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

May 5, 1997

Mr. Joseph J. Holonich, Chief
Uranium Recovery Branch
Office of Nuclear Materials
Safety and Safeguards
Mail Stop T7J9
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852-2738

Dear Mr. Holonich:

Enclosed are four copies of the final page changes (numbered Attachment 1 through 12) for incorporation into the preliminary final Clive Completion Report, dated March 1996. All of the changes made to the Completion Report, except for the changes discussed in items 9 and 10 below, were necessary to document the corrective action repairs that were recently completed. Corrective action repairs were required because some of the erosion protection material in various areas on the disposal cell did not meet the design intent (see Appendix K of the Completion Report).

Attachments 1 through 8 and Attachment 10 contain redlined pages to show where text was added and deleted. Behind the redlined pages are the replacement pages for incorporation into the Completion Report. Attachments 9, 11 and 12 only contain replacement pages. Please follow this step-by-step procedure for revising your copies of the Completion Report.

1. Locate Volume 1, pages i and ii, Table of Contents. Remove and destroy page i and ii. Insert replacement pages contained in Attachment 1.

2. Locate Volume 1, Section I, Executive Summary. Remove and destroy the text. Insert replacement pages contained in Attachment 2.

3. Locate Volume 1, Section III, Remedial Action Assessment. Remove and destroy the text. Insert replacement pages contained in Attachment 3.

4. Locate Volume 1, Section IV, Certification Basis. Remove and destroy the text. Insert replacement pages contained in Attachment 4.

5. Locate Volume 1, Appendix D, As-Built Drawings. Remove and destroy page D-2. Attachment 5 contains the replacement page D-2 and a new as-built drawing labeled Figure 5. Insert replacement page D-2 after page D-1. Insert the new as-built drawing, Figure 5, after Figure 4.

6. Locate Volume 2A, tab entitled Filter Zone Material. Remove and destroy the text. Insert the replacement pages contained in Attachment 6.

7. Locate Volume 2A, tab entitled 1-1/2 Inch Erosion Protection. Remove and destroy the text. Insert the replacement pages contained in Attachment 7.

8. Locate Volume 2A, tab entitled 8 Inch Erosion Protection. Remove and destroy the text. Insert the replacement pages contained in Attachment 8.

9. Locate Volume 2B, Calculation SLC-13, Aquifer Restoration. Remove and destroy the calculation located after the calculation title page. Insert the replacement page contained in Attachment 9. This calculation does not support the construction of the Clive disposal cell; it is associated with ground water restoration at the Vitro processing site. Therefore, it is not appropriate for presentation in this document.

10. Locate Volume 3, Appendix H, Post Remedial Action Site Conditions. Remove and destroy the text. Insert the replacement pages contained in Attachment 10. These page changes were required to document why the information contained in Attachment 1 of Appendix H is in this document. In addition, it deleted reference to two figures that do not exist.

11. Locate Volume 4. At the end of Appendix K insert replacement pages (Appendix L tab and text) contained in Attachment 11.

12. Replace the covers and spines on each Volume with the replacement covers and spines contained in Attachment 12.

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

Sincerely,

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

Enclosures

cc w/o enclosures:
H. Lefevre, NRC
S. Hamp, ERD
E. Artiglia, TAC
S. Cox, TAC
C. Spencer, MK-F

ATTACHMENT 1

SOUTH CLIVE SITE
URANIUM MILL TAILINGS REMEDIAL ACTION
COMPLETION REPORT

TABLE OF CONTENTS

ATTACHMENT 2

I. EXECUTIVE SUMMARY

The purpose of this completion report is to provide evidence that the final South Clive Disposal Site conditions are in accordance with the approved design, and that all U.S. Environmental Protection Agency (EPA) standards have been satisfied. Included as appendices, in order to support the stated conclusions, are the design calculations, as-built drawings and specifications, a summary of geotechnical testing performed, ~~and~~ the post-remedial action radiological measurements, and an engineering assessment of the as-built disposal cell.

The principal objectives of the remedial action ~~are~~ were to consolidate, isolate, and stabilize the tailings so as to prevent misuse by man and dispersal by natural forces, such as wind, rain, and flood waters, and to reduce radon emissions from the tailings. The controls ~~are~~ were designed to be effective for a minimum of 200 years, and for up to 1,000 years where practical.

The Remedial Action Plan (RAP), which ~~is~~ was approved by the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and the State of Utah, ~~and which~~ contains the conceptual design. This conceptual design was used to develop the final approved design. Two sets of technical specifications were prepared and two contractors were engaged in completing the disposal cell during construction operations. Addendum No. 1 ~~was~~ amended ~~to~~ the first set of technical specifications to address several issues encountered which were not covered in the RAP and conceptual design. Modification No. 1 ~~was~~ amended ~~to~~ the second set of technical specifications to provide room for approximately 250,000 cubic yards of additional ~~contamination~~ contaminated materials from remedial action at the Vitro site and vicinity properties.

Some failing ~~field density~~ test results were recorded and reported by the State of Utah. Failing field density tests indicated that portions of the cell did not meet design specifications for the contaminated tailings and radon barrier materials. The State of Utah indicated that the failing tests were retested and the results of the retests were found to be acceptable; however, a complete record of the retest data which supports this position has not been located. The same situation applies to the gradation test results for the select filter zone (bedding) and the 1-1/2 inch, and 8-inch erosion protection materials. Additional field tests of the as-built disposal embankment were conducted and an engineering analysis was performed to assess the test results ~~were performed~~. The results of the ~~study~~ analysis ~~were able to~~ demonstrated that measured cell performance in the field is the appropriate method to determine compliance with design specifications. The ~~study~~ analysis is presented in the report, included herein as Appendix K, entitled "An Engineering Assessment of the As-Built South Clive Disposal Cell". ~~Appendix K~~. The engineering assessment demonstrated that most disposal cell components either met the requirements of the construction specifications and drawings, or otherwise met the design requirements for long-term stability needed to comply with EPA standards. The engineering assessment determined that only a few areas of the riprap cover were inadequate from a design perspective. Those areas were repaired and the results are presented in Appendix L.

In conclusion, it is our opinion that all of the site work was completed in conformance with the design requirements, specifications, and drawings, as necessary for compliance with EPA standards, and that the as-built drawings, ~~except for~~ which include results of minor remedial work of erosion protection materials recommended in Appendix K, ~~reflect~~ are an accurate depiction of the existing site conditions.

I. EXECUTIVE SUMMARY

The purpose of this completion report is to provide evidence that the final South Clive Disposal Site conditions are in accordance with the approved design, and that all U.S. Environmental Protection Agency (EPA) standards have been satisfied. Included as appendices, in order to support the stated conclusions, are the design calculations, as-built drawings and specifications, a summary of geotechnical testing performed, the post-remedial action radiological measurements, and an engineering assessment of the as-built disposal cell.

The principal objectives of the remedial action were to consolidate, isolate, and stabilize the tailings so as to prevent misuse by man and dispersal by natural forces, such as wind, rain, and flood waters, and to reduce radon emissions from the tailings. The controls were designed to be effective for a minimum of 200 years, and for up to 1,000 years where practical.

The Remedial Action Plan (RAP), which was approved by the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and the State of Utah, contains the conceptual design. This conceptual design was used to develop the final approved design. Two sets of technical specifications were prepared and two contractors were engaged in completing the disposal cell during construction operations. Addendum No. 1 amended the first set of technical specifications to address several issues encountered which were not covered in the RAP and conceptual design. Modification No. 1 amended the second set of technical specifications to provide room for approximately 250,000 cubic yards of additional contaminated materials from remedial action at the Vitro site and vicinity properties.

Some failing test results were recorded and reported by the State of Utah. Failing field density tests indicated that portions of the cell did not meet design specifications for the contaminated tailings and radon barrier materials. The State of Utah indicated that the failing tests were retested and the results of the retests were found to be acceptable; however, a complete record of the retest data which supports this position has not been located. The same situation applies to the gradation test results for the select filter zone (bedding) and the 1-1/2 inch, and 8-inch erosion protection materials. Additional field tests of the as-built disposal embankment were conducted and an engineering analysis was performed to assess the test results. The results of the analysis demonstrated that measured cell performance in the field is the appropriate method to determine compliance with design specifications. The analysis is presented in the report, included herein as Appendix K, entitled "An Engineering Assessment of the As-Built South Clive Disposal Cell". The engineering assessment demonstrated that most disposal cell components either met the requirements of the construction specifications and drawings, or otherwise met the design requirements for long-term stability needed to comply with EPA standards. The engineering assessment determined that only a few areas of the riprap cover were inadequate from a design perspective. Those areas were repaired and the results are presented in Appendix L.

