the moisture content range. Test results for contaminated material were plotted and a best fit curve was obtained for each material category using a least squares methodology. Diffusion coefficients of 0.017, 0.019, and 0.018 square centimeters per second were estimated for the contaminated material to be excavated from the mill yard, ore storage, and windblown areas, respectively. Each diffusion coefficient value selected corresponds to the individual estimated long-term moisture content of 13 percent by weight for the subarea's material, or 43 and 37 percent saturation for the combined mill yard/ore storage layer and windblown material, respectively. Considering the diffusion coefficient measurements of the mill yard and ore storage soil samples as independent samples of the combined mill yard/ore storage layer, the average diffusion coefficient for the layer is the arithmetic mean of the values obtained at the 43 percent saturation, or 0.018 square centimeters per second. Since the diffusion coefficient measurements of contaminated materials from the former pile area were not made as a function of moisture, it was assumed that the diffusion coefficients could be estimated using their empirical derived dependence on moisture (NRC, 1984). A value of 0.0297 square centimeters per second was chosen for the former tailings pile material at a 5.10 percent long-term moisture content. This value was compared with diffusion coefficient measurements, at the 5.10 percent moisture content, for mill yard and ore storage soils and was shown to be conservative relative to assuming that the former mill tailings foundation soil could be represented by either of the two materials.

6.2.3 Radon emanation

Twelve standard measurements of radon emanation for contaminated materials from the mill yard, ore storage, and windblown areas ranged from 0.06 to 0.35. In general, radon emanation has been shown to be statistically independent of both moisture and radium-226 concentrations using standard regression and statistical analysis.

Average emanation factors of 0.34, 0.10, and 0.22 were calculated from four measurements made on a sample of contaminated material from the mill yard, ore storage, and windblown areas, respectively, with corresponding standard error of

frost protection layer, and rock riprap layer all contribute to the attenuation of radon movement and reduction of surface radon flux in order to meet the EPA standards.

However, only the radon barrier was considered in the radon diffusion calculations for conservatively determining its required thickness. The other components provide added assurance that the cover design will comply with EPA standards.

6.3 Radon Barrier Parameters

Radon barrier design parameters and support calculations were used in conjunction with the RADON model (NRC, 1989) to determine the cover thickness necessary to control radon flux to meet the EPA standard of 20 picocuries per square meter per second. The radon barrier thickness was determined based on methods specified in the TAD (DOE, 1989).

Specific parameters include (1) long-term moisture content, (2) radon diffusion coefficient, (3) radon emanation coefficient, (4) dry density, (5) specific gravity, (6) porosity, (7) layer thickness, and (8) radium-226 content. The RADON input parameters for the Naturita materials are presented in Appendix F, NAT-CALC-010.

6.3.1 Long-term Moisture

The average long-term moisture contents for the earthen radon barrier soils were determined by laboratory testing and compared to in-situ moisture contents from test pits.

Separate sample sets were tested for the former tailings area (eight samples) and the mill yard (three samples) to determine their respective long-term moisture contents. Minus 15 bar moisture measurements of radiologically contaminated material from the former tailings pile area (five samples) averaged 5.89 percent by weight for radiologically contaminated material. On the other hand, similar tests of three samples of uncontaminated soil from the former tailings pile area yielded values of 10.48, 7.48, and 4.22 percent by weight and averaged 7.39. The minus 15 bar value of 5.89 percent by weight was conservatively selected for the former tailings pile subsoil (NAT-CALC-010).

Similar testing of mill yard materials averaged 13 percent moisture content by weight and was selected as representative of the mill yard materials.

Capillary moisture testing of the windblown, vicinity property, and ore storage soils was not performed. Since the geotechnical properties of these materials are similar to those of the tested mill yard soils, a value of 13 percent by weight was also assumed for the windblown, vicinity property, and ore storage materials.

6.3.2 Radon Diffusion

A radon diffusion coefficient of $0.0029 \text{ cm}^2/\text{sec}$ was used for the radon barrier soils. This value is conservative when compared to a computed value of $0.0007 \text{ cm}^2/\text{sec}$ for this material. The diffusion coefficient used to evaluate exit flux represents the average of five diffusion measurements made on the proposed clay borrow materials.

Average radon diffusion coefficients for the contaminated mill yard, ore storage, and off-site material (windblown areas) were determined using eight different cover soil samples and a single soil sample from each contaminated area. Radon diffusion for each type of material was measured in the laboratory as a function of moisture content ranging from 3.5 to 20 percent by weight. For each soil sample, approximately five diffusion measurements were made, each at a different moisture content within the moisture content range. Test results for cover and contaminated material were separately plotted and a best fit curve was obtained for each material category using a least squares methodology. Diffusion coefficients of 0.017, 0.019, and 0.018 square centimeters per second were estimated for the contaminated material to be excavated from the mill yard, ore storage, and windblown areas, respectively. Each diffusion coefficient value selected corresponds to the individual estimated long-term moisture content of 13 percent by weight for the subarea's material, or 43 and 37 percent saturation for the combined mill yard/ore storage layer and windblown material, respectively. Considering the diffusion coefficient measurements of the mill yard and ore storage soil samples as independent samples of the combined mill yard/ore storage layer, the average diffusion coefficient for the layer is the arithmetic mean of the values obtained at the 43 percent saturation, or 0.018 square centimeters per second. Since the diffusion coefficient measurements of contaminated materials from the former pile area were not made as a function of moisture, it was assumed that the diffusion coefficients could be estimated using their empirical derived dependence on moisture (NRC, 1984). A value of 0.0297 square centimeters per second was chosen for the former tailings pile material at a 5.10 percent long-term moisture content. This value was compared with diffusion coefficient measurements, at the 5.10 percent moisture content, for mill yard and ore storage soils and was shown to be conservative relative to assuming that the former mill tailings foundation soil could be represented by either of the two materials.

6.3.3 Radon Emanation

Twelve standard measurements of radon emanation for contaminated materials from the mill yard, ore storage, and windblown areas ranged from 0.06 to 0.35. In general, radon emanation has been shown to be statistically independent of both moisture and radium-226 concentrations using standard regression and statistical analysis.

Average emanation factors of 0.34, 0.10, and 0.22 were calculated from four measurements made on a sample of contaminated material from the mill yard, storage, and windblown areas, respectively, with corresponding standard of the means of 0.01, 0.02, and 0.01. Since the mill yard, ore storage, and vicinity property materials and demolition debris are to be combined as a single mixed layer at the base of the disposal cell (see Section 6.3.5, Layer Thickness), the volume weighted average emanation factor for the mill yard and ore

the means of 0.01, 0.02, and 0.01. No emanation measurements were performed on the former tailings pile material; the volume-weighted average emanation factor of 0.33 for the mill yard and ore storage area is assumed to be representative of this material.

6.2.4 Dry densities and porosities

The dry densities, specific gravities, and porosities for the various types of contaminated material were determined using standard tests and procedures and assuming a design compaction of 95 and 90 percent, respectively, in accordance with ASTM D698.

