



Department of Energy
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January 21, 1997

Daniel M. Gillen, Assistant Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards
Mail Stop T7J9
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852-2738

Dear Mr. Gillen:

Enclosed are responses to the Nuclear Regulatory Commission's (NRC) comments on the Final Completion Report for the remedial action performed at the Gunnison, Colorado, processing site. The Department of Energy (DOE) is in the process of modifying the Completion Report to incorporate these responses. The revised Completion Report is expected to be sent to NRC by February 10, 1997. Therefore, please review the responses as soon as possible so that any changes can be incorporated into the revised document. Enclosed also is a copy of the responses to the Colorado Department of Public Health and Environment's (CDPHE) comments. Where appropriate, the Completion Report will be revised in response to these comments also.

In addition to modifying the Completion Report in response to the NRC and CDPHE comments, the Completion Report will be modified to make it more accurate and user friendly. The DOE appreciates the suggestions NRC made regarding improvements to future completion reports. Along with other changes, these suggestions will be incorporated into the revised document.

Please give me a call at (505) 845-5668 if you have any questions regarding this information.

Sincerely,

Sharon J. Arp
Site Manager
Uranium Mill Tailings Remedial Action Team
Environmental Restoration Division

2 Enclosures

cc: See Page 2

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Mr. Daniel M. Gillen

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January 21, 1997

cc w/enclosures:

H. Lefevre, NRC

R. Hindman, MK-F

G. Doyle, MK-F

J. McBee, TAC

cc w/o enclosures:

S. Hamp, ERD

E. Artiglia, TAC

NRC COMMENTS
"GUNNISON, COLORADO, PROCESSING AND DISPOSAL SITES
FINAL COMPLETION REPORT"

1. Discussion: Volume 1, Critical Review Issues Section, contains a table labeled "Summary of Geotechnical Test Results" which indicates that the radon barrier material averaged 4.8 percent bentonite. However, Volume 3, Appendix E, Radon Barrier Material, page 3, indicates that the average of the 105 bentonite verification tests performed was 5.3 percent with only one test (at 4.8 percent) falling below 5.0 percent. Page 3 further indicates that a sensor malfunction failed to indicate all the bentonite in the single sample measuring less than 5.0 percent. The U.S. Department of Energy (DOE) herefore considers (and the staff concurs) that all tests demonstrated that the 5.0 percent minimum value was achieved.

Comment: Revise the bentonite value in the table to reflect an average of 5.3 percent rather than the 4.8 percent currently indicated.

Response: The table labeled "Summary of Geotechnical Test Results" contained in Volume 1, Critical Review Issues Section, had a typographical error for the average percent bentonite. The average percent bentonite is 5.3%.

Implementation: The table will be revised to document that 5.3 is the correct average percent bentonite.

2. Discussion: In Volume I, Critical Review Issues Section, the page titled "Verification Measurements & Supplemental Standards Summary Charts" is followed, not by the two referenced summary charts, but by the Type D Riprap Comparisons chart. Page 2 of the Critical Review Summary Section references Volume 3, Appendices J and K, for the two summary charts. No charts entitled "summary" were noted in either appendix. It is not clear to the staff whether summary charts were omitted from the stated location in the Critical Review Issues Section, or whether the summary charts were just not identified as such in either Appendix J or Appendix K.

Comment: Provide the appropriate summary charts for each of the five chart categories identified in the Critical Review Summary Section of the Critical Review Issues Section (i.e. Verification Measurements and Supplemental Standards) or provide the proper reference to what DOE considers summary charts.

Response: Pages in the Critical Review Issues Section of Volume 1 were either missing or out of order.

Implementation: The Critical Review Issues Section of Volume 1 will be revised so that the information is presented in the proper order. In addition, the pages have been consecutively numbered for better document control.

3. Discussion: The U.S. Nuclear Regulatory Commission (NRC) and DOE agreement relative to streamlining both the CR content and NRC's CR review documentation included the omission of many as-built drawings traditionally submitted as part of the CR, as well as the retention and continued submission of other as-built drawings. It is the staff's understanding that well abandonment

drawings were to be included among those as-built drawings to be submitted with the CR.

Comment: Provide both the Processing Site and Disposal Site as-built well abandonment drawings identified in CR Volume 2, Appendix D, Drawing No. GUN-GE-10-0102.

Response: The as-built well abandonment drawings were inadvertently excluded from the Completion Report.

Implementation: As-built drawings for Processing and Disposal site well abandonment will be included in Appendix D of the completion report.

4. Discussion: Page 3 of Appendix J (Verification Measurements) indicates that the 1000-year bulk average Ra-226 is 10.6 pCi/g, with a maximum value of 17.5 pCi/g, excluding supplemental standard areas. However, the 1000-year Ra-226 value itself is a supplemental standard value for residual Th-230.