In conclusion, it is our opinion that all of the site work was completed in conformance with the design requirements, specifications, and drawings, as necessary for compliance with EPA standards, and that the as-built drawings, which include results of minor remedial work of erosion protection materials recommended in Appendix K, are an accurate depiction of the existing site conditions.

ATTACHMENT 3

A total of approximately 2,798,000 cubic yards of contaminated material from VITRO processing site and other vicinity properties was placed into the cell. Vicinity property material accounted for 487,000 cubic yards.

The only radiological verification measurements conducted at the South Clive Disposal Site were radon flux measurements. Although the South Clive Disposal Site was grandfathered into the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations governing radon emissions, measurements conducted at the site followed the standard protocol described in the regulations, with a few exceptions. Only 60 measurements were conducted at the site (instead of 100) and erosion protection materials had already been placed prior to performing measurements. Therefore, before the measurements could be conducted, the erosion protection materials near the survey points had to be removed.

Radon flux measurements were performed in accordance with UMTRA RAC health physics procedure OP-003-5, Radon Flux Measurements. All measurements were well below the 20 pCi/m^2-s standard given in the NESHAP regulations. The maximum radon flux measurement result was 1.13 pCi/m^2-s. Details concerning radon flux measurements can be found in Appendix J.

Site topographical surveys, measurements, and material test results on the as-built disposal cell are contained in Appendices K and L. Conclusions and recommendations based on

~~this data~~ the post-construction engineering assessment are also presented in Appendix K. Appendix L presents the results of riprap cover repair work recommended in Appendix K.

Notes:

(a) For the initial one third of the radon barrier, the nuclear density test method was used to determine the density and moisture of the compacted radon barrier layer. Because the water added during the compaction process contained boron, the moisture content measurements were not correct. The sand cone test method was used later to replace the nuclear test method. The test results from the nuclear density test are not included in the above table.

(b) Radium emanation survey on the top ten-feet of the tailings during construction was not conducted for adjusting the radon barrier thickness design at this time.

(c) 8" diameter erosion protection material was utilized during the second contract phase of cell construction.

(d) Compaction to dry density determined by ASTM 698.

III. REMEDIAL ACTION ASSESSMENT

An assessment of the remedial action activities in meeting design requirements is given in the following paragraphs. A brief description of pre-remedial action site conditions is provided followed by descriptions of the requirements to be met. A discussion of the methods used to perform remedial action, the types of technical testing performed to verify completion in accordance with design, and a summary description of the completed conditions are provided.

A. Pre-Remedial Action Site Conditions:

The South Clive Disposal Site near Clive, Tooele County, Utah is located approximately 65 miles in a straight-line distance due west of Salt Lake City. The northern boundary of the site area is approximately 1 mile south of Clive which is a railroad siding for the Union Pacific System. The railroad right-of-way servicing this siding extends from the Salt Lake City area westward toward Nevada. Highway access to the site is provided by U.S. Interstate 80 which passes approximately 2.5 miles to the north of the site. A dirt trail intersects the highway north of Clive, extends in a southerly direction, and runs along the site's western boundary.

The site is located within a relatively flat topographic area along the eastern edge of the Great Salt Lake Desert. The site has minimal topographic relief with a slight downward gradient that is relatively uniform toward the southwest. In the vicinity of the site, the

eastern border of the desert is formed by the Cedar Mountains which rise to elevations on the order of 7700 feet.

Vegetation across the site is sparse and is typical of semi-desert low shrub land. The area is rarely used and the nearest inhabitants are 15 - 20 miles away from the site. The existing roads in the area are used by recreational vehicles and for access to a military firing range south of the site.

B. Remedial Actions:

Remedial Actions consisted of:

- Preparation of the site and erection of a security fence.
- Construction of drainage control measures to direct all storm-water runoff away from the excavated embankment to an offsite natural waterway during construction activities.
- Handling of contaminated materials during their consolidation and relocation, and placement in the final embankment area.
- Construction of radon barrier over the tailings embankment to inhibit water infiltration and radon emanation.
- Placement of rock for erosion protection on the embankment with final grading to provide suitable drainage control.

- Installation of permanent fencing to discourage inadvertent intrusion of humans and livestock.

C. Geotechnical Testing:

Geotechnical tests performed fell within three categories.

1. Testing for exploratory reasons:

These include investigations for potential sources of borrow material to meet the specification requirements. This work was performed under the direction of a soils engineer and/or geologist.

2. Testing which was performed by a commercial laboratory:

This testing was performed by a laboratory which had been evaluated and approved for that work by the State of Utah. These tests include the following:

- Permeability testing (radon barrier material);
- Specific gravity testing (rock durability);
- Absorption test, for rock durability;
- Sodium sulphate resistance testing (rock durability);
- Abrasion testing, for rock durability of erosion protection material.

3. Field Testing:

These tests were performed to verify that placement of the material was performed in accordance with the specified requirements. The Remedial Action Inspection Plan (RAIP) contains the test methods and frequencies established by the State of Utah for performing testing and inspection. The RAIP and subsequent revisions were submitted for DOE and NRC concurrence prior to implementation. All personnel who performed field testing were qualified and certified in accordance with the requirements of the approved Quality Assurance Program Plan. Test results, quantities, and frequencies are contained in Appendix E. To summarize, the following materials were tested as noted to verify compliance of the work to the specification requirements.

Subsequent testing to confirm specification requirements of the as-built radon barrier layer and erosion protection materials was performed by AGRA Earth and Environmental, Inc.

D. Summary of Post-Remedial Action Site Conditions:

The completed condition of the site is described in Appendix H. As shown in Appendix H, the South Clive Disposal Site encapsulated contaminated materials, meeting criteria established in "Design Criteria for Stabilization of Inactive Uranium Mill Tailings Sites" (June 1984) as referenced in the Remedial Action Plan.

A total of approximately 2,798,000 cubic yards of contaminated material from VITRO processing site and other vicinity properties was placed into the cell. Vicinity property material accounted for 487,000 cubic yards.

The only radiological verification measurements conducted at the South Clive Disposal Site were radon flux measurements. Although the South Clive Disposal Site was grandfathered into the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations governing radon emissions measurements conducted at the site followed the standard protocol described in the regulations, with a few exceptions. Only 60 measurements were conducted at the site (instead of 100) and erosion protection materials had already been placed prior to performing measurements. Therefore, before the measurements could be conducted, the erosion protection materials near the survey points had to be removed.

Radon flux measurements were performed in accordance with UMTRA RAC health physics procedure OP-003-5, Radon Flux Measurements. All measurements were well below the 20 pCi/m^2-s standard given in the NESHAP regulations. The maximum radon flux measurement result was 1.13 pCi/m^2-s. Details concerning radon flux measurements can be found in Appendix J.

Site topographical surveys, measurements, and material test results on the as-built disposal cell are contained in Appendices K and L. Conclusions and recommendations based on

the post-construction engineering assessment are also presented in Appendix K. Appendix L presents the results of riprap cover repair work recommended in Appendix K.

Notes:

(a) For the initial one third of the radon barrier, the nuclear density test method was used to determine the density and moisture of the compacted radon barrier layer. Because the water added during the compaction process contained boron, the moisture content measurements were not correct. The sand cone test method was used later to replace the nuclear test method. The test results from the nuclear density test are not included in the above table.

(b) Radium emanation survey on the top ten-feet of the tailings during construction was not conducted for adjusting the radon barrier thickness design at this time.

(c) 8" diameter erosion protection material was utilized during the second contract phase of cell construction.

(d) Compaction to dry density determined by ASTM 698.

ATTACHMENT 4

Section II of this completion report demonstrates that the design was prepared in accordance with the approved design criteria and Remedial Action Plan for the South Clive Disposal Site. Section III demonstrates that work was completed and inspected to verify that it meets the requirements of the design. Based on the consistency and continuity between design requirements, detailed design and completion of remedial action activities and subsequent reverification analysis as detailed in ~~Appendix~~ Appendices K and L, it is recommended that the Department of Energy certify the remedial action at South Clive Disposal Site as being completed in accordance with the established agreements and EPA Standards. ~~The recommendation is made with the understanding that erosion protection rework will be performed as outlined in Appendix K.~~

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IV. CERTIFICATION BASIS

The State of Utah hereby certifies that remedial actions are completed at the South Clive Disposal Site in accordance with the requirements of:

1. UMTRA-DOE/AL-0141.0000 "Remedial Action Plan and Site Conceptual Design for Stabilization of the Inactive Uranium Mill Tailings Site Salt Lake City, Utah," dated December 1984.

