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WM-48

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

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Mr. Edward F. Hawkins, Chief
Uranium Recovery Field Office
Nuclear Regulatory Commission, Region IV
Box 25325
Denver, CO 80225

Dear Ed:

Enclosed please find our response to NRC comments on the Durango preliminary final RAP and one copy of the Durango final RAP. We believe our response will satisfactorily resolve major concerns of the NRC recognizing that some issues will have to be resolved as the remedial action progresses.

Also, enclosed are four original signature pages which will be placed into the final RAP following execution by all parties. The final RAP/ final design will be incorporated as Appendix B of Cooperative Agreement No. DE-FC04-81AL16257 between DOE and the State of Colorado. Any subsequent revision to the final RAP will result in a modification to the cooperative agreement and requires execution by both DOE and the State of Colorado, and concurrence by the NRC.

Please sign the enclosed pages and forward them to the State of Colorado in the enclosed addressed envelope for execution by the State. Following final execution of the signature pages, a final published version of the RAP will be forwarded to you.

Should you have any questions regarding this matter, please contact Milt Scoutaris of my staff at (505) 846-1206.

Sincerely,

John G. Themelis, Project Manager
Uranium Mill Tailings Project Office

8701150375 861229
PDR WASTE
WM-48 PDR

Enclosure:

cc w/o encl:
J. D'Antonio
D. Dubois, JEG
J. Oldham, MK-F

FEE NOT REQUIRED.

DESIGNATED ORIGINAL

Certified By Mary C. Hurd

[redacted]

87-226

RESPONSE TO NRC REVIEW COMMENTS

ON THE DURANGO Preliminary Final RAP

(Letter from R. Dale Smith to John Themelis Dated August 26)

1. Comment:

Signature Page - Please note that the proper designation for this NRC regional office is the roman numeral "IV" not the arabic number "4". Thank you for your attention to this minor detail.

Response:

The requested correction has been made.

Radon Barrier

2. Comment:

Page 55, Section 7.2.4 - The detailed final design must be submitted to, and concurrence received from, NRC prior to placement of final cover.

Response:

The detailed final cover design will be submitted for NRC approval.

3. Comment:

Page B-7, Section B.2.1.2, second paragraph - The results of the drilling and sampling program shall be submitted to NRC at the time the final design is submitted.

Response:

Agreed.

4. Comment:

Page B-13, first paragraph - The results of measurements made to determine site-specific values for the Ra-226 concentration, Rn-222 emanating fractions, diffusion coefficients, dry bulk density, porosity, particle size distribution and long term moisture content for the contaminated materials shall be submitted to NRC along with the final design for review and concurrence.

Response:

The tailings sampling results will be submitted to NRC when available.

5. Comment:

Page B-13, Moisture Contents - Please indicate the value for the calculated long term moisture content for the cover material and specify the suction value this corresponds to.

Response:

Moisture contents were based on Table B.1.6 in the Draft RAP. This table has been added to the December 1986 Final RAP as Table B.2.2. The long term moisture content of the cover is 15 percent.

6. Comment:

Page B-13, Cover radon diffusion coefficients - Please indicate the radon diffusion coefficient value for the cover material.

Response:

The cover radon diffusion coefficient is 1.4×10^{-2} cm^2/sec and is stated in Table B.2.2 of the December 1986 Final RAP.

7. Comment:

Page B-14, calculation - In the calculation on the theoretical average Ra-226 concentration for the tailings the conversion factor for pCi to Ci is mis-typed.

Response:

The correction has been made in the Final RAP.

8. Comment:

Page B-14, fourth paragraph - Verification of the actual required cover thickness which will be performed when site-specific tailings data become available must receive NRC written concurrence.

Response:

Verification calculations of the design cover thickness will be submitted to NRC for concurrence.