Comment: Clarify that these values exclude the supplemental standard areas for Th-230 in the water table.

Response: Some of the Appendix J samples are supplemental standard grids (i.e., sampled for Th-230) and are also in the water table. Therefore, the clarification given in the comment would not be correct. However, the statement given in the discussion could be corrected to reference supplemental standard areas given in appendix K.

Implementation: The statement on page 3 of Appendix J will be changed to indicate that the average and maximum values given exclude supplemental standard areas outlined in Appendix K.

5. Discussion: Staff notes that about 38 verification grids will contain 17 to 17.5 pCi/g Ra-226 in 1000 years because of residual Th-230. This is at, or just below the bulk Th-230 limit for areas above the water table. This remediation does not appear to be ALARA.

Comment: DOE should justify that reasonable attempts were made to remediate Th-230 in these areas.

Response: The last paragraph in Section 1 of the "Generic Protocol for Th-230 Cleanup/Verification at UMTRA Project Sites", indicates that the concentration limits given in Section 2 are health protective by reducing exposure to levels that are ALARA. Section 2 of the Generic Protocol gives the 1000-year Ra-226 standard of 5 pCi/g in the top 15 cm of soil and 15 pCi/g in successive 15 cm layers. It is assumed that background (2.5 pCi/g) is not considered part of the cleanup standard, just as indicated in the EPA Ra-226 standards. Due to the substantial cost of excavation, transport, and disposal of material considered contaminated, it would not be reasonable to excavate Th-230 to levels below the established standard. Therefore, the cleanup standard given in the Generic Protocol for Th-230 Cleanup/Verification is considered to be ALARA.

Implementation: None required.

6. Discussion: Based on the contamination limits indicated on Appendix J, Drawing No. GUN-SV-0001, data for a number of grid blocks has not been provided.

Comment: Submit additional grid data (Table J.4) for blocks A-30 to 32, A-37 to 40, A-45 to 46, B-22, B-25 to B-28, B-30, B-31, B-36 and B-44.

Response: Grid Blocks A-30 to 32, A-37 to 40, A-45, B-22, B-25 to B-28, B-30 to 32, B-36 and B-44 are part of the airport vicinity property. The data for these areas will be covered by the vicinity property completion report. This is explained on the top of page 5.

Data for grid blocks A-46, B-33 to 35, and B-41 to 43 are contained in Tables J.4.a, J.4.b and K.1.

For the north side of the processing site you may note that Tables J.4.a, J.4.b and K.1 contain data that appear to be outside the designated processing site boundary. When designation of the adjacent vicinity property occurred, the boundary line fell north of the designated processing site boundary. This left a void zone between the vicinity property and the designated processing site. All of the data collected in this void zone is documented in the completion report for the designated processing site. The drawings in Appendix J and K only show the designated processing site boundary; they do not show where the vicinity property boundary begins.

Implementation: None required.

7. Discussion: Some grids in blocks E-12 to 16 and E-20 to 24 do not have data indicated in either Appendix J or Appendix K.

Comment: Provide grid data as necessary, or justification for why there is no data.

Response: The DOE has reviewed the information contained in Table J.4.a, J.4.b and K.1 for grids in blocks E-12 to 16 and E-20 to 24. The data for these grids are contained in Table J.4.b and Table K.1. The DOE cannot identify any missing information.

Implementation: None required.

8. Discussion: Appendix J does not address the assessment of uranium contamination. The Remedial Action Plan (RAP) indicated that uranium concentrations would be assessed, and if remedial action was indicated, a supplemental standard would be proposed.

Comment: Summarize the Special Study that: 1) assessed the potential impacts of residual uranium soil contamination on ground water and 2) evaluated the need for a supplemental standard for uranium (see page 2 of DOE's Site-Specific Analysis, January 1994).

Response: The DOE agrees with the NRC comment.

Implementation: A brief discussion of the special subpile study will be added to the Appendix J. Included in this discussion will be data for the test pit #16 area along with other uranium soil concentration data for the rest of the site. A copy of the uranium cleanup protocol will also be included.

9. Discussion: Appendix K, page 3, states that for Th-230 in the water table, at the site manager's discretion, one foot of select fill (high clay content soil) will be placed as low in the excavation as practicable where Th-230 in the finer portion of the sample is greater than 175 pCi/g (approximates 15 pCi/g bulk averaged Ra-226 in 1000 years) to control radon emission. However, page 5 states that 41 grids in the subpile area had greater than 175 pCi/g Th-230, but select fill was not placed (Figure K.1). DOE's ALARA analysis of the future potential health risks, due to the 41 grids, consists of radon flux estimates for each grid (average values were used for other supplemental standard areas). DOE's flux model assumes that: 1) there is a low water table and the fill is saturated, 2) the Th-230 remains buried, and 3) the risk is to workers in a building on the modeled grid. DOE concludes that only one grid exceeds 650 mrem/yr, which is the dose expected at 0.02 WL (radon progeny concentration) for 50% resident occupancy. The estimated dose for that one grid was 1600 mrem/yr.