2. UMTRA-DOE/AL-0141.0000, Remedial Action Plan Addendum No.1, November 20, 1984, 8 changes in Section V, Cooperative Agreement No. DE-FC04-81AL16309.

3. UMTRA-DOE/AL-0141.0000, Remedial Action Plan Modification No. 1, April 1988, 8 changes in Section V, Cooperative Agreement No. DE-FC04-81AL16309.

4. Federal No. DE-FC04-81AL16309, Project Manual for the Uranium Mill Tailings Remedial Action Project.

5. Approved drawings and specifications for remedial action activities at the South Clive Disposal Site, prepared for the Department of Energy by the State of Utah.

6. An Engineering Assessment of the As-Built South Clive Disposal Cell.

Section II of this completion report demonstrates that the design was prepared in accordance with the approved design criteria and Remedial Action Plan for the South Clive Disposal Site. Section III demonstrates that work was completed and inspected to verify that it meets the requirements of the design. Based on the consistency and continuity between design requirements, detailed design, and completion of remedial action activities and subsequent reverification analysis as detailed in Appendices K and L, it is recommended that the Department of Energy certify the remedial action at South Clive Disposal Site as being completed in accordance with the established agreements and EPA Standards.

ATTACHMENT 5

AS-BUILT DRAWINGS

~~Drawings were~~ Figures 1 - 4 are based on the survey performed on the as-built disposal cell in September and October of 1995.

Figure 5 is the final as-built drawing and represents the condition of the cell following rework which was performed from November 1996 through March 1997. (Reference Appendices K and L.)

Figure 1	Topographic Map - Top of Rock Cover
Figure 2	Topographic Map - Surface of Radon Barrier
Figure 3	Rock Cover Thickness Contour
Figure 4	Bedding Thickness Contour
Figure 5	(Final As-Built)

AS-BUILT DRAWINGS

Figures 1 - 4 are based on the survey performed on the as-built disposal cell in September and October of 1995.

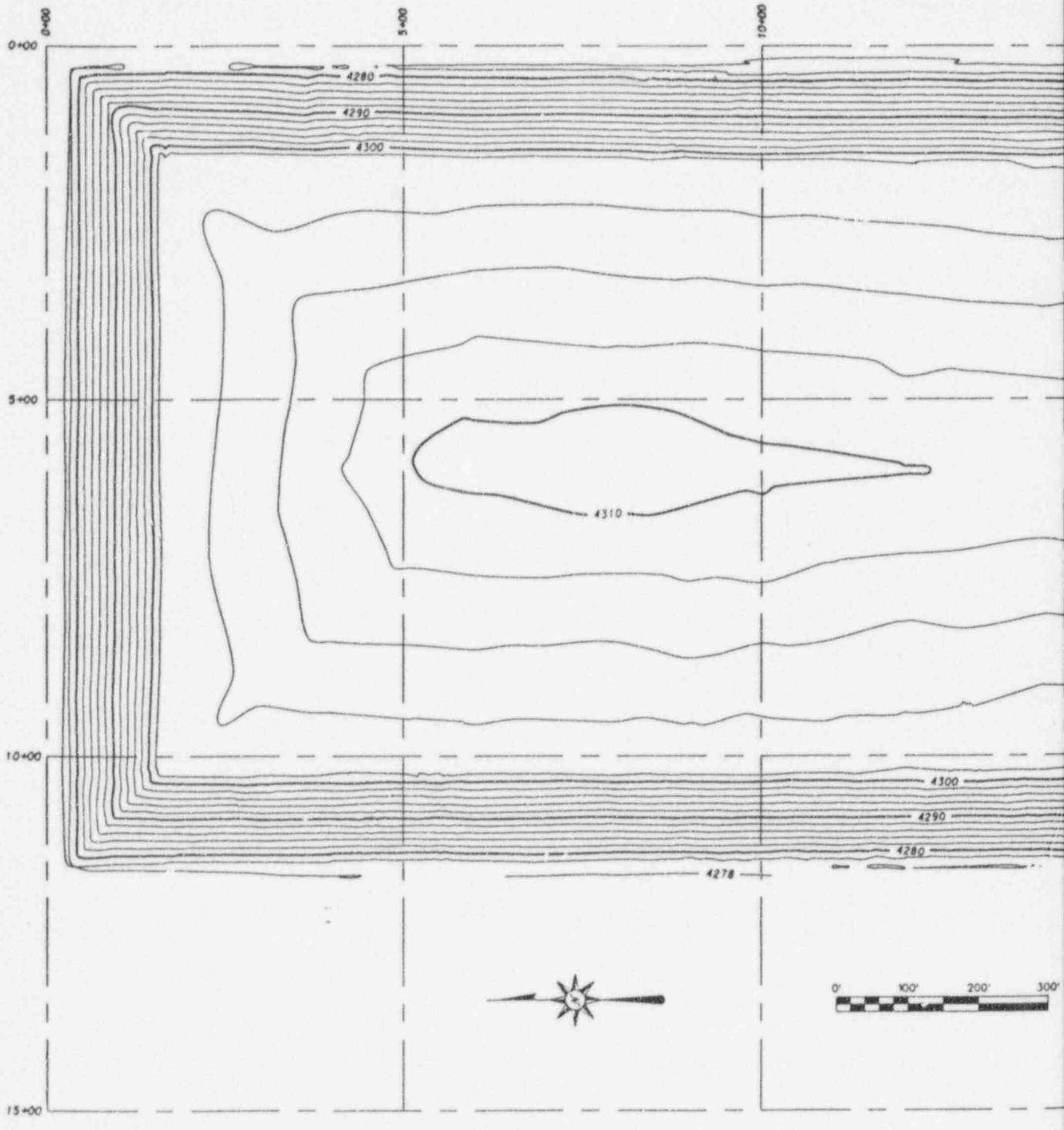
Figure 5 is the final as-built drawing and represents the condition of the cell following rework which was performed from November 1996 through March 1997. (Reference Appendices K and L.)

Figure 1	Topographic Map - Top of Rock Cover
Figure 2	Topographic Map - Surface of Radon Barrier
Figure 3	Rock Cover Thickness Contour
Figure 4	Bedding Thickness Contour
Figure 5	(Final As-Built)