Eleven maximum dry density and five specific gravity measurements of material from contaminated areas ranged from 1.20 to 2.09 grams per cubic centimeter and 2.51 to 2.80, respectively. The respective average compacted density in grams per cubic centimeter (90 percent compaction) and specific gravity for each contaminated area were 1.73 and 2.70 for the former tailings area (five samples measured for density only), 1.49 and 2.71 (three samples) for the mill yard and 1.47 and 2.51 for the ore storage area (one sample), and 1.44 and 2.76 for the windblown area. Since no specific gravity measurements were made on the soils from the former tailings pile area, the average 2.70 value calculated for the mill yard was assumed to be representative of this material. An average dry density and specific gravity of 1.47 grams per cubic centimeter and 2.60 were assumed for the vicinity property material, and corresponding values of 2.40 grams per cubic centimeter and 3.00 were used for demolition debris. On this basis, estimated porosities for contaminated soils from the former pile, mill yard, ore storage, and windblown areas were 0.36, 0.45, 0.41, and 0.48, respectively.

6.2.5 Layer thickness

Based upon volumes of the various types of contaminated materials, layer thicknesses may be determined as necessary for radon barrier calculations. These values, of course, will depend upon final material disposition.

6.2.6 Radium-226 concentrations

Average radium-226 concentrations were estimated for each contaminated subarea of the Naturita site based on an assessment of radiometric measurements (hand-held and borehole gamma logs) and radiochemical and gamma spectroscopic measurements of contaminated material collected from surface soil samples, test pits, and boreholes constructed within the subareas. The division of the site into subareas is shown in Figure 1.3. Incremental radium-226 depth profiles were constructed at each measurement grid point within a subarea. The average radium-226 concentration for the subarea was determined by integrating the profiles over the volume contained between the topographical surfaces defining the ground surface and the excavation depth required to comply with EPA cleanup standards. Estimated design volumes, areas, and average radium-226 concentrations for contaminated materials at the Naturita site are shown in Table 1.1.

6.2.7 Ambient radon concentration

An ambient radon concentration in air of 2.3 picocuries per liter was obtained from background air samples collected for 24 hours in the vicinity of the Naturita processing site using continuous radon samplers (FBDU, 1981). However, recent pre-remedial action radon monitoring at a distant background location for four quarters (April 25, 1989, through March 12, 1990) using integrating Track-Etch® detectors indicates that an ambient radon concentration of 0.6 picocuries per liter would be more appropriate (DOE, 1990b) for RAECOM calculations.

6.3 EVALUATION OF RADON BARRIER

(Refer to Disposal Site RAS section 6.4, page 6-5.)

6.4 SITE CLEANUP

Extensive field sampling and radiological surveys, including the cobbles-to-fines study, have been conducted by a number of investigators to determine the extent and degree of contamination at the Naturita processing site. The distribution of contaminated materials as a function of excavation depths is shown in Figure 1.3.

6.4.1 Radiological site characterization

Details of site characterization data are presented in Calculation 17-730-01-02 (*Contaminated Material Excavation-Excavation Extent and Depth, Volume and Radium-226 Concentration*) in Attachment 1. Measurements of background radioactivity near the Naturita site and measurements of existing radiological site conditions are summarized in Table 6.1.

Approximately 771,400 cubic yards (589,820 cubic meters) of contaminated materials cover 115.2 acres (47.5 hectares) at the Naturita processing site and immediately adjacent vicinity properties, including approximately 21,820 cubic yards (16,690 cubic meters) of vicinity properties and 240,000 cubic yards (182,400 cubic meters) of contaminated soil thinly dispersed over 166.6 acres (61.4 hectares) in area D west of Highway 141 and partial areas of E, F, and G (Figure 1.3). Estimated design volumes, areas, and average radium-226 concentrations for the various major contaminated materials are presented in Table 1.1. Depths of contamination range from 1.0 foot (0.30 meter) for windblown areas on the east bank of the San Miguel River to approximately 14.1 feet (4.3 meters) in the mill yard, with a volume-weighted average depth of contamination of approximately 4.0 feet (1.2 meter). The radium-226 contamination on the site and vicinity properties ranges from 8 to 3300 picocuries per gram, and has a volume-weighted average of approximately 90 picocuries per gram.

Characterization data to date have not indicated potential for preferentially mobilized thorium-230 at the site. Further investigations to characterize the potential for thorium-230 mobility have been performed in conjunction with test pitting to determine cobbly soil characteristics (described in Attachment 4). Three locations of elevated natural uranium have been identified and could have been caused by varied activities (e.g., ore spillage during hauling days). Additional

**URANIUM CLEANUP AND VERIFICATION AT NATURITA
(RAC-OP-007)**

**SOIL VERIFICATION USING COBBLES-TO-FINES CORRECTION
(OP-003-4)**

Rev.

sh. 7

PYL 10/14/96

WYL 10/14/96

TABLE 1

**COMPARISON OF DEPTH OF CONTAMINATION WITH
EXCAVATION DEPTH ACCORDING TO CURRENT EXCAVATION PLAN**

TEST PIT NO.	DEPTH OF CONTAMINATION (ft)	EXCAVATION DEPTH ACCORDING TO CURRENT EXCAVATION PLAN (ft)	DIFFERENCE IN DEPTH (Depth of Contamination - Excavation depth) (ft)
CF-1	0	2	-2
CF-2	5	5	0
CF-3	0 (with 6" topsoil backfill)	2	-2 (with 6" topsoil backfill)
	2 (without 6" topsoil backfill)	2	0 (without 6" topsoil backfill)
CF-4	1	2	-1
CF-5	0 (with 6" topsoil backfill)	3	-3 (with 6" topsoil backfill)
	2 (without 6" topsoil backfill)	3	-1 (without 6" topsoil backfill)
CF-6	8	5	3
CF-7	3	2	1
CF-8	4	8.5	-4.5
CF-9	0	1	-1
CF-10	3	3	0
CF-11	9 (with 6" topsoil backfill)	5	4 (with 6" topsoil backfill)
	10 (without 6" topsoil backfill)	5	5 (without 6" topsoil backfill)
CF-12	2 (with 6" topsoil backfill)	10	-8 (with 6" topsoil backfill)
	3 (without 6" topsoil backfill)	10	-7 (without 6" topsoil backfill)
CF-13	0	1	-1
CF-14	1	2	-1
CF-15	0	2	-2
CF-16	7	8.5	-1.5
CF-17	0	5	-5
	3	5	-2
CF-18	4.5 (with 6" topsoil backfill)	5	-0.5 (with 6" topsoil backfill)
	5.5 (without 6" topsoil backfill)	5	0.5 (without 6" topsoil backfill)
CF-19	5	8.5	-3.5
CF-19A	8 (with 6" topsoil backfill)	5	3 (with 6" topsoil backfill)
	10 (without 6" topsoil backfill)	5	5 (without 6" topsoil backfill)
CF-20	4	1	3
CF-21	0	0	0
CF-22	4	1	3
CF-23	0	0.5	-0.5
CF-24	4	3	1
CF-25	6	5	1
CF-26	4 (with 6" topsoil backfill)	3	1 (with 6" topsoil backfill)
	8 (without 6" topsoil backfill)	3	5 (without 6" topsoil backfill)
CF-27	2 (with 6" topsoil backfill)	3	-1 (with 6" topsoil backfill)
	3 (without 6" topsoil backfill)	3	0 (without 6" topsoil backfill)
CF-28	0 (with 6" topsoil backfill)	5	-5 (with 6" topsoil backfill)
	4 (without 6" topsoil backfill)	5	-1 (without 6" topsoil backfill)
CF-29	2 (with 6" topsoil backfill)	3	-1 (with 6" topsoil backfill)
	4 (without 6" topsoil backfill)	3	1 (without 6" topsoil backfill)
CF-30	4 (with 6" topsoil backfill)	3	1 (with 6" topsoil backfill)
	7 (without 6" topsoil backfill)	3	4 (without 6" topsoil backfill)
AVERAGE			-0.7 (with 6" topsoil backfill) 0.1 (without 6" topsoil backfill)

Table 1.1 Contaminated material volume at the Naturita, Colorado, site

Location ^a	Area acres (hectares)	Volume cubic yards (cubic meters)	Average radium-226 (pCi/g)
Mill yard	13.9 (5.6)	315,520 (241,250)	127
Former ore storage area	3.7 (1.5)	10,340 (7910)	75
Windblown/other material ^b (areas A/B/C and partial areas of E, F, and G)	72.4 (29.3)	209,880 (160,480)	37.4 ^c
Former tailings area	28.2 (11.4)	225,490 (172,410)	90
Demolition debris		10,170 (7780)	
TOTAL	118.2 (47.8)	771,400^d (586,830)	

^aSee Figure 1.3.