Comment:

- a. DOE needs to explain why the 41 grids did not receive select fill.
- b. In order to substantiate the modeling assumptions and resulting risk assessments, DOE should indicate in the CR how the backfill on the site remains at the current thickness for at least 200 years. If backfill thickness cannot be maintained, the radon flux models should be revised and other exposure pathways should be considered in addition to radon inhalation.
- c. Indicate in the CR what commitments, if any, the State of Colorado has made in terms of land use restrictions or required efforts to mitigate future radiation exposure due to the large areas of elevated Th-230.
- d. Use a generally accepted public dose limit such as 100 mrem/yr, for comparison to the modeling results.

Response:

- a. The 41 grids did not receive select fill due to an administrative error.
- b. The state of Colorado has indicated that they intend to turn this property over to Gunnison County for their use to house county shop buildings, specifically for the Road and Bridge Department. The radon flux modeling contained in the completion report is representative of this anticipated future use (e.g., slab on grade construction). Because of the relatively shallow ground water table it is not anticipated that a foundation will be built below grade. Therefore, radon flux modeling using a reduced cover layer thicknesses was not felt to be required.

There is a potential for Th-230 contaminated material to be uncovered during installation of utilities associated with the county shop buildings, thereby causing the Th-230 material to become an airborne radiological hazard. Analysis of this pathway will be included in the completion report.

- c. The DOE does not feel that it is appropriate to discuss land use restrictions in the completion report. The completion report is written to document the as-left conditions of the site so that property owners can make sound decisions regarding future use of the property. The proper vehicle for outlining land use restrictions would be in the land transfer documentation (quick claims, easements, title transfers, etc.). In their letter to the DOE dated September 6, 1996, the State of Colorado has indicated that they intend to require the following land use restrictions: 1) the property owner will be required to properly dispose of or replace any contaminated material that is exposed; and 2) the state will require radon vent systems on enclosed structures.
- d. The limit used was chosen because it can be related to the standard established by the EPA in 40 CFR 192 for radon progeny exposure. This exposure limit has been accepted by both the regulators and the general public.

Implementation:

- a. Page 5 will be modified to state that the reason select fill was not placed on the 41 grids was due to an administrative error.
 - b. The DOE will perform further risk assessments on other pathways associated with airborne exposure of Th-230 contamination to workers. This information will be included in Appendix K.
 - c. None required.
 - d. None required.
10. Discussion: The second sentence on page 8 of Appendix K indicates that grid B-43-16 had the highest 1000-year Ra-226 of grids not receiving select fill that had Th-230 in the fines of less than, or equal to 175 pCi/g. However, Table K.1 indicates that the grid B-43-16 bulk Th-230 concentration in the fines portion was 457 pCi/g (fines represent about 25 percent of the bulk sample). Also, grids B-43-8 and D-17-19 did not receive select fill and have higher 1000-year Ra-226 values than did grid B-43-16.

Comment: Correct page 8 of Appendix K based on data presented in Table K.1.

Response: The completion report contains an error for location B-43-16. Review of the data for location B-43-16 indicates that this grid did receive select fill and had a Th-230 concentration greater than 175 pCi/g in the fines. DOE will re-evaluate which of the grids is considered to be worst case (based on thickness of backfill and 1000-year Ra-226 concentration) and model exposure for this grid.

While reviewing the information in Appendix K we determined that grid location D-34-07 indicated an incorrect bulk Th-230 concentration of 80.7 pCi/g. This value is actually the fines concentration not the bulk concentration. Therefore, the resulting 1000-year Ra-226 concentration is 15.2 pCi/g. Location D-34-07 should be included in Table J.4.b not Table K.1.

Implementation: The text in Appendix K will be revised to reflect the analysis performed for the worst case scenario. Grid location D-34-07 will be removed from Table K.1 and added to Table J.4.b.

11. Discussion: As indicated by Comments 9 and 10, the Generic Protocol for Th-230 Cleanup/Verification says one foot of select fill (high clay content soil) will be considered for placement in the excavation where Th-230 in the finer portion of the sample is greater than 175 pCi/g, but Table K.1 demonstrates that implementation was for 175 pCi/g bulk Th-230. Since the fines portion averages 25 percent of the bulk sample, DOE used a guideline value four times higher than expected.

Comment: Revise Appendix K to address the above matter, and to point out that grid C-48-23 has a 1000-year Ra-226 value of 187 pCi/g and a bulk Th-230 concentration of 524 pCi/g.