M K - F E R G U

UMTRA PROJECT

SOUTH CL



CERTIFICATION

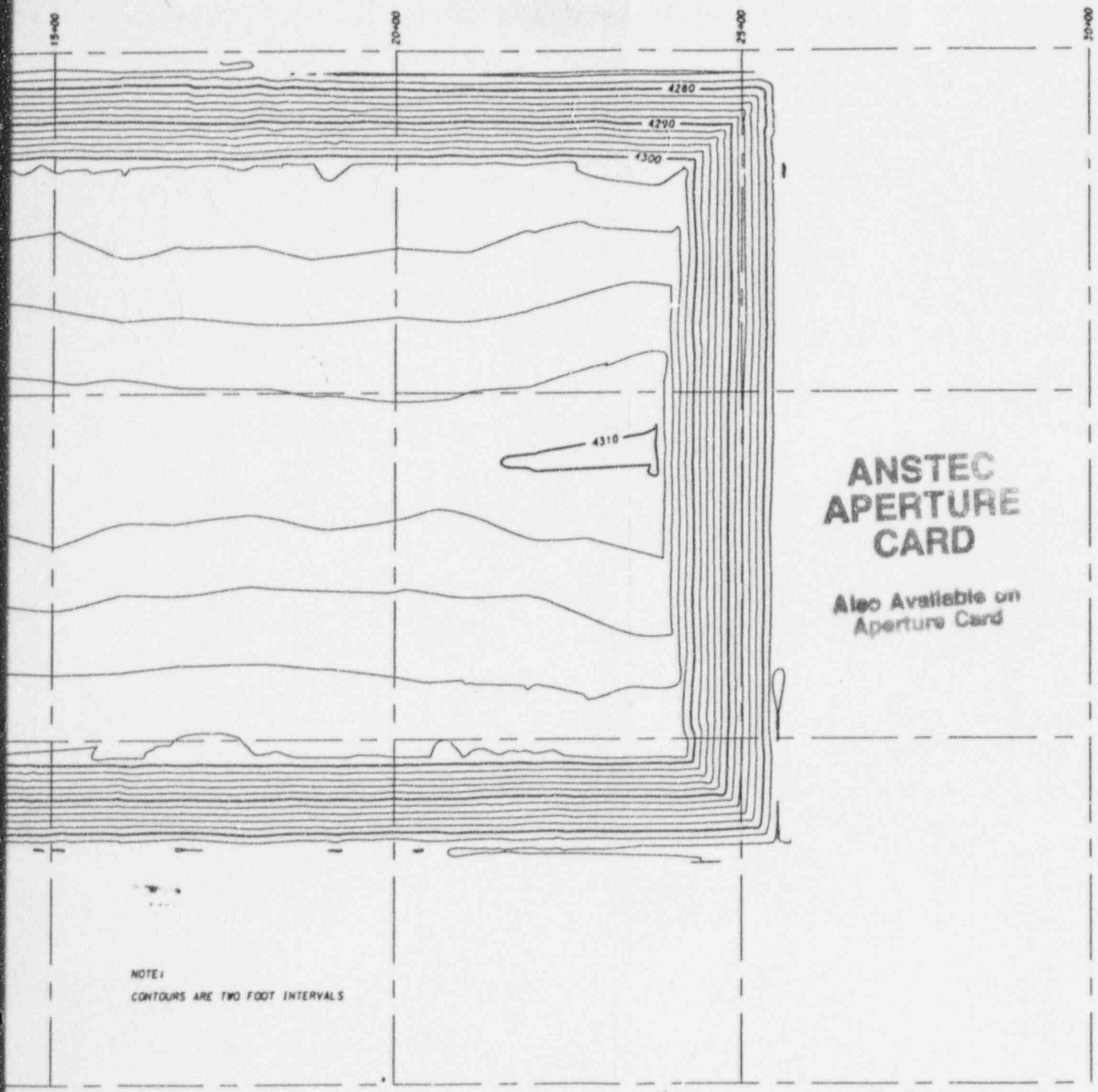
I, DAVID MAX MORRIS, CERTIFY THAT THIS T
FROM FIELD NOTES OF A SURVEY MADE UND

UTAH PROFESSIONAL LAND SURVEYOR L.S.

SON COMPANY

- SALT LAKE CITY, UTAH

VE DISPOSAL SITE



NOTE:
CONTOURS ARE TWO FOOT INTERVALS

9705140449-01

FIGURE 5

OGRAPHIC MAP IS PREPARED
R MY SUPERVISION IN MARCH 1997.

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MK - FERGUSON CO.

UMTRA PROJECT - SALT LAKE CITY, UTAH - SOUTH CLIVE DISPOSAL SITE

FOR: MK-FERGUSON CO.	Q.E.D. SURVEYING SYSTEMS Inc. 1018 COLO. AVE. GRAND JUNCTION COLORADO 81501 (303) 241-2370 464-7568	SURVEYED BY: RM EG
SCALE: 1" = 100'		DRAWN BY: VAP
DATE: FIELD 3/6-14/97 OFFICE 04/07/97		ACAD ID: MKUTAH
		SHEET NO. 2 of 2
		FILE: 95279

ATTACHMENT 6

was 0.88%, with a maximum of 1.17% and a low of 0.63%. The maximum allowable loss on the L.A. Abrasion test was 25%. The average loss was 14.5%, with a maximum of 17.5% and a low of 9.1%.

- Compaction controls were accomplished through passes by a bulldozer as monitored by the State of Utah.

- The lift thickness was continuously monitored to ensure lift thickness requirements.

- The required frequency for performing gradation tests was a minimum of one gradation test for every 20,000 cubic yards of material placed. In addition, one gradation test for each day of placement (in excess of 150 cubic yards).

- The gradation testing was performed in accordance with AASHTO T-27 UDOHMOI-8-012 or 912A, respectively.

- There were 32 gradation tests performed, which represented 62,930 cubic yards of filter zone material placed, providing an average test frequency of one gradation test for each 1,967 cubic yards placed. All 32 gradation tests performed marginally failed the Design Specifications. The State of Utah personnel confirmed that failing gradation tests were retested, however the records could not be located to support this issue. As agreed with NRC, ~~the~~ technical performance criteria ~~will be~~ were used to evaluate the cell construction ~~reference Appendix K, Sections 5.1 and 6.2.1~~. Additional sampling and gradation testing was performed on the filter zone material. An

evaluation of the additional gradation test results was made to determine the technical adequacy of the gradations. It was concluded that the filter zone gradations were adequate to satisfy the required filter criteria. (Appendix K, Section 6.1.2).

- All scales used were calibrated against equipment having a know valid relationship to National Institute of Standards Technologies (NIST).

- Tests were proportionally taken throughout production, placement, and/or compaction and were not taken all in one given time frame.

- All tests performed on filter zone material were in accordance with required ASTM Standards, AASHTO Standards and the Site Design Specifications.

- The pH by laboratory determination was required at a minimum test frequency of one pH test for each 10,000 cubic yards of material placed.

- There were 8 pH tests performed for a total of 62,930 cubic yards placed. The average pH of the filter zone material was 7.7. This provides an average test frequency of one pH test for each 7,866 cubic yards placed.

FILTER ZONE MATERIAL

- The filter zone materials were obtained from the Gray Back Pit, as approved by the State of Utah and Jacobs Engineering.

- A screening plant was erected to separate material into stockpiles with the correct grading achieved during operation. The subcontractor performed daily gradation testing of the material, as produced.

- There were approximately 62,930 cubic yards of filter zone material placed.

- Samples of the filter zone material were submitted to a commercial testing laboratory for testing. Testing was performed in accordance with the following standards: ASTM C-131 and C-535 (Los Angeles Abrasion), AASHTO T-104 UDOHMOI-8-931 (Sodium Soundness), AASHTO T-84 UDOHMOI-8-926 (Specific Gravity), T-88 UDOHMOI-8-927 (Absorption), and T-104 UDOHMOI-8-934 for pH value.

- There were four samples submitted to the laboratory prior to placement of filter zone material.

- The required specific gravity was a minimum of 2.60. The average specific gravity was 2.65, with a maximum of 2.65 and a low of 2.64. The maximum allowable absorption was 2%. The average absorption was 0.89%, with a maximum of 1.23% and a low of 0.61%. The soundness was required to be less than 8% loss. The average loss

was 0.88%, with a maximum of 1.17% and a low of 0.63%. The maximum allowable loss on the L.A. Abrasion test was 25%. The average loss was 14.5%, with a maximum of 17.5% and a low of 9.1%.

- Compaction controls were accomplished through passes by a bulldozer as monitored by the State of Utah.

- The lift thickness was continuously monitored to ensure lift thickness requirements.

- The required frequency for performing gradation tests was a minimum of one gradation test for every 20,000 cubic yards of material placed. In addition, one gradation test for each day of placement (in excess of 150 cubic yards).

- The gradation testing was performed in accordance with AASHTO T-27 UDOHMOI-8-012 or 912A, respectively.

- There were 32 gradation tests performed, which represented 62,930 cubic yards of filter zone material placed, providing an average test frequency of one gradation test for each 1,967 cubic yards placed. All 32 gradation tests performed marginally failed the Design Specifications. The State of Utah personnel confirmed that failing gradation tests were retested, however the records could not be located to support this issue. As agreed with NRC, technical performance criteria were used to evaluate the cell construction. Additional sampling and gradation testing was performed on the filter zone material. An evaluation of the additional gradation test results was made to

determine the technical adequacy of the gradations. It was concluded that the filter zone gradations were adequate to satisfy the required filter criteria. (Appendix K, Section 6.1.2).

- All scales used were calibrated against equipment having a know valid relationship to National Institute of Standards Technologies (NIST).

- Tests were proportionally taken throughout production, placement, and/or compaction and were not taken all in one given time frame.

- All tests performed on filter zone material were in accordance with required ASTM Standards, AASHTO Standards and the Site Design Specifications.

- The pH by laboratory determination was required at a minimum test frequency of one pH test for each 10,000 cubic yards of material placed.