^bVolume of proposed supplemental standards area is not included.

^cVolume-weighted average of subareas A/B/C and partial areas of E, F, and G.

^d21,820 cubic yards of contaminated materials from vicinity properties are not included.

pCi/g — picocuries per gram.

40 CFR Part 192 to adjacent windblown areas and portions of the designated processing site where the following justifications are met: cleanup would be costly and difficult because of the steep slopes and rocky terrain; the windblown material does not pose a health risk; major environmental impacts would occur because of cleanup; or workers would be exposed to unsafe conditions. Areas where the use of supplemental standards is being proposed are areas D and F, and partial areas of E and G on Figure 1.3, riverfront wetlands on both banks of the San Miguel River, and an area containing a high-pressure gas pipeline. The applications are being developed, and will be submitted for agency concurrence as part of the Naturita completion report.

FIGURE 1.3
EXTENT OF CONTAMINATION AT THE
NATURITA SITE, COLORADO

Table 6.1 Background radioactivity and radiological conditions at the Naturita, Colorado, site

Parameter	Background data	Site data
Gamma exposure rate		
Range ($\mu\text{R/hr}$)	11.8 - 15.1	8 - 369
Average ($\mu\text{R/hr}$)	13.5	36 ^a
Radon concentration		
Range (pCi/L)	0.4 - 0.6	0.8 - 2.9
Average (pCi/L)	0.5	2.0
Radium-226 concentration		
Range in soil (pCi/g)	0.6 - 5.4	0.5 - 822
Average in soil (pCi/g)	2.1	62.1 ^b
Radon flux		
Range (pCi/m ² s)	N/A	2.4 - 30
Ground water (pCi/L) ^c		
Natural uranium	N/A	5.2 ppm
Radium-226		28.6
Lead-210		13.5

^aArea-weighted average.

^bVolume-weighted average.

^cMaximum on-site concentration from monitor well.

N/A — not available.

pCi/g — picocuries per gram.

pCi/L — picocuries per liter.

pCi/m²s — picocuries per square meter per second.

ppm — parts per million.

$\mu\text{R/hr}$ — microroentgens per hour.

uranium characterization was performed during test pitting to determine cobbly soil characteristics (also described in Attachment 4).

6.4.2 Standards for cleanup

The DOE is committed to removing radiologically contaminated materials from the site and has identified offsite locations such that all EPA standards in 40 CFR Part 192 are met. All disturbed areas on the processing site and vicinity properties will be restored to grade for adequate control of surface drainage. No contaminated materials or buildings are to be released for unrestricted use. All buildings on the site will be demolished, and all contaminated debris and building components will be disposed of in an acceptable manner.

The supplemental standard provisions of 40 CFR Part 192 appropriate to vicinity properties are being considered for application in several areas as described in Calculation 17-730-02-04, *Proposed Supplemental Standards Areas*, of Attachment 1. These areas include steep slopes where conventional cleanup techniques cannot

be employed and where disturbances would likely cause future erosion problems; areas containing protected vegetation, wildlife habitat, or cultural resources; and utility easements such as the high-pressure gas line within Area E. The application for supplemental standards derived from this calculation is included in this RAP report as Appendix A for review and concurrence.

Subsoil conditions in the alluvial floodplain at the Naturita site generally consist of a high percentage of barren cobbles and gravels greater than a number 4 mesh sieve (approximately 75 percent by weight) that are essentially free from radiological contamination. Radiological contamination is associated with the finer fraction passing a number 4 mesh sieve (0.19-inch x 0.19-inch [0.48-centimeter x 0.48-centimeter] openings). Excavation depths currently estimated from available characterization data will remove radium-226 concentrations in the finer fraction to less than 5 and 15 picocuries per gram above background for surface and subsurface soils. However, if radium-226 concentrations exceeding 5 or 15 picocuries per gram in the finer fraction are encountered in soils containing a high percentage of cobbles/gravels during construction, soil cleanup may be based on *bulk* radium-226 concentrations of 5 and 15 picocuries per gram of radium-226 above background calculated from the CTF test pit study. This application of CTF correction shall be in accordance with the NRC's concurrence on the bulk applicability of EPA soil cleanup standards for radionuclides (see Attachment 4 and procedure OP-003-4, "Soil Verification Using Cobbles-to-Fines Correction" (see Attachment 4).

The bulk soil cleanup standards for thorium-230 in 15-centimeter-thick soil layers, averaged over grid areas of 100 square meters, will be determined on a grid-specific basis. Measured residual bulk radium-226 concentrations (less than 5 and 15 picocuries per gram for 15-centimeter surface and subsurface soil layers, respectively) will be used to calculate appropriate excavation depths for bulk thorium-230 removal to ensure that the effective bulk radium-226 concentration in 1000 years (due to the radioactive decay of thorium-230) will not exceed the 5 and 15 picocuries per gram above background soil cleanup standard for bulk radium-226 concentrations. This approach is outlined in the supplemental standard titled the *Generic Protocol for Thorium-230 Cleanup/Verification at UMTRA Project Sites* (see Attachment 4), submitted to the NRC for concurrence and implementation at Naturita and other UMTRA Project sites. Bulk thorium-230 exceeding the supplemental standard limits and encountered below the water table in the saturated zone will be addressed in accordance with the thorium-230 cleanup protocol for contamination in the saturated zone (see Attachment 4).

Uranium concentrations (and mobility, if necessary) in subsoil below the design excavation limits for radium-226 and thorium-230 will be assessed using a pathway analysis approach to evaluate potential environmental, ground water, and public health impacts. The need for additional remedial action for uranium will be based on this analysis and on uranium verification results (see SOP RAC-OP-007, Uranium Cleanup and Verification at Naturita, located in Attachment 4), and any required cleanup criteria will be developed as a supplemental standard under criterion (f) of 40 CFR §192.21 and the provision that residual uranium concentrations will be as low as reasonably achievable. CDPHE and NRC approval for the derived supplemental standard will be sought for implementation.

6.4.3 Verification of cleanup

Excavation control monitoring will be conducted during remedial action to prevent both inadequate underexcavation and costly overexcavation in cleanup to the EPA standards. Verification sampling will ensure that bulk radium-226 concentrations averaged over 15-centimeter depth increments and areas no greater than 100 square meters will meet the 5 picocuries per gram and 15 picocuries per gram above background standards promulgated by the EPA for respective surface and subsurface soils.

Independent radiological surveillances and health/safety audits will be conducted by the DOE and the TAC during remedial action to ensure that all activities are performed to meet federal, state, and local standards and guidelines. Quality control and assurance requirements and procedures are in place to ensure that adequate cleanup and subsequent verification are properly implemented and documented (DOE, 1990a).