Response: The NRC is mistaken regarding their statement that select fill was used when the bulk Th-230 was greater than 175 pCi/g. Aside from the 41 grid locations, all other locations with Th-230 fine concentrations greater than 175 pCi/g were backfilled with select fill. This can be verified by reviewing Table K.1 which shows that grids with bulk Th-230 values lower than 50 pCi/g were backfilled with select material. The two errors identified in Comment 10 and the fact that the 41 grids from Table K.2 (not receiving select fill) were also included in Table K.1 may have caused confusion on when select fill was placed.

From the above discussion it was not apparent why NRC wanted the DOE to highlight the radioactive concentration for grid location C-48-23. This question was further delineated during discussions with the NRC. NRC indicate that they wanted DOE to perform risk analyses for the grids that caused the highest risk due to Th-230 concentration versus depth of backfill.

Implementation: As discussed in response to comment 10, DOE will re-evaluate the Th-230 data versus backfill data to determine which grid location(s) cause the highest risk and model exposure for this grid.

12. Discussion: Appendix E (Material Testing) of the CR includes some data on the placed contaminated material and on the Fill Type B used for the frost protection layer.

Comment: Provide the average placement moisture for the above materials for comparison to the long-term values used in the radon flux model.

Response:

- a. Very conservative estimates were used in the as-built radon barrier calculation for the moisture contents of the contaminated materials, i.e., estimates were based on 15-bar moisture content test results. It is not considered reasonable to expect that the contaminated materials will ever dry to such low moisture contents when they are covered by a minimum of 9.1 feet of overlying material.
- b. Select Fill Type B was not incorporated in the as-built radon flux model. The as-built analysis model uses the radon barrier as the uppermost layer beneath the atmosphere. Results of the analysis show that the 18 inch thick radon barrier is sufficient to meet the EPA standards for radon flux.

- c. The uppermost 6 feet of material underlying the radon barrier is cobbly soil, as modeled in the as-built radon barrier calculation. The predominant portion of the cobbly soil placed was not testable by ASTM D698, and therefore in-place moisture and density tests were not made.

Implementation: None Required.

13. Discussion: Design calculations have not been included in the CR. The Table of Contents (Volume 2 and 4/4A) indicates that an interested party either: 1) refer to the RAP or 2) contact the DOE. Since the NRC staff has not been privy to radon barrier design calculations subsequent to its September 1993 Final Technical Evaluation Report (FTER) for the RAP, these post-FTER calculations should have been included within the CR. This especially true since the NRC staff made a specific FTER request that the radon barrier design calculations be incorporated within the CR. Additionally, based on a September 4, 1996, conversation, the DOE's Site Manager indicated that this calculation had not yet been made but would be made in the near future and shortly thereafter provided to the NRC staff for its review.

Comment: Provide this calculation as soon as possible, so that NRC staff can complete this particular element of its CR review.

Response: This Radon Barrier calculation was informally transmitted to the NRC in November 1996. The calculation will be formally transmitted as part of the page changes to the completion report. In addition, the completion report will be revised to include a list of all calculations that are considered to be pertinent for assessing the design of the as-built cell. Any calculation included on this list that has been revised or is new since agency approval of the Remedial Action Plan will be included as part of the completion report.

Implementation: Included in the completion report will be a list of all calculations that are considered pertinent for assessing the as-built cell design, and a copy of each calculation that is new or has been revised since agency approval of the Remedial Action Plan. The Radon Barrier calculation will be included in this list of calculations.

Response to CDHPE Comments
Gunnison, Colorado Completion Report

Comment 1, Copy of Completion Report to Community. Due to the fact that this report will play an important role in the future land use decisions at the site, and the CDPHE has already received several requests for review of the Durango Completion Report, we believe that a copy of the Completion Report should be provided to the Gunnison community, either via the public library of the county.

Response. A copy of the completion report will be provided to the Gunnison public library once the document has been concurred upon by the NRC and CDPHE. DOE will send a copy of the document to Gunnison County if requested by either CDPHE or County officials.

Implementation. None

Comment 2, Items not included in Report- General Information. We were surprised to find that the Completion Report does not contain much of the general information about remediation that used to be included in the reports. For example, the report does not specifically state the dates of remedial action activities, or who the subcontractor was. Also missing is general information about backfill activities at the processing site, for example, the quantities of select and general backfill are not provided, nor their compaction requirements. We view the Completion Report as a stand-alone document that will be used extensively as a reference in the future as questions arise regarding how and when the remedial action was conducted. We strongly encourage DOE to further embellish the Volume 1 Summaries to contain more of this general-type information.

Response. The purpose of a completion report is to demonstrate that the design criteria established in the RAP was met. Because of the vast amount of documentation and information associated with an UMTRA remedial action the DOE never intended that the completion report be a stand-alone document. Therefore, references are provided within the completion report should information beyond the scope of the document be required.