- There were 8 pH tests performed for a total of 62,930 cubic yards placed. The average pH of the filter zone material was 7.7. This provides an average test frequency of one pH test for each 7,866 cubic yards placed.

ATTACHMENT 7

- Compaction controls were accomplished through passes by a buildozer, as monitored by the State of Utah.

- The required test frequency for performing gradation testing was a minimum of one gradation test for each 20,000 cubic yards of 1-1/2 inch zone material placed.

- There were a total of 52 gradation tests performed, which represented 124,960 cubic yards of 1-1/2 inch zone material placed. This provided an average test frequency of one test for each 2,398 cubic yards placed. Twenty-one out of the 52 gradation tests performed marginally failed the Design Specifications. The State of Utah personnel confirmed that failing gradation tests were retested, however the records could not be located to support this issue. As agreed with the NRC, ~~the~~ technical performance criteria ~~will be~~ were used to evaluate cell construction. ~~reference Appendix K, Sections 5.1 and 6.2.1.~~ Additional sampling and gradation testing was performed on the 1-1/2 inch erosion protection zone material. An evaluation of the additional gradation test results was made to determine the adequacy of the gradations. The evaluation concluded that the 1-1/2 zone material gradations were adequate, except for two small strips adjacent to the sideslopes, where grades were 7 to 8 percent (Appendix K, Section 6.1.2). Repairs were made to the two small strips as necessary to reduce topslope grades to acceptable values. The side slope riprap was extended up slope and the top slope riprap was regraded. Topographic survey data (reference Appendix L), confirmed that top slope grades meet the technical requirements determined in Appendix K.

I-1/2 INCH EROSION PROTECTION ZONE MATERIAL

- The 1-1/2 inch zone materials were obtained from the Gray Back Pit source, as approved by the State of Utah and Jacobs Engineering.

- A screening plant was erected to separate the rock material into stockpiles of correct grading.

- There were approximately 124,690 cubic yards of 1-1/2 inch zone material placed.

- Samples of the 1-1/2 inch material were submitted to a commercial testing laboratory for testing in accordance with the following standards: ASTM C-131 and C-535 (Los Angeles Abrasion), AASHTO T-104 UDOHMOI-8-931 (Sodium Soundness), AASHTO T-84 UDOHMOI-8-926 (Specific Gravity), AASHTO T-88 UDOHMOI-8-927 (Absorption), and AASHTO T-104 UDOHMOI-8-934 for pH value.

- The required specific gravity was a minimum of 2.60. The average specific gravity was 2.66, with a maximum of 2.68 and a low of 2.62. The maximum allowable absorption was 2%. The average absorption was 1.16%, with a maximum of 1.42% and a low of 0.61%. The soundness was required to be less than 8% loss. The average loss was 1.63%, with a maximum loss of 3.30% and a low of 0.63%. The maximum allowable loss on the L.A. Abrasion test was 25%. The average loss was 14.0%, with a maximum loss of 16.9% and a low of 10.9%.

- Compaction controls were accomplished through passes by a bulldozer, as monitored by the State of Utah.

- The required test frequency for performing gradation testing was a minimum of one gradation test for each 20,000 cubic yards of 1-1/2 inch zone material placed.

- There were a total of 52 gradation tests performed, which represented 124,960 cubic yards of 1-1/2 inch zone material placed. This provided an average test frequency of one test for each 2,398 cubic yards placed. Twenty-one out of the 52 gradation tests performed marginally failed the Design Specifications. The State of Utah personnel confirmed that failing gradation tests were retested, however the records could not be located to support this issue. As agreed with the NRC, technical performance criteria were used to evaluate cell construction. Additional sampling and gradation testing was performed on the 1-1/2 inch erosion protection zone material. An evaluation of the additional gradation test results was made to determine the adequacy of the gradations. The evaluation concluded that the 1-1/2 zone material gradations were adequate, except for two small strips adjacent to the sideslopes, where grades were 7 to 8 percent (Appendix K, Section 6.1.2). Repairs were made to the two small strips as necessary to reduce topslope grades to acceptable values. The side slope riprap was extended up slope and the top slope riprap was regraded. Topographic survey data (reference Appendix L), confirmed that top slope grades meet the technical requirements determined in Appendix K.

- The pH by laboratory determination was required at a minimum test frequency of one pH test for each 10,000 cubic yards placed.

- There were 19 pH tests performed for a total of 124,690 cubic yards placed. The average pH of the 1-1/2 inch zone material was 7.7. This provided an average test frequency of one pH test for each 6,563 cubic yards placed.

- All scales used were calibrated against equipment having a known valid relationship to the National Institute of Standards Technologies (NIST).

- Tests were proportionally taken throughout production, placement, and/or compaction and were not taken all in one given time frame.

- All testing performed on the 1-1/2 inch zone material were in accordance with ASTM Standards, AASHTO Standards, and the Site Design Specifications.

ATTACHMENT 8

- Gradation tests were required to be performed at a minimum frequency of one gradation test for each 20,000 cubic yards of material placed, and at least one gradation test for each day of significant material placement (in excess of 150 cubic yards).

- The gradation testing was performed in accordance with AASHTO T-27 UDOHMOI-8-912.

- There were a total of 57 gradation tests performed, which represented 58,700 cubic yards of 8 inch zone material placed. This provided an average test frequency of one gradation test for each 1,030 cubic yards placed. Two out of the 57 gradation tests taken failed to meet the Design Specifications. The State of Utah personnel confirmed that failing gradation tests were retested, however the records could not be located to support this issue. As agreed with the NRC, ~~the~~ technical performance criteria ~~will be~~ were used to evaluate the cell construction. ~~reference Appendix K, Sections 5.1 and 6.2.1.~~ Additional inspection, sampling, and testing was performed on the 8 inch erosion protection zone material. An evaluation of the additional gradation test results was made to determine the technical adequacy of the gradations. The gradations were determined to be adequate for sheet flow conditions, but not in eight specific potential concentrated flow areas (Appendix K, Section 6.1.2). Areas of segregated small-size particles were also identified. The eight areas were regraded to eliminate unacceptable flow concentrations, and areas of segregated small-size particles were removed and replaced with acceptable riprap (reference Appendix L).

8 INCH EROSION PROTECTION ZONE MATERIAL

- The 8 inch erosion protection materials were obtained from Gray Back Pit source, as approved by the State of Utah and Jacobs Engineering.

- A screening plant was erected to separate rock material into stockpiles of correct grading.

- There were approximately 58,700 cubic yards of 8 inch zone material placed.

- Samples of the 8 inch material were submitted to a commercial testing laboratory for testing in accordance with the following standards: ASTM C-131 and C-535 (Los Angeles Abrasion), ASSHTO T-104 UDOHMOI-8-931 (Sodium Soundness), AASHTO T-84 UDOHMOI-8-926 (Specific Gravity), AASHTO T-88 UDOHMOI-8-927 (Absorption), and T-104 UDOHMOI-8-934 for pH value.

- The specific gravity was required to be greater than 2.60. The average specific gravity was 2.66, with a maximum of 2.67 and a low of 2.61. The maximum allowable absorption was 2%. The average absorption was 1.10%, with a maximum of 1.55% and a low of 0.77%. The sodium soundness was required to be less than 7% loss. The average loss was 1.50%, with a high of 1.88% and a low of 0.67%. The maximum allowable loss on the L.A. Abrasion test was 25%. The average loss was 13.8%, with a high of 17.1% and a low of 9.1%.

- Gradation tests were required to be performed at a minimum frequency of one gradation test for each 20,000 cubic yards of material placed, and at least one gradation test for each day of significant material placement (in excess of 150 cubic yards).

- The gradation testing was performed in accordance with AASHTO T-27 UDOHMOI-8-912.

- There were a total of 57 gradation tests performed, which represented 58,700 cubic yards of 8 inch zone material placed. This provided an average test frequency of one gradation test for each 1,030 cubic yards placed. Two out of the 57 gradation tests taken failed to meet the Design Specifications. The State of Utah personnel confirmed that failing gradation tests were retested, however the records could not be located to support this issue. As agreed with the NRC, technical performance criteria were used to evaluate the cell construction. Additional inspection, sampling, and testing was performed on the 8 inch erosion protection zone material. An evaluation of the additional gradation test results was made to determine the technical adequacy of the gradations. The gradations were determined to be adequate for sheet flow conditions, but not in eight specific potential concentrated flow areas (Appendix K, Section 6.1.2). Areas of segregated small-size particles were also identified. The eight areas were regraded to eliminate unacceptable flow concentrations, and areas of segregated small-size particles were removed and replaced with acceptable riprap (reference Appendix L).