9. Comment:

Appendix B - Review of this appendix indicates that Table B.1.6 titled "RAECOM Input for the Bodo Canyon Disposal Site" previously contained on Page B-36 of the Draft RAP dated June 1985 has been omitted. Please include this table or explain its absence.

Response:

The RAECOM Input table was inadvertently omitted from the preliminary Final RAP. It has been added to the Final RAP as Table B.2.2

Groundwater

10. Comment:

Page B-31, Figure B.3.3 - Figure B.3.3 does not specifically show the shallow alluvial wells referred to in the text on Page B-30, first paragraph. This figure should indicate which wells referred to in the text are the shallow alluvial wells.

In addition, the fault that traverses the raffinate pond area should be shown in this figure, as the location of the fault is important as it is probably the main factor controlling the direction of ground-water flow.

Response:

The text on Page B-32 of the Final RAP (December 1986) has been amended to include specific reference to well #23 and #25 in Figure B.3.3, the shallow alluvial wells in question.

The fault traversing the raffinate ponds area is clearly shown in Figure B.3.1 on Page B-30 of the Final RAP (December 1986).

11. Comment:

Page B-36, Section B.3.3.2, Remedial Action and Post-Remedial Action Conditions, third paragraph - The text references five feet for the radon barrier thickness. This conflicts with information in other sections. Figure 5.1 on Page 36 indicates six feet for the radon cover and the text on Page B-40, second paragraph indicates that the cover system will be "at least three feet thick." Clarification as to the thickness of the radon barrier is necessary.

Response:

The text on Pages B-38 and B-42 of the Final RAP (December 1986) has been amended to be consistent with Figure 5.1; the design thickness for the radon barrier is six feet.

12. Comment:

Pages B-38 through B-51, Section B.3.4, Chemical Conditions - Several methods are used in demonstrating (modeling) the expected conditions. Two comments are directed at the use of these methods

(A) When a method is used, a reference should be given as to where the method was obtained and why this particular method is being used.

(B) Consistent units of measurement should be used in the text and in deriving values in the method formulas. If previous documents contain different units, these values should be converted to consistent units.

Response:

(A) The modeling methods and equations used in Section B.3.4 are all clearly referenced. When no reference is given for a particular equation or assumption, it is because they follow logically from previously given equations or assumptions and require no original citation, or because they are generally accepted conventions in hydrogeology (e.g., Darcy's Law; the "retardation equation"). The general modeling approach of Gilbert et al. (DOE, 1983) referenced in Section B.3.4.2 is used because it is simple, logically consistent, and is based upon conventional equations to predict contaminant transport. The mixing calculations used to generate Table B.3.5 are also simple, logical, and appropriate for predicting water quality impacts at the site.

(B) All measurements and calculated values are given in standard, consistent units. All final values for leachout rates and ground-water velocities are given in inches or feet per year. Laboratory-determined hydraulic conductivity values are reported in cm per second, but converted to inches per year in infiltration calculations. All K_d values are given in ml per gram, and all water quality parameters in mg per liter (ppm) or other appropriate units.

13. Comment:

Page B-39, Table B.3.3 - Several of the values given for the estimated maximum concentration in Table B.3.3, as derived by using the formula for factor F (Page B-38) and the values for the small tailings pile in Table B.3.2 (Page B-39), appear to be incorrect. For example, using the formula for factor F, aluminum should be 384, rather than 380, as shown.

Response:

The values in Table B.3.3 have been rounded off to two or (for sulfate) three significant figures.

14. Comment:

Pages B-46, B-51, and B-52, Section B.3.4.2 Post-Remedial Action Conditions, Distribution Coefficient - Estimated field distribution coefficients (K_d) are calculated using the formula on the top of Page B-46. Using the values of the three parameters (uranium, sulfate, and vanadium) from Table B.3.2 (Page B-39) in the formula results in different values than shown at the top of Page B-46. Additionally, the statement on Page B-51 that the distribution coefficient for non-reactive contaminants, such as uranium, sulfate, and chloride, are very low (approaching zero) contradicts the values given on Page B-46 for the field K_d's.