Final verification surveys will be performed to document average bulk radium-226 concentrations on all 100-square-meter areas remediated. Residual bulk thorium-230 concentrations will be verified in accordance with the current NRC-approved protocol (supplemental standard) for thorium-230 cleanup and verification (see Attachment 4). Uranium concentration verification will be in accordance with SOP RAC-OP-007. Nine-plug composite surface soil samples will be collected for each 100-square-meter area at the final excavation depth (if above the water table) and analyzed by gamma spectroscopy or radiochemical methods to verify compliance with EPA standards for radium-226 or approved supplemental standards for other radionuclides. For contaminated cobbly soils, an NRC-approved procedure (*Soil Verification Using Cobbles-to-Fines Correction* [see Attachment 4]) will be implemented at the site for bulk radionuclide determination, excavation control, and site verification. A number of test pits have been constructed in the former tailings area, mill yard, and ore storage areas to determine the average mass partition function for the site and its lower 95 percent confidence limit, as well as the average radionuclide concentration (and the upper 95 percent confidence limit) of the large soil size fraction retained on a number 4 mesh sieve (*Statistical Mass Partition Function - Alternative 1 (Test Pits)*, Section 5.4, in the NRC-approved cobbly soil cleanup procedure in Attachment 4). Site verification efforts in cobbly soils may use these site parameters and radiometric measurements for every 100-square-meter grid of the finer soil fraction passing a number 4 mesh sieve to assess bulk radionuclide concentrations. Background bulk radionuclide concentrations will also be determined for three background locations containing cobbly surface/subsurface soils.

In addition, a nine-point composite hand-held instrument gamma measurement technique may be used in windblown-contaminated areas north of the former tailings area. Regression analysis will be used to correlate composite nine-point gamma count-rate measurements per 100-square-meter grid with radium-226 concentration measurements. Accordingly, verification of windblown areas would be based on the mean gamma count rate at the upper 95 percent confidence level corresponding to total radium-226 concentrations for 5 and 15 picocuries per gram for surface and subsurface soil remediation. If the site health physics manager

decides that the nine-point composite gamma measurement technique is appropriate for these areas, a hand-held verification protocol will be developed for site-specific conditions and must be approved by the DOE UMTRA Project Office prior to implementation. The RTRAK® mobile gamma detection unit may also be used for verification of contaminated areas that are too large to sample by hand methods and along the haul road.

6.5 SUMMARY AND CONCLUSION

The DOE has committed to clean up the Naturita processing site and associated vicinity properties in accordance with EPA standards, NRC guidelines, and UMTRA Project health and safety requirements. An application for supplemental standards is being developed to exclude those areas identified in Calculation 17-730-02-04 of Attachment 1 from remedial action. Data have been collected, verified, and analyzed to provide a reasonable preliminary design. Additional characterization and media testing will be performed to provide more representative material and radon diffusion parameters for the former tailings area, mill yard, ore storage, and windblown soils. These additional activities will complement the available database and ensure the fulfillment of the DOE commitment to clean up the site in accordance with the UMTRCA and EPA standards. The final excavation elevations are shown on the final contaminated material excavation plan in Figure 6.1.

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NATURITA MATERIALS MATRIX

Sorted By Barrel Number

BARREL NUMBER	DRUM NUMBER	CONTENTS	VOLUME	UNIT	RCRA	RRM	ASBESTOS	OTHER CONDITIONS	DISPOSAL METHOD
B1	D11	Lube Oil	50	gal	zNA			Mixed w/water	Recycled
B2	D12	Lube Oil	20	gal	zNA			Mixed w/water	Off-site disposal by Cyprus - Foote
B3	D13	Oil	55	gal	zNA	X		Mixed w/water	Encapsulated & placed in cell per spec.
B4	D14	Lube Oil	65	gal	zNA			Mixed w/water	Off-site disposal by Cyprus - Foote
B5	D15	Oil	20	gal	zNA			Mixed w/water	Recycled
B6	D26	Lube Oil	20	gal	zNA	X		Mixed w/water	Encapsulated & placed in cell per spec.
B7	D28/29/30/31	Red Oily Liquid	45	gal	Herbicides				Off-site disposal by Cyprus - Foote
B8	D32	Grease	35	gal	zNA	X			Consolidated w/B69. Placed in cell per specs.
B9	D33/53	Grease	35	gal	zNA	X			Encapsulated & placed in cell per spec.
B10	D34/37	Grease	20	gal	zNA	X			Consolidated w/B69. Placed in cell per specs.
B11	D38	Lube Oil	15	gal	zNA			Mixed w/water	Recycled
B12	D39	Oil	50	gal	Ignitable FP 128F			Mixed w/water	Off-site disposal by Cyprus - Foote
B13	D40	Liquid	45	gal	Ignitable FP 86F			Acetone 5100 ppm Z - Betanone 480 ppm Benzene 83 ppm Toluene 110 ppm	Off-site disposal by Cyprus - Foote
B14	D42	Oil	25	gal	Ignitable FP 128F			Mixed w/water	Off-site disposal by Cyprus - Foote
B15	D43	Red Oily Liquid	20	gal	Herbicides	X			Encapsulated & placed in cell per spec.
B16	D43A	Oil contaminated soil	50	lbs	zNA	X		Soil from around leaky oil drum.	Placed in cell per specifications.
B17	D43B	Oil contaminated soil	350	lbs	Ignitable FP 92F	X			Encapsulated & placed in cell per spec.
B18	D44	Liquid	5	gal	zNA	X		Same as B13.	Evaporated while in storage, placed in cell per spec.
B19	D45	Lube Oil	20	gal	zNA			Mixed w/water	Recycled
B20	D46	Lube Oil	30	gal	zNA			Mixed w/water	Recycled
B21	D46A	Oil	40	gal	zNA			Mixed w/water	Recycled
B22	D47	Lube Oil	50	gal	zNA			Mixed w/water	Recycled
B23	D54	White Powder	300	lbs	zNA	X		pH 10.2	Mixed w/tailings & placed in cell per specs.
B24	D55	White Powder	300	lbs	zNA	X		pH 6.6	Mixed w/tailings & placed in cell per specs.
B25	D56	White Powder	150	lbs	zNA	X		pH 10.0	Mixed w/tailings & placed in cell per specs.