To facilitate NRC review of the document two versions of the completion report were developed. The NRC version only contains information that is felt to be critical for verifying compliance to the design criteria (i.e., cell construction data, processing site contamination verification data). The DOE version contains other noncritical information considered by the NRC to be non-essential for certification and licensing of the site. The CDPHE was provided with the NRC version of the completion report. In the future the CDPHE will be provided the DOE version of the completion report rather than the NRC version. When finalized the DOE version will be sent to the Gunnison local library.

The DOE believes that for the most part sufficient summary level information is contained in the Volume 1 of the DOE version of the Completion Report. The specific dates that remedial action was performed can be added to Section III, Remedial Action Assessment, of Volume 1. Volume 1, Certification Basis, states that MK-Ferguson Company was the remedial action contractor and

that MK Environmental Services Inc. was the design contractor. The DOE does not feel any value is added by discussing other lower tier subcontractors who worked on the project.

The DOE agrees that for the Gunnison remedial action, in particular, information regarding backfill at the processing site is important and that this information should be included in the completion report.

Implementation. Section III, Remedial Action Assessment, of Volume 1 will be revised to include the date remedial action was performed. Appendix E will be modified to include information regarding backfill thickness, compaction requirements, and how to distinguish general backfill from select fill material.

Comment 3, Items not included in Report- Backfill at Processing Site. The Completion Report does not include information about the backfill materials at the processing site. In particular, we need information regarding the specifications. In addition, we need information regarding how the select backfill can be distinguished from the general fill and what the compaction requirements were. This information will be very important in terms of future land use at the processing site.

Response. The DOE agrees that for the Gunnison remedial action, in particular, information regarding backfill at the processing site is important and that this information should be included in the completion report.

Implementation. Appendix E will be modified to include information regarding backfill thickness, compaction requirements, and how to distinguish general backfill from select fill material.

Comment 4, Items not included in Report - Site Specific Cleanup Procedures. The Completion Report fails to address adherence to the cleanup procedures that were established for uranium (reference MK letter to S. Arp, date 8/4/94, "Revised Gunnison Test Pit 16 Excavation Protocol"). A section should be added to the Completion Report to address this issue and confirm that the agreed-upon protocol was followed. In addition, CDPHE previously requested and was provided with information regarding the depth of excavation at the site compared against the original test pit data for uranium. We believe that this information is important to include in the Completion Report, and strongly recommend that it be added. During the groundwater compliance phase of the project, information regarding potential secondary sources of contamination will prove to be critical in terms of determining the appropriate compliance strategy. Any information that was gathered during remediation with respect to contaminant concentrations left behind should be included in the Completion Report.

Response. The entire Test Pit #16 area was excavated to 3' below the tailings/soil interface. Because of the nature of test pit operations (e.g., obtaining a point sample with a backhoe), the uranium information obtained is only a rough estimate of the likely conditions at the site. However, uranium analysis was conducted on approximately 9% of the site soil verification samples collected from the northern subpile area and the former mill yard area.

The DOE agrees that the completion report should provide all available information regarding contaminant concentrations that were left on the processing site. However, as previously stated, the DOE does not agree that the completion report should contain all the information gathered or generated as a result of characterizing the contamination profile at the site.

Implementation. Information regarding excavation in the test pit 16 area will be included in the Appendix J of the completion report. In addition, uranium analysis performed during site verification will be added to Appendix J.

Comment 5, Items not included in Report - Radon Diffusion Coefficient Data. In Calculation Number GUN-643-01-02 it is stated that "laboratory tests will be performed to verify the actual coefficient of radon barrier when treated with bentonite." We could not find this new data in the Completion Report.

Response. This data is contained in Calculation Number GUN-643-01-03. This calculation was inadvertently left out of the completion report.

Implementation. Calculation Number GUN-643-01-03 has been included in Volume 4/4A of the completion report.

Comment 6, Radon Barrier Bentonite Content. In Volume 1, Critical Review Issues: Appendix E, Summary of Geotechnical Test Results, the table shows that the average bentonite content of the radon barrier is only 4.8%, which is below the minimum required in the design. In Volume 3, Radon Barrier, Page 3, it is stated that 105 verification tests were performed for the percent bentonite, 104 of which met or exceeded the design requirement. Since this is a critical design component, the Completion Report should contain better documentation of the procedures used to verify bentonite content, and a table which shows the actual data points (or provide an appendix that contains the raw data).

Response. The chart, "Summary of Geotechnical Test Results", provided in the Critical Review section of Volume 1 contained a typographical error for the average percent bentonite. The average percent bentonite is 5.3%. The 4.8% reading was the only bentonite verification test which failed to meet the minimum 5.0% bentonite content requirement. A quality deficiency report was written for this deviation.

Since the method used to verify the percent bentonite added to the radon barrier material is not standard, the DOE agrees that it is appropriate to outline this procedure in the completion report and provide the verification data.

Implementation. A brief summary of the procedures used to verify the percent bentonite added to the radon barrier and the verification data will be added to Appendix E.