The reference on Pages B-52 through B-53 that arsenic has a distribution coefficient on the order of 100 ml/g does not correlate with the field value of K_d that can be derived from Table B.3.2 (Page B-39). The field value of K_d for arsenic is calculated to be 10 ml/g. For the sake of

conservatism, the field K_d value for arsenic should be used in the calculation on the top of Page B-52. Using the field K_d, the value for the residual arsenic plume would increase from .7 feet per year to 7 feet per year.

Response:

The estimated field K_d values for uranium, sulfate, and vanadium given on Page B-46 of the Preliminary Final RAP (Page B-48 of the Final RAP) are calculated using values from Table B.3.2 (Page B-41 in the Final RAP) and water quality data from the September 1982 and November 1983 sampling of Bendix lysimeter #5 (10 feet depth)--see Tables F-21 and F-24 of the Draft EIS (DOE, 1984) for these water quality data. Thus, the K_d values represent an average based on two sampling dates. The K_d values calculated for U, SO_4, and V on Page B-46 have been reviewed and are correct. In any case, all the mixing calculations are based on a worst-case leachout rate that assumes no geochemical attenuation ($K_d = 0$).

The statement given on Page B-51 (June 1986 Preliminary Final RAP) regarding very low K_d values for non-reactive contaminants does not really contradict the low values (2.9 and 3.0 ml/g) calculated for uranium and sulfate on Page B-46. These are relatively low values compared to the orders of magnitude higher K_d values typically reported for many other trace constituents (e.g, Fe, Mn, Pb, V) in ground water.

The field estimate for arsenic's K_d using data from column one of Table B.3.2 (3.0 mg/g) and water quality data for lysimeter #5 at the small tailings pile (<0.01 mg/l) is greater than 300 ml/g. Therefore, using a K_d of 100 ml/g does, in fact, provide a conservative calculation on Page B-52 of the Preliminary Final RAP.

15. Comment:

Pages B-38 through B-43, Section B.3.4 Chemical Conditions - There is inadequate discussion of the background water quality for Bodo Canyon or the Durango processing sites. This is particularly important to understanding of the geohydrology of the Bodo Canyon site which appears to have only water quality analysis results for one sampling. A discussion should be included as to how one-time sampling compares with any previous analysis.

Response:

Results of the November 1985 sampling of Bodo Canyon monitor wells have been added to Table B.3.4 in the Final RAP. These water quality data are generally consistent with data from the January 1985 sampling results, except that molybdenum concentrations were much higher in the November 1985 ground-water samples. The second paragraph of Page B-52 (December 1986 Final RAP) includes a brief discussion of the naturally poor ground-water quality at the site. Follow-up sampling of existing monitor wells at the site is planned just prior to the start-up of remedial action construction activities. This will provide additional data on the natural variability of ground-water quality at the site. The additional data will be forwarded to NRC when available.

The now-sealed Dames and Moore monitor wells at the site were sampled four times from November 1982 to August 1983. Tables F-28 through F-36 of the Draft EIS (DOE, 1984) present water quality results from this sampling effort. However, these data show anomalously high levels of arsenic barium, chromium, iron, lead, and radium; therefore, the DOE feels that these data are suspect and should not be used in evaluating present hydrochemical conditions at Bodo Canyon.

Geotechnical

16. Comment:

Page B-29, fourth paragraph - It is indicated that the cut slope No. 2 bedding planes dip away from the cut at approximately 4 to 7 degrees. It is also stated that a geologist will map the joint system, bedding planes, and identify any unstable conditions associated with the slope cut.

Response:

A review of the cut slopes in the Bodo Canyon disposal area will be conducted by a geologist during construction.

17. Comment:

Page B-21, Soil profiles and properties - Tailings strength parameters must be based on actual test samples from the Durango site. This test data must be transmitted to the NRC upon completion.