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NATURITA MATERIALS MATRIX

Sorted By Barrel Number

BARREL NUMBER	DRUM NUMBER	CONTENTS	VOLUME	UNIT	RCRA	RRM	ASBESTOS	OTHER CONDITIONS	DISPOSAL METHOD
B26	D58	White Powder	300	lbs	zNA			pH 10.1	Mixed w/tailings & placed in cell per specs.
B27	D59	White Powder	220	lbs	zNA	X		pH 8.4	Mixed w/tailings & placed in cell per specs.
B28	D60	White Powder	180	lbs	zNA	X		pH 10.4	Mixed w/tailings & placed in cell per specs.
B29	D61	White Powder	200	lbs	zNA	X		pH 10.6	Mixed w/tailings & placed in cell per specs.
B30	D62	White Powder	125	lbs	zNA	X		pH 9.4	Mixed w/tailings & placed in cell per specs.
B31	D63	White Powder	180	lbs	zNA	X		pH 9.9	Mixed w/tailings & placed in cell per specs.
B32	D64	White Powder	110	lbs	zNA	X		pH 10.0	Mixed w/tailings & placed in cell per specs.
B33	D66	Tar	55	gal	zNA	X			Placed in cell per specifications.
B34	D67/72	Sludge	80	lbs	zNA	X			Encapsulated & placed in cell per spec.
B35	D68/73	Sludge	200	lbs	zNA	X			Encapsulated & placed in cell per spec.
B36	D69/74	Sludge	80	lbs	zNA	X			Encapsulated & placed in cell per spec.
B37	D70A/71	Sludge	180	lbs	zNA	X			Encapsulated & placed in cell per spec.
B38	D75/78	Sludge	120	lbs	zNA	X			Encapsulated & placed in cell per spec.
B39	D77/80	Sludge	200	lbs	zNA	X			Encapsulated & placed in cell per spec.
B40	D79A/79B/83	Sludge	160	lbs	zNA	X			Encapsulated & placed in cell per spec.
B41	D76/84	Sludge	210	lbs	zNA	X			Encapsulated & placed in cell per spec.
B42	D81/85	Sludge	185	lbs	zNA	X			Encapsulated & placed in cell per spec.
B43	D70/82	Sludge	160	lbs	zNA	X			Encapsulated & placed in cell per spec.
B44	D79/83A	Sludge	160	lbs	zNA	X			Encapsulated & placed in cell per spec.
B45	D103/104	White Powder	200	lbs		X		pH 8.2	Mixed w/tailings & placed in cell per specs.
B46	D104/105/106	White Powder	SEE D103			X		pH 9.1	Mixed w/tailings & placed in cell per specs.
B47	D106/107	White Powder	180	lbs		X		pH 11.1	Mixed w/tailings & placed in cell per specs.
B48	D107	Rinsate/water from transformer 529235	20	gal	zNA	X		Arodor 17 ppm Rinsate <50 ppm is not regulated	Encapsulated & placed in cell per spec.
B49	D108	Oil	55	gal	zNA			Mixed w/water	Off-site disposal by Cyprus - Foote
B50	D109	Oil contaminated soil	225	lbs	zNA	X		Soil from around leaky oil drum.	Encapsulated & placed in cell per spec.
B51	D110	Batteries	280	lbs	Lead Plates	X		Broken and Dry	Placed in cell per specifications.
B52	D111	Batteries	280	lbs	Lead Plates	X		Broken and Dry	Placed in cell per specifications.
B53	D112	Batteries	280	lbs	Lead Plates	X		Broken and Dry	Placed in cell per specifications.
B54	D113	Batteries	280	lbs	Lead Plates	X		Broken and Dry	Placed in cell per specifications.

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NATURITA MATERIALS MATRIX

Sorted By Barrel Number

BARREL NUMBER	DRUM NUMBER	CONTENTS	VOLUME	UNIT	RCRA	RRM	ASBESTOS	OTHER CONDITIONS	DISPOSAL METHOD
B55	D114	Yellow Powder	50	lbs	Corrosive pH 1.3	X			Mixed w/tailings & placed in cell per specs.
B56	D115	Powder	100	lbs		X		pH 4.4	Mixed w/tailings & placed in cell per specs.
B57	D116	Oil	55	gal	zNA			Mixed w/water	Off-site disposal by Cyprus - Foote
B58	D117	Diesel from mill equipment	40	gal	zNA				Off-site disposal by Cyprus - Foote
B59	D118	Diesel from mill equipment	55	gal	zNA				Off-site disposal by Cyprus - Foote
B60	D119	Oil	50	gal	zNA			Mixed w/water	Recycled
B61	D120	1st Aid Supplies			zNA	X			Placed in cell per specifications.
B62	D121	Batteries	280	lbs	Lead Plates	X		Broken and Dry	Placed in cell per specifications.
B63	D122	Oil	40	gal	zNA			Mixed w/water	Off-site disposal by Cyprus - Foote
B64	D123	Oil/soil	110	lbs	zNA	X			Encapsulated & placed in cell per spec.
B65	D124	Oil	35	gal	zNA	X		Mixed w/water	Encapsulated & placed in cell per spec.
B66	D125	Oil	35	gal	zNA			Mixed w/water	Recycled
B67	D126	Oil	55	gal	zNA	X			Encapsulated & placed in cell per spec.
B68	D127	Sludge	30	gal	zNA	X			Encapsulated & placed in cell per spec.
B69	D128	Ore Samples	30	lbs	zNA	X			Consolidated with B8 and B10. Placed in cell per specifications.
B70	D129	Oil	20	gal	zNA	X			Encapsulated & placed in cell per spec.
B71	D130	Coveralls	50	lbs		X			Placed in cell per specifications.
B72	D131	Coveralls	50	lbs		X			Placed in cell per specifications.
OTHER		CONTENTS	VOLUME	UNIT	RCRA	RRM	ASBESTOS		DISPOSAL
Trailer		Asbestos	323	bgs		X	X		Placed in cell per specifications.
			17	wraps					
Trailer		Fiber Glass	342	bgs		X			Placed in cell per specifications.

NOTES:

- 1) The BARREL NUMBER column is the current identification system for these materials. The DRUM NUMBER column was the original identification system used during the original site characterization.
- 2) Barrel contents listed as "White Powder" are either lime or soda ash.
- 3) Barrel contents listed as Yellow Powder" or "Powder" are corrosive or slightly corrosive materials.
- 4) The zNA symbol means the barrel contents were tested for RCRA characteristics, and the results of the test were below regulatory levels.
- 5) Encapsulated means the contents were mixed with an absorbent material, placed in a new drum or overpacked, and grouted (cement mixture) to fill all voids.

Table 1.1
Contaminated Material Volume at the Naturita Site, Colorado

MATERIALS	APPROXIMATE IN SITU QUANTITY
Contaminated Soil	389,000 cy ⁽¹⁾
Stockpiled demolition debris	8,300 cy ⁽¹⁾
Stockpiled V.P. materials.	3,000 cy ⁽¹⁾
<ul style="list-style-type: none"> • Petroleum Products <ul style="list-style-type: none"> – Oils – Ignitable Types – Herbicide Types • Lead Batteries • Corrosive Solids • Sludges/Soils • Other 	990 gal. 125 gal. 65 gal. 1,400 lbs. 2,595 lbs. 2,530 lbs. 100 lbs.
Stockpiled drums (55 gal.) containing processing waste, by-products, and petroleum products.	72
Stockpiled bags and wraps (approximately 18 ft ³ each) with asbestos containing materials and fiberglass.	<u>682</u> bags/wraps
Total	401,000⁽¹⁾ cu yd
Range of Ra-226 concentrations for the Naturita RRM.	The 15-143 pCi/g

⁽¹⁾ Quantities shown represent the best estimate; actual quantities will vary. The estimated quantities do not include contaminated material from supplemental standard areas which could add as much as 147,000 cy of contaminated material if the supplemental standards are not approved.

6.0 RADON ATTENUATION

6.1 Introduction

This section summarizes the disposal cell design and relevant parameters selected in evaluating the radon barrier. A discussion of the radiation survey plan is also included with respect to reasonable assurance that compliance with EPA standards outlined in 40 CFR Part 192 will be achieved.

6.2 Design

The proposed remedial action will consolidate contaminated materials from the former tailings pile, mill yard, and ore storage areas within the designated Naturita process site boundary, as well as windblown and waterborne material distributed over adjacent vicinity properties, into a single disposal cell at the Upper Burbank disposal site with an approximate volume of 401,000 cubic yards (307,000 cubic meters). This volume includes contaminated material to be removed from remote vicinity properties in the Naturita community and an estimated 8,300 cubic yards (6,300 cubic meters) of contaminated demolition debris from the office building, 11 other site structures and a large quantity of on-site scrap metal and milling equipment. The estimated quantities do not include contaminated material from supplemental standard areas which could add as much as 147,000 cubic yards (112,000 cubic meters) of contaminated materials if the supplemental standards are not approved.