- During placement of erosion protection materials, inspections were performed to ensure that rock materials were handled and placed in a manner that would preclude degradation, segregation and to minimize voids in the layer.

- The pH by laboratory determination was required at a minimum frequency of one pH test for each 10,000 cubic yards placed.

- There were 30 pH tests performed for a total of 58,700 cubic yards of 8 inch zone material placed for an average pH of 7.7. This provided a test frequency of one pH test for each 1,956 cubic yards placed.

ATTACHMENT 9

SLC-13 HAS BEEN REMOVED

IT DID NOT APPLY TO THE SOUTH CLIVE DISPOSAL SITE AND SHOULD NOT HAVE BEEN INCLUDED IN THE COMPLETION REPORT

ATTACHMENT 10

- The stabilized material has been fenced along the outer shoulder of the inspection road in order to discourage human intrusion.

- The attached photographs were taken following completion of the remedial action activities and depict the conditions which existed at that time. Figure No. 1 is the southern exposure and Figure No. 2 is the eastern exposure.

Following remedial action, the Bureau of Radiation Control determined that a survey should be made to ascertain the extent of any radioactive contamination of the property surrounding the South Clive disposal cell. A survey was performed and a copy is included as Attachment No. 1 of this section.

A post-remedial engineering assessment was performed (reference Appendix K) which determined that some areas of the riprap cover were inadequate. Those areas were repaired and a summary of the rework is presented in Appendix L.

CONSTRUCTION MONITORING OF EMBANKMENT SETTLEMENTS

Settlements were monitored using 9 settlement plates installed in the top slope portion of the embankment for monitoring differential settlement across the embankment. ~~The settlement plates and their approximate locations are shown on the attached two figures (H1 & H2).~~ Settlement was only monitored and recorded during the period of 9/23/88 to 1/9/90. Plots are included as Attachment No.2.

APPENDIX H
POST-REMEDIAL SITE CONDITIONS

- The final quantity of contaminated material relocated from Vitro site and placed onto a tailings embankment at South Clive Disposal Site was 2,798,000 cubic yards. This included 482,000 cubic yards of material from vicinity property remedial actions.

- The final dimension of the embankment is 1150' x 2560' (66 acres), about 400' longer than the original design. The embankment was 25 to 31 feet above the existing grade and 7 to 9 feet below the grade for excavating radon barrier material. The side slopes of the embankment are 5(H):1(V) and the top slopes of the embankment are approximately 2% from the center ridge toward the side slopes.

- The excavated bottom of the embankment was scarified about 12" and re-compacted to 95% effort as specified in ASTM D-698.

- The relocated contaminated materials were compacted at 90% effort as specified in ASTM D-698, covered with a 7-foot radon barrier to control the release of radon and to inhibit water infiltration then capped with a 2-foot rock to counter the erosional effects of wind and water, the radon barrier cover was compacted to at least 95% effort as specified in ASTM D-698.

- The embankment is also surrounded by two ditches and an inspection road. The ditches are connected to a natural waterway by a swale.

- The stabilized material has been fenced along the outer shoulder of the inspection road in order to discourage human intrusion.

- The attached photographs were taken following completion of the remedial action activities and depict the conditions which existed at that time. Figure No. 1 is the southern exposure and Figure No 2 is the eastern exposure.

Following remedial action, the Bureau of Radiation Control determined that a survey should be made to ascertain the extent of any radioactive contamination of the property surrounding the South Clive disposal cell. A survey was performed and a copy is included as Attachment No. 1 of this section.

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CONSTRUCTION MONITORING OF EMBANKMENT SETTLEMENTS

Settlements were monitored using 9 settlement plates installed in the top slope portion of the embankment for monitoring differential settlement across the embankment. Settlement was only monitored and recorded during the period of 9/23/88 to 1/9/90. Plots are included as Attachment No.2.

In September and October of 1995, a total of 68 radon flux measurements were taken on the surface of the radon barrier. The average value is 0.3 pCi/m^2-s as presented in Appendix K.

ATTACHMENT 11

APPENDIX L

ENGINEERED REPAIR WORK OF SOUTH CLIVE DISPOSAL CELL

I. Summary of Repair Work:

This section of the completion report discusses the results of repair work to the existing riprap cover layer which was performed in November 1996 through March of 1997. The repair work was deemed necessary based on the results of the engineering assessment entitled "An Engineering Assessment of the As-Built South Clive Disposal Cell", which is included in Appendix K. The repair work was performed in accordance with the recommendations of the engineering assessment. Briefly, the repair work performed is summarized as follows:

1. Surface irregularities on the east and west sideslopes were re-graded. Re-grading resulted in a uniform surface which eliminated the concern for flow concentrations.

2. Small areas on the cell of segregated fine particle size riprap material were removed, and were replaced with new riprap material meeting technical design requirements for quality, particle size, and layer thickness.

3. Additional sideslope riprap material was produced, and added to areas where layer thickness did not meet the minimum thickness requirement. The additional material was worked into the existing riprap layer to provide a uniform well graded surface with adequate layer thickness.

4. The southeast and southwest corners of the disposal cell topslope were re-graded to reduce excessively steep grades, and to provide a more uniform grade break. First, the sideslope was adjusted by adding new material to extend the 5(H):1(V) sideslope. Following completion of the sideslope adjustment, the topslope riprap was re-graded. Re-grading of these topslope areas provides a more uniform grade break.

   Exhibit 4 shows the detailed locations where riprap repair and in-place testing was performed.

Upon completion of the re-work and re-grading, a final as-built topographical map of the disposal cell was produced. This drawing incorporates all grade changes that were made to the final cover layer. The final as-built topographic map is presented as Exhibit 1.

II. Inspection and Testing:

The erosion protection material used for repair and re-grading was obtained from the Gray Back Pit source, which was originally approved by the State of Utah and Jacobs Engineering, and was re-approved by MK-Environmental Services for this new scope of work. The material was processed to obtain a sufficient amount for placement into the low areas of the final cover.

There were 1,550 cubic yards of riprap material produced. There were two sets of the following durability tests performed: Specific Gravity and Absorption (ASTM C-127), Sodium Sulfate Soundness (ASTM C-88), LA Abrasion (ASTM C-131/C-535), Splitting Tensile Strength (ISRM Method), and Schmidt Rebound Hardness (ISRM Method). AGRA Earth & Environmental, of Salt Lake City, Utah was the approved commercial testing laboratory which performed the required durability testing. A petrographic examination was performed in accordance with (ASTM C-295-85), and an MKES geologist determined that the material was acceptable for long-term use as erosion protection.

Of the 1,550 cubic yards of material produced, the average specific gravity (SSD)was 2.61, with a maximum of 2.61 and a low of 2.61. The average absorption was 0.64 percent, with a maximum of 0.64 percent and a low of 0.64 percent. The average sodium soundness was 0.10 percent, with a high of 0.10 percent and a low of 0.10 percent. The average loss on the L.A. Abrasion test was 4.1 percent with a high of 5.2 percent and a low of 3.0 percent. The average Splitting Tensile Strength was 1502.5 psi, with a high value of 1647 psi and a low value of 1358 psi. The average test value obtained from the Schmidt Rebound Hardness was 42.5, with a high value of 53.0 and a low value of 32.0.

The durability test results were used in a scoring system, with each set of durability tests required to score 80.0 or better. The average score for the two durability tests was 87.0, with a high score of 88.3 and a low score of 85.7. All test values and scores were approved by MKES prior to riprap acceptance and placement on the disposal cell.

During production of the riprap material, gradation testing was required to be performed in accordance with ASTM C-136. Since the total quantity of material was less than 2,000 cubic yards, the required test frequency was set at one test initially, with a final test near completion of production. There were four gradation tests of the 1,550 cubic yards of riprap material produced, providing an average frequency of one test for each 388 cubic yards of material produced.

Specifications required that at least 75 percent of the material, by weight, be such that the minimum dimension was not less than one-third of the maximum dimension. During

riprap material production, dimensional analysis revealed that the erosion protection materials met the specified requirements.

The riprap material production was closely monitored on a daily basis by an MK-F Level II Quality Control Inspector and intermittent inspection was performed by an MKES geologist. The inspector was trained by the site MKES geologist to identify site-specific anomalies for the erosion protection material.