Response:

Results of tests on tailings samples will be sent to NRC when available.

18. Comment:

The letter of March 21, 1986, contained responses to NRC comments. Item No. 19 stated that data from petrographic analyses of rock sources would be transmitted to the NRC. This data has not yet been transmitted to the NRC.

Response:

Laboratory analysis of rock proposed for use by the RAC subcontractor will be sent to NRC when it is available. Rock data are available from several other borrow sites that were previously under consideration for use at the Bodo Canyon site. These data will not be sent to NRC because the RAC subcontractor has proposed to use rock from a different quarry.

19. Comment:

Additional laboratory testing of the swell and dispersivity characteristics of prepared radon barrier soils must be performed to allow independent evaluation of the suitability of the soils.

Response:

TAC site characterization studies identified that recompacted soil samples from test pit 503 at the Bodo Canyon disposal site are dispersive and could be easily eroded by water. Additional tests were conducted by the RAC on two additional soil samples from the disposal site. The two soil samples were found to be non-dispersive. In subsequent discussions the NRC expressed concern that the tests were not sufficient to ensure that dispersive soils would be excluded from the radon barrier. NRC also states that there may be shrinkage of the radon barrier due to drying.

Further evaluation of the soil characteristics of the disposal site have indicated two conclusions. First, the graded filter layer to be placed over the radon cover will prevent piping, or dispersion of the fine-grained material even if the soils are concluded to be dispersive (Sherard et al, 1976). This graded filter layer is already part of the cover design. Second, shrinkage of the radon barrier is unlikely because of the small difference between the placed and long-term moisture content. The moisture content as placed (16 to 19 percent) is close to the expected long-term moisture content (15 percent), indicating that shrinkage of the radon barrier is not expected to be significant (Peck, Hanson, and Thornburn, 1973). Additional laboratory testing may be required to quantify the shrinkage expected with a one to four percent reduction in moisture content.

Erosion Protection

20. Comment:

A commitment from DOE that the erosion protection which will be keyed into competent bedrock in several locations (southeast and northwest) is needed. In this regard, assurance is needed that the bedrock is capable of resisting erosion and that the rock is not highly-weathered or highly-fractured. Appropriate changes to the final remedial action plan should be made and submitted to NRC for review and approval.

Response:

Additional data on the bedrock conditions at Bodo Canyon will be obtained during the excavation and placement of the low permeability layer prior to tailings placement. Design of the perimeter ditch erosion protection could then be adjusted to suit the bedrock conditions that are identified. The required changes to the plans will be sent to NRC for review and concurrence.

References

Peck, R.B., W.E. Hanson, T.H. Thornburn, 1973. Foundation Engineering, 2nd Edition, John Wiley and Sons, New York.

Shepard, J.L., L.P. Dunnigan, R.S. Decker, 1977. "Some Engineering Problems with Dispersive Clays," published from the symposium on Dispersive Clays, Related Piping, and Erosion in Geotechnical Projects, Seventy-ninth Annual Meeting of the ASTM (STP 623), Chicago, Illinois, June 27 - July 2, 1976.

U.S. Department of Energy
Agreement No. DE-FC04-81AL16257
Appendix B

SIGNATURE PAGE

THE UNITED STATES OF AMERICA
DEPARTMENT OF ENERGY

BY: _____
John G. Themelis
Project Manager, Uranium
Mill Tailings Project Office

THE STATE OF COLORADO
DEPARTMENT OF HEALTH

BY: _____
Thomas Vernon, M.D.
Executive Director

CONCURRENCE

NUCLEAR REGULATORY COMMISSION

BY: _____
R. Dale Smith
Director Uranium
Recovery Field Office,
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United States Department of Energy

Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Durango, Colorado

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

December, 1986

Uranium Mill Tailings Remedial Action Project UMTRAP