Comment 7, Items not included in Report - Settlement In Volume 3, Appendix E, Contaminated Material the preload fill is briefly discussed. However, there is no mention of whether or not the predicted settlement actually occurred. Are any data or visual observations available to verify that settlement occurred as predicted?

Response The amount of settlement due to the preload was not an issue. The issue was to ensure that the primary compression in the materials underlying the radon barrier occurred prior to placement of the radon barrier. In addition, the designed height of the preload was conservatively estimated so that it would not be necessary to perform settlement measurements in the field. Therefore, the approved design did not include any requirements for measuring the amount of settlement due to the preload.

Implementation None.

Comment 8, Verification/Soil Cleanup, Original Test Pit Data In comparing the original test pit data to the excavation that took place on the site, we are concerned about the fact that in the area of TP-18, it appears that very little excavation took place, yet the test pit data shows tailings to an elevation of approximately 7,041 feet and high concentrations of thorium at depth, which would have necessitated the placement of select fill in this area. Please provide information that confirms that the contaminated materials were removed from this area. (See also, Comment 14, below regarding use of the original test pit data during excavation.)

Response All tailings material was removed during remediation, and within 15 feet of the given coordinates for TP-18. Soil verification samples collected according to the verification protocol confirm that all contaminated materials (Ra-226 and Th-230) were removed from the area. Excavation was conducted below elevation 7640 (the elevation listed in the comment should be 7641 rather than 7041), which was one foot below the water table at the time of excavation.

Coordinates for Test Pit No. TP-18 indicate that the test pit is located at the edge of the steep cut bank in the final excavation surface. Since it is common for the test pits to be dug within several feet of the staked location (to preserve the marker), the actual test pit may have been dug in the area of the deeper excavation. An additional search for the records will be made to determine if any other factors are or could be responsible for the apparent discrepancy in the cross section. If any firm evidence is found to revise the cross section, a revised cross section will be included in the completion report. Because of the method that the samples were obtained (samples were collected in a contaminated zone using a backhoe) data collected during test pitting activities could indicate contamination at deeper depths due to cross-contamination.

It should be remembered that test pitting was originally conducted to obtain cobbles-to-fines information. Determining the radionuclide concentrations at various depths was later added to the protocol so that DOE could gain a better handle on contaminated material quantities. Test pit sampling was never intended to be used as an indicator of the effectiveness of remediation.

Implementation None.

Comment 9, Verification/Soil Cleanup, Site Specific Procedures. Appendix J does not contain the site-specific Cobbles-to-fines, Surface and Subsurface Cleanup, and uranium cleanup protocols. Since we view the Completion Report as a stand-alone document, we believe it is very important to include these site specific procedures.

Response. The DOE agrees that these protocols should be part of the completion report since they are not standard operating procedures (e.g., ASTM). As stated previously, however, the DOE does not consider the completion reports to be stand-alone documents. The cobbles to fines procedure is already in Appendix J. The Surface and Subsurface Cleanup Protocol and the uranium cleanup protocol will be added to Appendix J.

Implementation. Add the Surface and Subsurface Cleanup Protocol and the uranium cleanup protocols to Appendix J.

Comment 10, Appendix J, Verification Measurements. Page 2 - it is unclear why there is a difference between the bulk background Ra-226 concentration of 1.8 pCi/g and the bulk 1,000 Ra-226 concentration of 2.5 pCi/g. The document should clarify that the 1,000 year value includes thorium (this explanation is much clearer in Volume 1, Remedial Action Assessment, page 10).

Response. The bulk background Ra-226 concentration does not include Ra-226 produced from Th-230 decay or the reduction of Ra-226 due to decay. However, the bulk background 1,000 year Ra-226 concentration does include the decay of Ra-226 and the Ra-226 produced from Th-230 decay in 1,000 years.

Implementation. The text on page 2 of Appendix J will be changed to clarify the 1000-year bulk background Ra-226 concentration.

Comment 11, Land Use Controls/Future Site Use. The Supplemental Standards (Appendix K) discussion focuses on the risks resulting from radon gas emanation. This package is incomplete without a discussion of other risks that are posed by the remaining thorium, i.e. risks to persons directly exposed to the deposits. In addition, the DOE should provide information that can be used by CDPHE in the future to the predict risks should any of the backfill be removed, or more importantly, if the thorium deposits themselves are disturbed.

Response. MK-F will assess the risks associated with excavating into the Th-230 contaminated soils for construction purposes such as placing a water line or other utilities.

Implementation. Appendix K will be modified to include an assessment of risks associated with uncovering Th-230 contaminated soil deposits during a construction effort.

Comment 12, Future Land Use Maps. The maps included in Appendix K will be beneficial in terms of identifying areas where future land use activities will need to be controlled. However, we request the following three changes: 1) Figure K-1 should include the depth to contamination. 2) An additional map should be produced that combines the data from figures K-1, K-3, and K-4.