In-place gradation testing was required to be performed in accordance with ASTM C-136, and was performed at a minimum frequency of one gradation test for each 20,000 cubic yards of material placed. There were a total of four in-place gradation tests performed. Of the 1,550 cubic yards produced, all 1,550 cubic yards were placed as repair material, providing an average test frequency of one test for each 388 cubic yards placed. (Reference Exhibit 2 for the Erosion Protection Summary Table which outlines the testing.) The following table has been provided detailing the average percent passing for the riprap material:

Sieve Size	Required % Passing	Average % Passing
12 inch	100	100
4-1/2 inch	0-40	11
2 inch	0-10	1

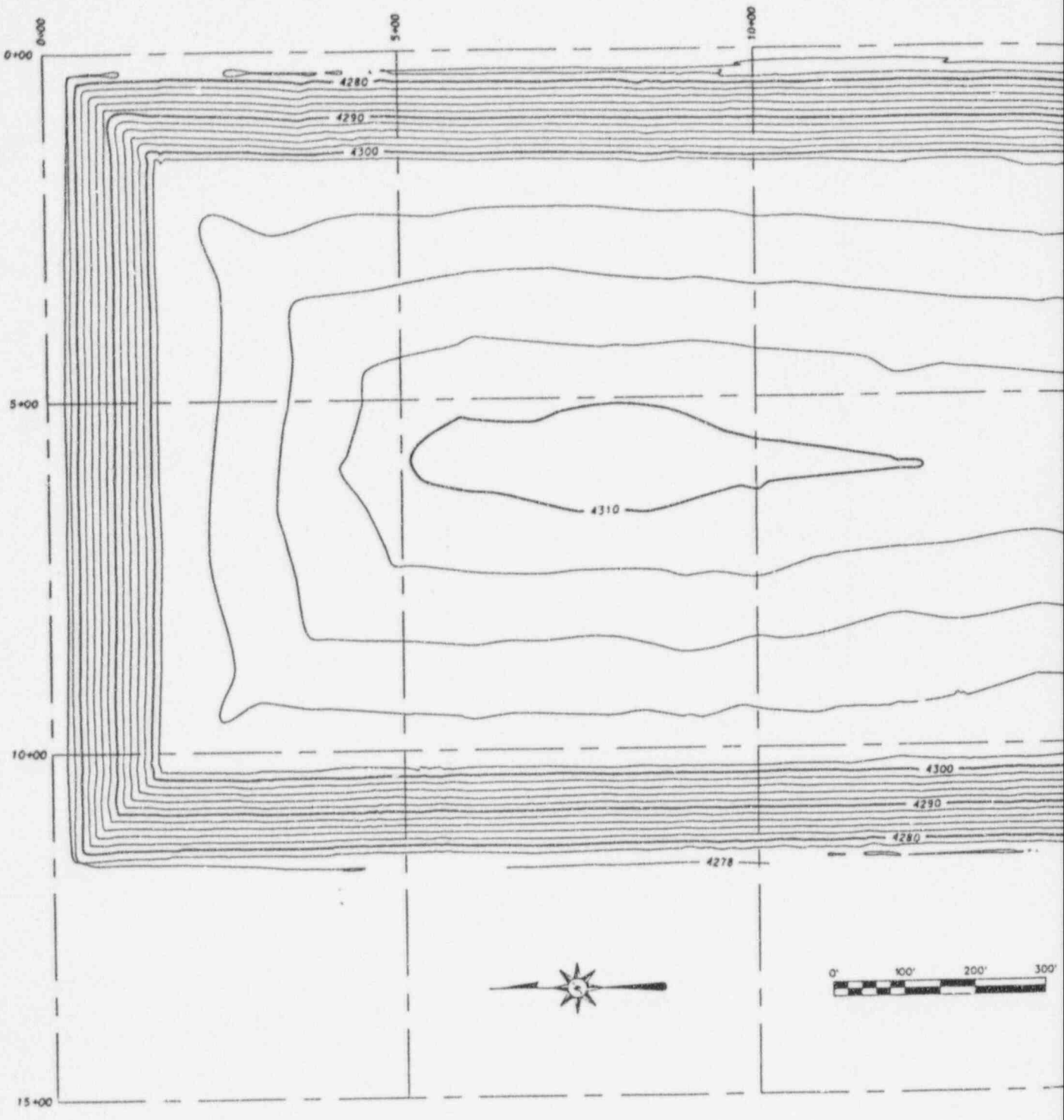
During placement and re-grading of the final cover layer, the erosion protection materials were continuously monitored to ensure that rock materials were handled and placed in a manner that would preclude degradation and segregation, and to minimize voids in the layer. In addition, as materials were placed or re-graded for smooth contour and proper elevation, the site QC Inspectors performed in-place depth checks to ensure the overall thickness of the final cover layer re-work area met specified requirements. There were 11 passing depth checks performed, all of which exceeded the minimum required thickness of 0.9 feet. (Reference Exhibit 3 for a summary of the depth checks performed.) (Reference Exhibit 4 for the locations of the in-place depth checks and in-place gradation tests.)

In Exhibit 4, the as-built drawing depicts the various repair or re-graded areas. These are designated Areas A through I, and are the locations in which depth checks and gradations were performed. All of the disposal cell repair work was performed in accordance with recommendations and technical requirements in the Engineering Assessment (Appendix K).

EXHIBIT 1

M K - F E R G U

UMTRA PROJECT -
SOUTH CLIV



CERTIFICATION

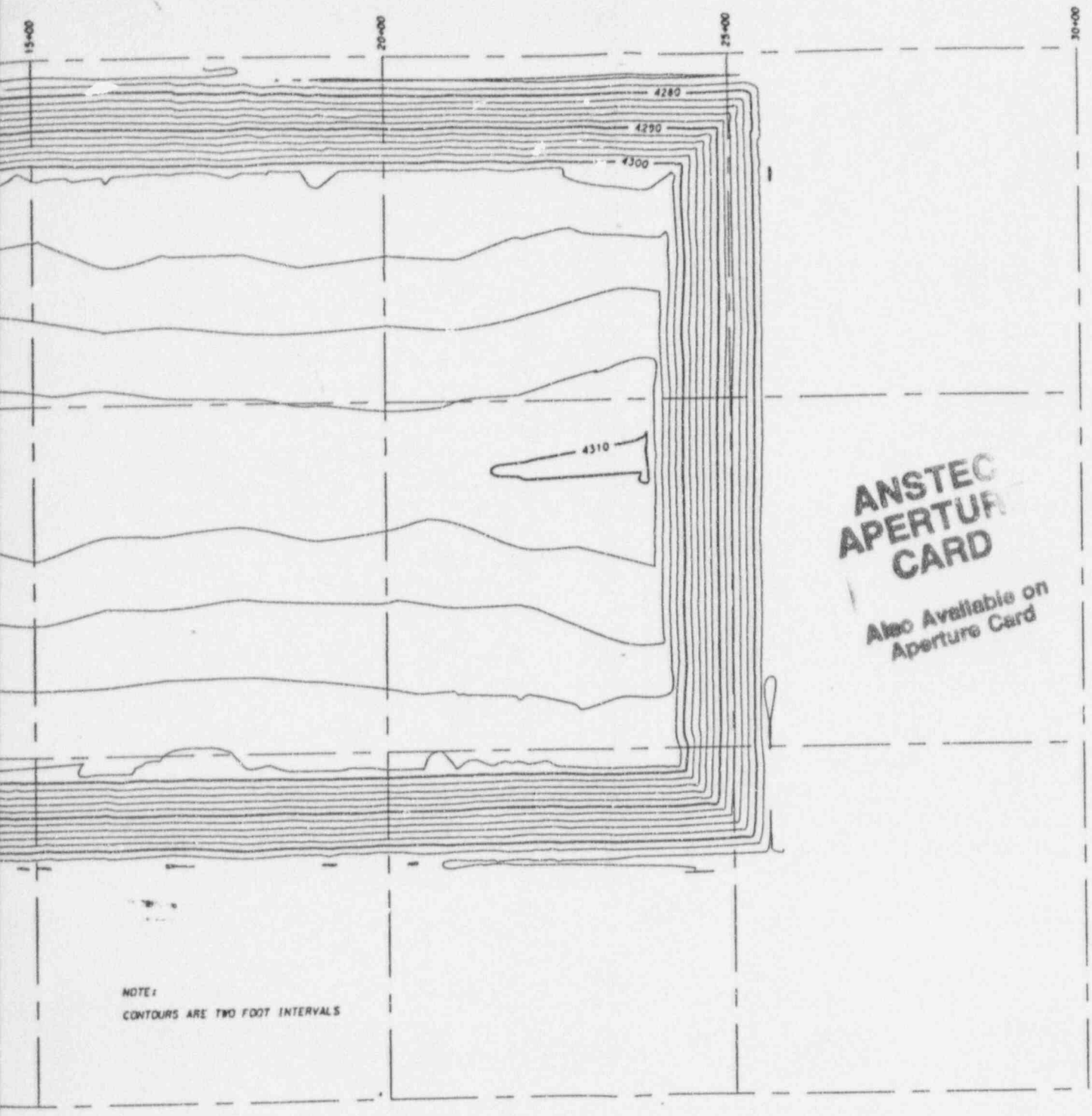
I, DAVID MAX MORRIS, CERTIFY THAT THIS T
FROM FIELD NOTES OF A SURVEY MADE UN

UTAH PROFESSIONAL LAND SURVEYOR L.S.