A compacted (95 percent Standard Proctor) earthen radon barrier 36 inches (0.91 meters) thick will be placed on both the top slope and side slopes. (see Appendix F, NAT-CALC-010). Calculated thickness of the radon barrier required to meet EPA standards are:

- 2.36 inches (6 centimeters) assuming the RRM in the upper 16 feet (500 centimeters) of the contaminated material embankment is constructed of windblown area material with a radium-226 content of 59.5 pCi/g.
- 8.45 inches (21 centimeters) assuming the RRM in the upper 16 feet (500 centimeters) of the contaminated material embankment is constructed of former tailings pile area material with a radium-226 content of 94.1 pCi/g (worst case).

The contaminated material will be placed within the cell in a sequence designed to reduce the radon releases below the EPA standards in accordance with the intent to attain levels "as low as reasonably achievable" (ALARA).

Additional cover components will be sequentially placed above the primary earthen radon barrier. On the gradual topslope, these components will consist of a 66-inch (1.68-meter) thick frost protection layer, 6-inch (0.15-meter) bedding layer, and a 12-inch (0.3-meter) thick erosion protection layer. The 5-to-1 sideslopes will also contain the same sequence of material on top of a 36-inch (0.9-meter) thick earthen radon barrier. The radon barrier, soil

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storage results, 0.33, was used to characterize this layer. An average emanation factor of 0.22 was used for the windblown material, which will be stabilized as a single layer. No emanation measurements were performed on the former tailings pile material; the volume weighted average emanation factor of 0.33 for the mill yard and ore storage area was assumed to be representative of this material.

6.3.4 Dry Densities and Porosities

The dry densities and porosities for the earthen radon barrier and various types of contaminated material were determined using Standard tests and procedures and assuming a design compaction of 95 and 90 percent, respectively, in accordance with ASTM D 698. Material properties used for the Radon diffusion-modeling calculations are presented in the table titled "Summary of Input Parameters for "RADON" Model, page 5 of Appendix F, NAT-CALC-010, Rev.3."

6.3.5 Layer Thickness

The thickness of the radon barrier has been designed assuming the upper 16 feet (500 centimeters) of the contaminated material embankment would be constructed of contaminated windblown materials with a radium-226 content of 59.5 pCi/g. The contaminated material will be placed within the cell in a sequence designed to reduce the radon release below the EPA standards in accordance with the intent to attain levels "as low as reasonably achievable" (ALARA).

6.3.6 Radium-226 Concentrations

Average radium-226 concentrations were estimated for each contaminated subarea of the Naturita site based on an assessment of radiometry measurements (hand held and borehole gamma logs) and radiochemical and gamma spectroscopic measurements of contaminated material collected from surface soil samples, test pits, and boreholes constructed within the subareas. Incremental radium-226 depth profiles were constructed at each measurement grid point within a subarea. The average radium-226 concentration for the subarea was determined by integrating the profiles over the volume contained between the topographical surfaces defining the ground surface and the excavation depth required to comply with EPA cleanup standards. Estimated in-situ volumes, areas, and the range of radium-226 concentrations for contaminated materials at the Naturita site are shown in Table 1.1.

6.4 Evaluation of Radon Barrier

The radon barrier was evaluated with respect to compliance with the EPA radon flux standard of 20 picocuries per square meter per second using the previously discussed parameters in the RADON code (NAT-CALC-010). Only radon transmission resistance due to the high clay content earthen layer directly over the contaminated material was considered. Due to the unknown status of the supplemental standards applications and contaminated material volumes, only conservative worst-case evaluations were incorporated into the radon barrier design. No attempt has been made to optimize the

thickness of the radon barrier. The minimum thickness of 36 inches (91.4 centimeters) has been selected for the radon barrier thickness. This design requirement would be unaffected by the proposed supplemental standard applications. Consequently, under these conditions, it was concluded that a minimum radon barrier of 36 inches (91.4 centimeters) would suffice for both the topslope and sideslopes.

The additional frost protection, bedding, and riprap layers above the radon barrier provide additional assurance that the average surface radon flux will be well below the EPA standard of 20 picocuries per square meter per second.

6.5 Summary and Conclusion

The disposal cell and radon barrier design will reduce the surface radon flux to levels below the EPA standards stated in 40 CFR §192.02(b).

CHANNEL INVERT IN SANDSTONE ROCK THIS AREA SEE CHANNEL SECTIONS F-F' SHEET MAT-05-10-1780.

sh 60

3875-47
Barrier Trench

Rev. A

PYL 9/30/97
WYL 9/30/97

RELOCATE COUNTY ROAD E222. SEE SHEET MAT-05-10-1782 FOR RELOCATION DETAILS.

STATION	COORDINATES	ELEVATION	REMARKS
0+00.00	N 172,376.08 E 79,144.70	3410.00	BEIGN CHANNEL 1, 20.0' WIDE, 3' = 0.0281 FT/FT
2+07.22 PC	N 172,383.32 E 79,151.32	3404.14	A = 35.170°; L = 37.41'
2+08.00 PT	N 172,383.32 E 79,151.32	3402.84	A = 35.170°; L = 37.41'
3+52.22 PCL	N 172,194.71 E 79,457.89	3402.84	20.0' WIDE, BEIGN WIDE TRANSITION TO 30.0'
4+06.47 PC	N 172,112.80 E 79,529.11	3402.84	20.0' WIDE, END WIDE TRANSITION
4+08.95 PT	N 172,112.80 E 79,529.11	3402.84	A = 64.082°; L = 34.17'
5+78.54 PC	N 172,024.73 E 79,604.97	3403.84	A = 15.783°; L = 134.77'
7+06.48 CB	N 171,970.85 E 79,679.62	3403.84	3' = 0.05 FT/FT BEIGN WIDE TRANSITION FROM 20.0' TO 30.0'
7+12.91 PT	N 171,970.85 E 79,679.62	3403.84	
8+02.12 PCL	N 171,817.88 E 79,729.09	3403.84	WIDE 30.0' END WIDE TRANSITION TO 50.0' OVER DOW 1
8+03.13 PC	N 171,817.88 E 79,729.09	3403.84	A = 37.535°; L = 34.31'
12+28.08 PT	N 171,565.02 E 79,879.34	3403.84	20.0' WIDE, BEIGN WIDE TRANSITION TO 30.0'
13+08.84 PCL	N 171,565.02 E 79,879.34	3403.84	END CHANNEL NO. 1
STATION	COORDINATES	ELEVATION	REMARKS
0+00	N 172,376.08 E 79,144.70	3410.00	BEIGN CHANNEL 1, 20.0' WIDE, 3' = 0.0281 FT/FT
1+00.78 PC	N 172,383.32 E 79,151.32	3404.14	A = 35.170°; L = 37.41'
2+02.14 PT	N 172,383.32 E 79,151.32	3402.84	A = 35.170°; L = 37.41'
4+22.45 PC	N 172,194.71 E 79,457.89	3402.84	20.0' WIDE, BEIGN WIDE TRANSITION TO 30.0'
4+06.47 PT	N 172,112.80 E 79,529.11	3402.84	A = 64.082°; L = 34.17'
6+23.84 PC	N 171,817.88 E 79,729.09	3403.84	A = 15.783°; L = 134.77'
6+06.00 PT	N 171,817.88 E 79,729.09	3403.84	
8+21.81 PC	N 171,565.02 E 79,879.34	3403.84	A = 37.535°; L = 34.31'
8+78.57 PT	N 171,565.02 E 79,879.34	3403.84	20.0' WIDE, BEIGN WIDE TRANSITION TO 30.0'
11+08.00 PCL	N 171,478.13 E 79,984.72	3403.84	20.0' WIDE, BEIGN WIDE TRANSITION TO 30.0'
12+00 CB	N 171,478.13 E 79,984.72	3403.84	3' = 0.05 FT/FT BEIGN WIDE TRANSITION FROM 20.0' TO 30.0'
14+02.33 CB	N 171,277.51 E 79,984.72	3403.84	3' = 0.054 FT/FT
15+08.00 CB	N 171,277.51 E 79,984.72	3403.84	3' = 0.11 FT/FT, BEIGN WIDE TRANSITION TO 50.0'
15+78.13 PC	N 170,933.32 E 79,984.72	3403.84	A = 37.535°; L = 34.31'
16+74 PT	N 170,933.32 E 79,984.72	3403.84	A = 37.535°; L = 34.31'
17+33.70	N 170,933.32 E 79,984.72	3403.84	END CHANNEL 2 75.0' WIDE
STATION	COORDINATES	ELEVATION	REMARKS
0+00	N 171,333.81 E 79,171.20	3403.84	BEIGN CHANNEL 3 20.0' WIDE, 3' = 0.0281 FT/FT
4+08 CB/PC	N 171,784.54 E 79,578.05	3403.84	A = 37.535°; L = 34.31'
5+35.97 PCL	N 171,784.54 E 79,578.05	3403.84	END OF CHANNEL NO. 3