This combination map will show the depths at which material into which excavation must be controlled exists (either select backfill or thorium deposits). All maps need to include the TP-3 area see Comment 14, below). 3) Figure K-2 will be used as part of the deed annotation for the site (that is, the figure will be part of the formal deed that will be recorded in the County Clerk's Office). Therefore, this figure needs to include the 41 thorium no-select fill grids, and the TP-3 area.

Response. The requested changes will be incorporated into the completion report. NOTE: All maps will and associated tables should refer to the original survey data provided by Ames Construction for the as-built excavation limits and final grading elevations. All other values are derived estimates which include approximations. Furthermore, subsequent grading (such as the relocation of Gold Basin Road) is not considered in determining depths.

Implementation. 1) Figure K.1 will be revised to include the depth to contamination for the 41 grid locations. (The location of the 12 subgrids around TP-3 will be added, but there is no data to use to estimate the elevation of the limit of excavation at the location of TP-3), 2) Figures K.1, K.3 and K.4 will be combined as requested onto one or two figures (The labels for block, grid, and subgrid may not fit next to each of the 41 subgrids. Subgrid numbers (only) may fit. The 12 subgrids at TP-3 will be added), 3) Figures K.1 and K.2 will be combined as requested

Comment 13. Discussion Regarding Site -Specific Thorium Protocol. On page 2 of Appendix K, the value of 175 pCi/g is described as the concentration in the fines "approximately equal to 15 pCi/g or Radium-226 in bulk soil after 1,000 years of decay". This is incorrect. This value was determined to be a concentration above which the use of select backfill was necessary to keep the radon flux below 3.9 pCi/m²-sec. Due to the confusion over this value, and the lack of explanation for its derivation in the parent document (Site-Specific Protocol) the original assumptions used to generate this value (the depth of backfill, soil properties, etc.) should be recapped in the Completion Report. The discussion should then include whether the final site conditions met the assumptions. That is, is it safe to assume that the grids that contain select backfill meet the radon flux standard?

Response. The derivation of the 175 pCi/g value will be summarized in the completion report. Page 8 of Appendix K states that when the select fill is saturated by the seasonal high water table, radon emissions will be negligible which indicates that the grids that received select fill will meet the radon flux standard after the select fill is saturated.

Implementation. The derivation of the 175 pCi/g value will be summarized in Appendix K of the completion report.

Comment 14. Verification/Soil cleanup. Select Backfill in Test Pit 3 Area. In Appendix K, a discussion is included regarding the area surrounding TP-3. The Thorium Protocol specifically called for placement of select backfill in the grids surrounding TP-3 because the original test pitting activities revealed thorium at depth below a level where the standards would be met. (The test pit data showed that the standards were met at the tailings/cobble interface, but below the interface, thorium concentrations were substantially higher.) This was a key issue in terms of

CDPHE approval of both the Thorium and the Cobbles-to-fines protocols. Our concern was that buried lenses of higher concentration material could be left at depth when these protocols were used to halt the excavation at a higher elevation. Therefore, provisions were made to address this issue. Specifically, the original test pit data were used to be utilized by site personnel to compare against what was found in the field. When discrepancies were noted, additional test pitting was to be conducted. Apparently this did not occur, as the data for TP-3 were ignored. (See also, related Comment 8). The Thorium Protocol specifically recognized the problem in the area of TP-3 and required the placement of select backfill to minimize the radon emanation from the thorium deposit known to exist at depth. The DOE must address the issue of residual risk from radon emanation and the risks from future disturbance of the thorium deposit in this area. This information should be included in Appendix K and the area in question also be noted on the Appendix K figures.

It is also unclear what is meant by the statement that TP-3 was between two grids and therefore, only 6 surrounding grids would have needed select backfill (Appendix K, page 4). There may be some confusion regarding the location of TP-3. TP-3 was located at the northwest corner of the site, and there are not two surrounding grids in the area.

Response. The DOE never intended to use the test pit data to guide excavations in the field. As discussed in response to comment 8, the test pit data was only used to better quantify the amount of contaminants at the processing site. In order to avoid performing additional test pitting activities during field excavation the requirement was added to the Thorium Protocol to place select backfill in the grids that surround TP-3. Unfortunately, this area was excavated and backfilled in mid 1993 which was prior to DOE directing MK-F to implement the protocol. When implementing the protocol, MK-F made the decision that they would not re-excavate and place select fill as required in the protocol. This decision was not discussed with DOE.

At this time it is not felt to be reasonable to place select fill in this area. Therefore, DOE will perform a risk assessment based on the highest observed 1000-year radon flux estimates for this location. This information would then be added to the completion report as part of the supplemental standards discussed in Appendix K. In addition, TP-3 will be added to Figure K.1.