NOTE: ALL COORDINATES, ELEVATIONS AND DIMENSIONS ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD BY THE SUBCONTRACTOR.

THIS DRAWING IS NOT VALID IF THE STATE OF CALIFORNIA HAS NOT REVIEWED THE ORIGINAL ENGINEERING DRAWING.

SCALE IN FEET
CONTOUR INTERVAL: 2'

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

CONTAMINATED MATERIAL
EMBANKMENT - GRADING PLAN
AND EROSION PROTECTION

UMETCO MINERALS CORPORATION
UMTRA PROJECT
2704 DOWS DRIVE, SUITE 200, GRAND JUNCTION, CO 81508

DE-AC04-83AL18798
MAT-DS-10-1787

DIVERSION CHANNEL No. 3
CHANNEL WIDTH EQUALS
10.0' FROM STA 0+00 TO
STA 5+35.97

EXISTING TITLE II DISPOSAL CELL
COVER SLOPE = 0.02 FT/FT

PERMANENT SITE BOUNDARY
SEE SHEET MAT-DS-10-1785
FOR SITE BOUNDARY
COORDINATES

END CONTAINMENT BERM
OPPOSITE CHANNEL No. 2
STA 14+02.33

CHANNEL WIDTH TRANSITIONS
FROM 20.0' AT STA 11+00
TO 50.0' AT STA 12+00

RIGHT SIDE OF CHANNEL
TRANSITIONS FROM 25.0'
AT STA 15+09.98 TO
50.0' AT STA 17+33.70.

CHANNEL INVERT IN SANDSTONE ROCK THIS AREA SEE CHANNEL SECTIONS G-G' & H-H' SHEET MAT-DS-10-1781.

ISSUED FOR CONSTRUCTION

Remedial action

The proposed remedial action for the disposal and stabilization of the contaminated materials is to relocate them to the Upper Burbank disposal site at Uravan, a Colorado licensed disposal facility. The Upper Burbank disposal site is approximately 15 road miles (25 km) northwest of the Naturita processing site.

After the removal of contaminated materials, the excavated areas in and around the Naturita processing site will be restored by placing fill, grading, seeding, and restoration of a Blessing Ditch bench.

1.3 SCOPE AND CONTENT

This RAP describes the proposed remedial action for the Naturita processing site. An extensive amount of data and supporting information has been generated and evaluated for this remedial action. These data and supporting information are not incorporated into this single document but are included or referenced in the supporting documents.

Attachment 1: *Calculations, Final Design for Review*

Attachment 2: *Geology Report*, describes the details of geologic, geomorphic, and seismic conditions at the Naturita processing site.

Attachment 3: *Ground Water Hydrology Report*, describes the hydrogeology, water quality, and water resources at the processing site. It includes hydrological services calculations contained in Appendix A of Attachment 3.

Attachment 4: *Additional Information*, selected information of interest to the remedial action of this site and information requested by either the NRC or CDPHE.

These documents provide data, analysis, and a more detailed description of the various aspects of the RAP.

1.4 COLLATERAL DOCUMENTS

The environmental assessment (EA) of the Naturita remedial action describes existing conditions at the processing site and the environmental impacts of the remedial action. The EA summarizes the proposed remedial action, the alternatives, and the associated environmental impacts and includes environmental details not reported in the RAP.

The *Technical Approach Document* (TAD) (DOE, 1989) describes the technical approaches and procedures used on the Uranium Mill Tailings Remedial Action (UMTRA) Project. Contained in the document are discussions on major technical areas; design considerations; surface water hydrology and erosion control; geotechnical aspects of disposal cell design; radiological issues, in particular as they pertain to the radon barrier; and the protection of ground water resources.

1.5 RAP ORGANIZATION

The compilation and presentation of information contained in this RAP have been modeled after the approach taken in the NRC's site technical evaluation reports (TER). This RAP has been formatted in accordance with the requirements of the NRC's standard format and content (SF&C) guide for documentation as applicable to the UMTRA Project site (NRC, 1989). This document has been generated to facilitate the NRC's preparation of a TER for the proposed remedial action at the Naturita site. The design details or criteria are available in supporting documents, reports, drawings, specifications, and calculations.

protected by 5.5 feet (1.7 meters) of additional cover to assure long-term integrity of the radon/infiltration barrier.

- The disposal cell will be contoured to provide efficient drainage of precipitation away from the repository and to minimize excess moisture in the cover and associated infiltration.

The DOE has assessed the performance of the proposed disposal cell at the Upper Burbank site in conjunction with the hydrogeologic system (Figure 5.2) underlying the cell and has demonstrated that the disposal cell design will minimize and control releases of hazardous constituents to groundwater and surface water to the extent necessary to protect human health and the environment. Natural stable materials have been proposed for use in constructing the Upper Burbank disposal cell so that long-term performance is ensured.

The EPA groundwater protection standards consist of three components: (1) a list of hazardous constituents; (2) a corresponding list of concentration limits for the constituents; and (3) a point of compliance (POC). These three components are discussed in the following paragraphs.

5.3.1 Hazardous Constituents

Hazardous constituents were identified that are reasonably expected to be in or derived from residual radioactive material to be stabilized at the disposal site. The hazardous constituents were identified by characterization of residual radioactive material. The hazardous constituents at the Naturita site are listed in Table 3.1 of Appendix C.

5.3.2 Proposed Concentration Limits

To achieve compliance with standards, the DOE proposes numerical concentration limits for constituents in groundwater at a POC. Concentration limits have been established for hazardous constituents in groundwater in the uppermost aquifer for the hazardous constituents listed above. The proposed concentration limits are the MCLs, the statistical maximum of background groundwater quality for those hazardous constituents without MCLs, or the analytical detection limits. These concentration limits are presented in Appendix C. Table 3.1.

5.3.3 Point of Compliance

Wingate well CM93-2 is designated as the POC for the proposed Upper Burbank disposal site. This well is immediately downgradient of the disposal cell as shown on Figure 1.13 in Appendix B.