The test pit is not wholly within one grid location. It is located on the middle of the line separating two verification grid locations (C-04-17 and C-04-22). Therefore, the choice of symmetrically surrounding grids would be 2, 6, 8, or 12 (not 9).

Implementation. Modify Appendix K to include a risk assessment for the TP-3 area. Add the TP-3 area to the Figure K.1.

Comment 15, Area-weighted Averages. On page 6 of Appendix K, area weighted averages are discussed. The area-weighted average calculations should be included in this package as it is hard to understand the summary without being able to actually see how the calculation was performed.

Response. The radon flux estimate of 1.38 pCi/m²-s given on page 7 of Appendix K is an area weighted radon flux estimate. Area weighted values are calculated by multiplying parameters (in this case average radon flux values) by the amount of area affected by each parameter (in this case # of grids with select fill and # of grids without select fill), summing the products and dividing by the total area (in this case total number of grids).

Implementation. The method for determining area weighted averages will be included in Appendix K.

Comment 16, Radon Flux Analysis. In the Radon Flux Analysis on Page 7 of the Appendix K, it is unclear why grid B-43-16 was chosen for this analysis, when the radon flux is dependent upon both the thorium concentration and the depth of the backfill. Another grid, with less backfill and lower thorium concentration may actually have a higher flux.

Response. Grid B-43-16 was incorrectly identified. Location B-43-16 received select fill and has a Th-230 concentration greater than 175 pCi/g in the fines. The text and the table will be corrected as needed to address this location. In addition, the text will be modified to include the worst case situation based on thorium concentrations and depth of backfill, rather than the highest 1000 year Ra-226 concentration.

Implementation. The text will be modified to reflect this information.

Comment 17, Risk Calculations, Approximate Standards. The risk calculations included on Page 8 of Appendix K should be compared against an exposure standard rather than using only a comparison between occupancy of a home with 0.02 WL. DOE orders or NRC guidance and/or regulations should be used which provide the appropriate exposure limits for workers.

Response. Persons being exposed at the site in the future would not be considered radiation workers and would not have radiological training to help limit their personal exposure. Therefore, exposure standards for workers contained in NRC guidance or DOE guidance is not appropriate to use in this case. Public exposure standards are based on a 100 mrem/year limit for individuals exposed to a licensed (NRC or state) or a regulated (DOE) radiation source. The processing site will not be licensed by the NRC (or state) or regulated by the DOE. However, this standard would be most appropriate for comparison to exposures received from gamma radiation or other airborne radionuclides such as Th-230 where there are no UMTRA EPA standards established. The comparison given in the completion report is appropriate since equivalence to UMTRA EPA cleanup standards for radon emissions is being demonstrated.

Comment 18, Number of Grids Exceeding the Flux Standard. On Page 8 of Appendix K, the discussion states that 14 locations exceed the 3.9 pCi/m²-sec flux standard. However, on Table K-3, only 13 such grids are listed.

Response. There are 14 locations on Table K.3 that exceed the 3.9 pCi/m²-s standard.

Implementation. None.

Comment 19, Location of Grid D-04-21. The discussion about the worst-case grid, D-04-21 on Page 9 of Appendix K, should more clearly indicate that this grid is on the airport property, near the emergency runway and not on the mill site itself. The text should acknowledge that since this grid is off-site, the State of Colorado will not have control over its land use.

Response. The indicated text will be added to the completion report.

Implementation. Page 9 of Appendix K will be modified.

Comment 20, Table K-1. Table K-a. The last column should be listed as a bulk value. Units should be listed for the depth column.

Response. The suggested changes will be added to Table K.1 and Table K.2.

Comment 21, Table K-4 and use of maps K.3 and K-4. Table K-4 appears to only contain the data for the depth to the select fill layer for grids at the corners of larger areas. Can we assume then that excavation in the middle of one of these areas could be performed to some intermediate depth interpolated from the corner elevations without disturbing the select fill? If not, we will need to be provided with the depth data for every grid that contains select fill. Table K-4 will be most useful if it is used as an overall guide as to how deep an excavation can proceed at any point on the site. Thus this table should also include the depth to the thorium deposits that did not receive select fill.

Response. Survey data for the bottom of select fill were only provided at the corners of the select fill. Therefore, supportable estimated depths of the top of select fill can only be made at the corners originally surveyed.

Two factors must be considered in using all the estimated depths from the ground surface to another point. First, all grading subsequent to the surveys will not be reflected in the depth of estimates. This includes grading already performed by the county for the relocation of Gold Basin Road. Second, interpolation is required between actual survey points to estimate elevations at subgrid locations, since the original survey followed the ground features, not the subgrid locations.

Implementation. The original survey data will be included in the completion report to be used as the guide to the location of the select fill and the Th-230 contamination at the limit of excavation for the appropriate subgrids.