5.4 Performance Assessment

The DOE is required to demonstrate that the performance of the disposal cell at the disposal site will comply with the EPA groundwater protection standard (40 CFR §192.02). The DOE has assessed the performance of the proposed disposal site in conjunction with the hydrogeological system and has shown that the disposal unit will minimize and control releases of hazardous constituents to groundwater and surface water to the extent necessary to protect human health and the environment. Assessments of hydrogeologic characteristics and geochemical attenuation are discussed in Section 3.3 of Appendix C.

5.5 Performance Monitoring

Pursuant to 40 CFR§192 the DOE will implement a monitoring program to be carried out during the post-disposal period, which is adequate to demonstrate that the initial performance of the disposal cell is in accordance with design requirements. DOE will monitor potential repository seepage using wells at the contact of the Salt Wash Member and Summerville Formation near the disposal cell for a period of time following completion of remedial action as a best management practice. Monitoring any perched groundwater on the top of the Summerville from the disposal cell includes wells BR95-1, BR95-2 and BR95-3 as a best management practice. If seepage is detected in these monitor wells, performance monitoring of wells CM93-1 and CM93-2 will be conducted.

5.6 Corrective Action Plan

The Upper Burbank disposal cell has been designed and will be constructed to perform for the mandated design life of 1000 years. The design of the cell has incorporated standard safety factors and should therefore perform for at least 1000 years with minimal maintenance. It is not anticipated that the designed disposal cell will fail, because all-natural materials will be used and the radon infiltration barrier will be adequately protected from disruption by frost and biointrusion.

The DOE is required by the EPA groundwater standards in 40 CFR§192 to evaluate alternative corrective actions that could be implemented if the disposal cell monitoring program indicated that the unit is not performing adequately. The DOE will consider reasonable failure scenarios of the disposal unit and demonstrate that corrective actions can be conducted no later than 18 month after detecting an excursion. Monitoring of wells BR95-1, Br95-2, and BR95-3 allows for the early detection of seepage from the Upper Burbank Repository. Detection of this seepage allows for the early assessment of cell performance and removal of contaminated liquids prior to contamination of the Wingate aquifer. Such corrective actions can be used to restore system performance prior to exceedence of concentration limits in the POC.

Umetco Minerals Corporation

HYDROGEOLOGIC
CROSS SECTION
UPPER BURBANK SITE

NOVEMBER 1985
UTERVA, COLORADO
PAGE 17

2X VERTICAL EXAGGERATION

LEGEND

Perched water saturated zone thickness references

CM93-1 Observation during drilling and
neutron logs of holes by Unkelo
Feel, 1993

V768 Neutron logs of holes by Bishop,
Brogden and Rumph, 1986

V769 Field measurements, April 1991

V770 Topographic Contour

Thickness of perched raffinate contour

0 Thickness of Raffinate measured in feet
CM93-3 Hole identification number

Holes

1 Hole logs and information contained
in Appendix B

2 Map represents probable maximum
extent of the perched zone.

UMETCO MINERALS CORPORATION

THICKNESS OF
PERCHED RAFFINATE
ON SUMMERVILLE FORMATION

October 1993, 100 310

(1) Unit thickness based on CM93-1

(2) From Tables 3.1 and 3.2 Appendix B and NAT-CALC-006, p. 32

(3) From Table 3.3 Appendix B

Umetco Minerals Corporation

Hydrogeologic Units
Upper Burbank Repository
Uravan, Colorado

**REMEDIAL ACTION PLAN FOR
THE INACTIVE URANIUM
PROCESSING SITE AT
NATURITA, COLORADO**

**Remedial Action Selection Report
Attachment 2, Geology Report
Attachment 3, Ground Water Hydrology Report
Attachment 4, Supplemental Information**

November 1998

**Appendix B of the
Cooperative Agreement
No. DE-FC04-81AL16257**

**REMEDIAL ACTION PLAN FOR THE INACTIVE
URANIUM PROCESSING SITE
AT NATURITA, COLORADO**

November 1998

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

**Prepared by
Jacobs Engineering Group Inc.
Albuquerque, New Mexico**

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REMEDIAL ACTION PLAN

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ATTACHMENT 1 CALCULATIONS

ATTACHMENT 2 GEOLOGY REPORT

ATTACHMENT 3 GROUND WATER HYDROLOGY REPORT

ATTACHMENT 4 SUPPLEMENTAL INFORMATION

GENERIC PROTOCOL FOR THORIUM-230 CLEANUP/VERIFICATION
AT UMTRA PROJECT SITES

SOIL VERIFICATION WING COBBLES-TO-FINES CORRECTION
(OP-003-4)

URANIUM CLEANUP AND VERIFICATION AT NATURITA
(RAC-OP-007)

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LIST OF ACRONYMS

<u>Acronym</u>	<u>Definition</u>
AEC	Atomic Energy Commission
CDPHE	Colorado Department of Public Health and Environment
DOE	U.S. Department of Energy
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
MCL	maximum concentration limit
$\mu\text{R/hr}$	microrentgens per hour
MK-ES	Morrison Knudsen-Environmental Services
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m ² s	picocuries per meter squared/second
RAC	Remedial Action Contractor
RAP	remedial action plan
SF&C	standard format and content
SRP	standard review plan
TAC	Technical Assistance Contractor
TAD	Technical Approach Document
TDS	total dissolved solids
TER	technical evaluation report
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act
VCA	Vanadium Corporation of America

CHANGE HISTORY

Document version	Date	Pages/comments
Rev. 0, Ver. 1	03/20/98	Initial version.
Rev. 0, Ver. 2	11/13/98	Incorporate comments from NRC and CDPHE.

After removal of the ore storage area and mill yard area materials, including wastewater retention pond and collection ditch synthetic liner material, the cleanup work at the processing site will be done in small increments, one area at a time, working from higher elevations to lower elevations, with restoration of cleaned-up areas completed immediately after excavation has been completed. Working in this manner will eliminate production of contaminated runoff from upland areas during remediation work.

- Develop/utilize a commercial borrow area to supply fill material for site restoration at the processing site.
- Dismantle/demolish all temporary facilities that cannot be decontaminated and haul these to the Uravan Project disposal site. This applies to sediments from the washwater retention ponds and any contaminated soils adjacent to temporary facilities.
- Following removal of all contaminated materials and replacement with clean fill, regrade the site. Restore all disturbed areas, including borrow areas, wetlands, and the Blessing Ditch bench, and clean up and demobilize the site.

3.3.2 Testing and inspection

The Naturita site remedial action inspection plan provides the details of the methods, procedures, and frequencies by which construction materials and activities are to be tested and inspected to verify compliance with the design specifications.

Quality assurance audits and in-process surveillances shall be conducted by the DOE and the Technical Assistance Contractor (TAC) to verify and ensure that remedial action activities are performed in accordance with approved UMTRA Project requirements and the *UMTRA Project Quality Assurance Plan* (DOE, 1990a).

3.4 SUMMARY

Based on the design presented and described in Parts A and B of the RAP, the supporting documents, the design drawings, the specifications, and the attachments, the DOE concludes that the design complies with the EPA site remediation standards (40 CFR §192.02(a)).

7.0 LIST OF CONTRIBUTORS

The following individuals contributed to the preparation of this RAP.

Name	Contribution
D. Bierley, D. Jones, S. Cox, R. Heydenburg, A. Holm	Document review
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J. Torline, S. Portlock	Document production coordination
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