S O N C O M P A N Y

SALT LAKE CITY, UTAH

E DISPOSAL SITE



NOTE:
CONTOURS ARE TWO FOOT INTERVALS

9705140449-02

OGRAPHIC MAP IS PREPARED
MY SUPERVISION IN MARCH 1997.

(329172)-2201

MK - FERGUSON CO.

UMTRA PROJECT - SALT LAKE CITY, UTAH - SOUTH CLIVE DISPOSAL SITE

FOR: MK-FERGUSON CO.	O.E.D. SURVEYING SYSTEMS Inc. 1018 COLO. AVE. GRAND JUNCTION COLORADO 81501 (303) 241-2370 464-7568	SURVEYED BY: RM EG
		DRAWN BY: VAP
SCALE: 1" = 100'		ACAD ID: MKUTAH
		SHEET NO. 2 of 2
DATE: FIELD 3/6-14/97 OFFICE 04/07/97		FILE: 95279

EXHIBIT 2

APPENDIX L

SALT LAKE CITY, UTAH
SUMMARY OF GEOTECHNICAL TEST RESULTS
EROSION PROTECTION

TYPE OF MATERIAL	QUANTITY	DURABILITY TESTING						DURABILITY GRADATION TESTING			
	TOTAL CUBIC YDS*	AVERAGE SPECIFIC GRAVITY (Percent)	AVERAGE ABSORPTION (Percent)	AVERAGE LA ABRASION (Percent)	AVERAGE SODIUM SULFATE (Percent)	AVERAGE SCHMIDT HARDNESS	AVERAGE SPLIT TENSILE (psi)	AVERAGE SCORE	REQUIRED SCORE	AVERAGE FREQUENCY (Cubic Yards)	NO. OF GRAD. TESTS
Riprap	1,550	2.61	0.64	4.1	0.10	42.5	1502.5	87.0	≥80	194	8

* FINAL QUANTITY

EXHIBIT 3

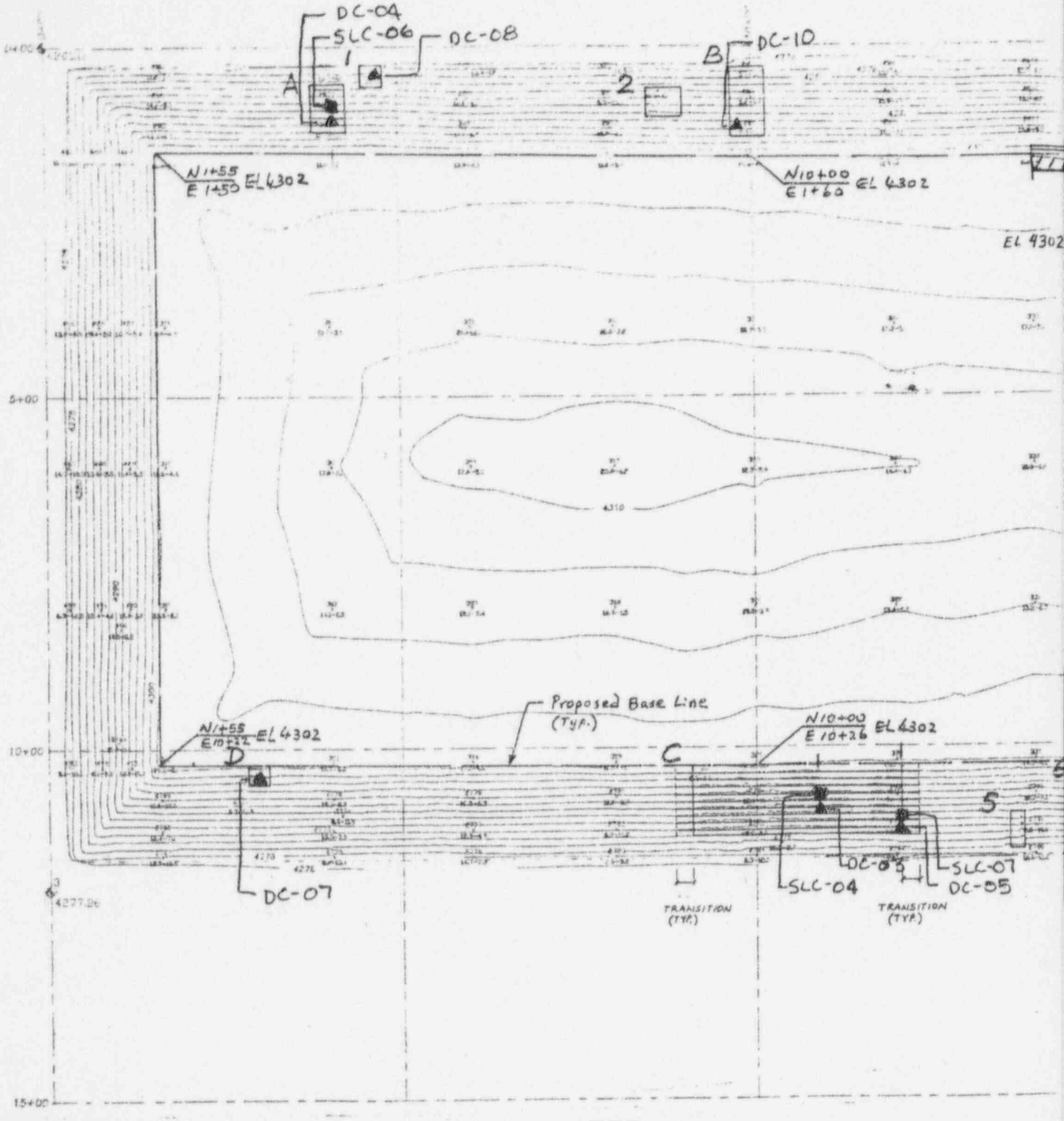
CLIVE, UTAH DISPOSAL SITE
APPENDIX L
IN-PLACE DEPTH CHECKS
REPAIR WORK

DEPTH CHECKS						
NUMBER	DATE	COORDINATES		DEPTH (In inches)	*AVERAGE (In inches)	PASS/FAIL
DC-01	02/25/97	N 18+94	E 11+30	12	12	PASS
DC-02	02/25/97	N 21+49	E 11+19	12	12	PASS
DC-03	02/25/97	N 10+87	E 10+71	**14.25/13.5/13.75	13.83	PASS
DC-04	02/25/97	N 04+02	E 00+81	**16.75/15.0/15.5	15.75	PASS
DC-05	03/04/97	N 12+07	E 11+20	**12.5/13.75/11.25	12.5	PASS
DC-06	03/04/97	N 22+46	E 10+31	12	12	PASS
DC-07	03/04/97	N 02+88	E 10+42	**12.5/12.75/11.75	12.33	PASS
DC-08	03/04/97	N 04+73	E 00+39	**11.75/12.5/12.25	12.17	PASS
DC-09	03/04/97	N 20+00	E 11+65	12	12	PASS
DC-10	03/04/97	N 09 +75	E 00+77	12	12	PASS
DC-11	03/04/97	N 18+58	E 01+56	12	12	PASS

* Minimum thickness is 0.9 feet

** Three measurements to obtain average

EXHIBIT 4



NOTES:

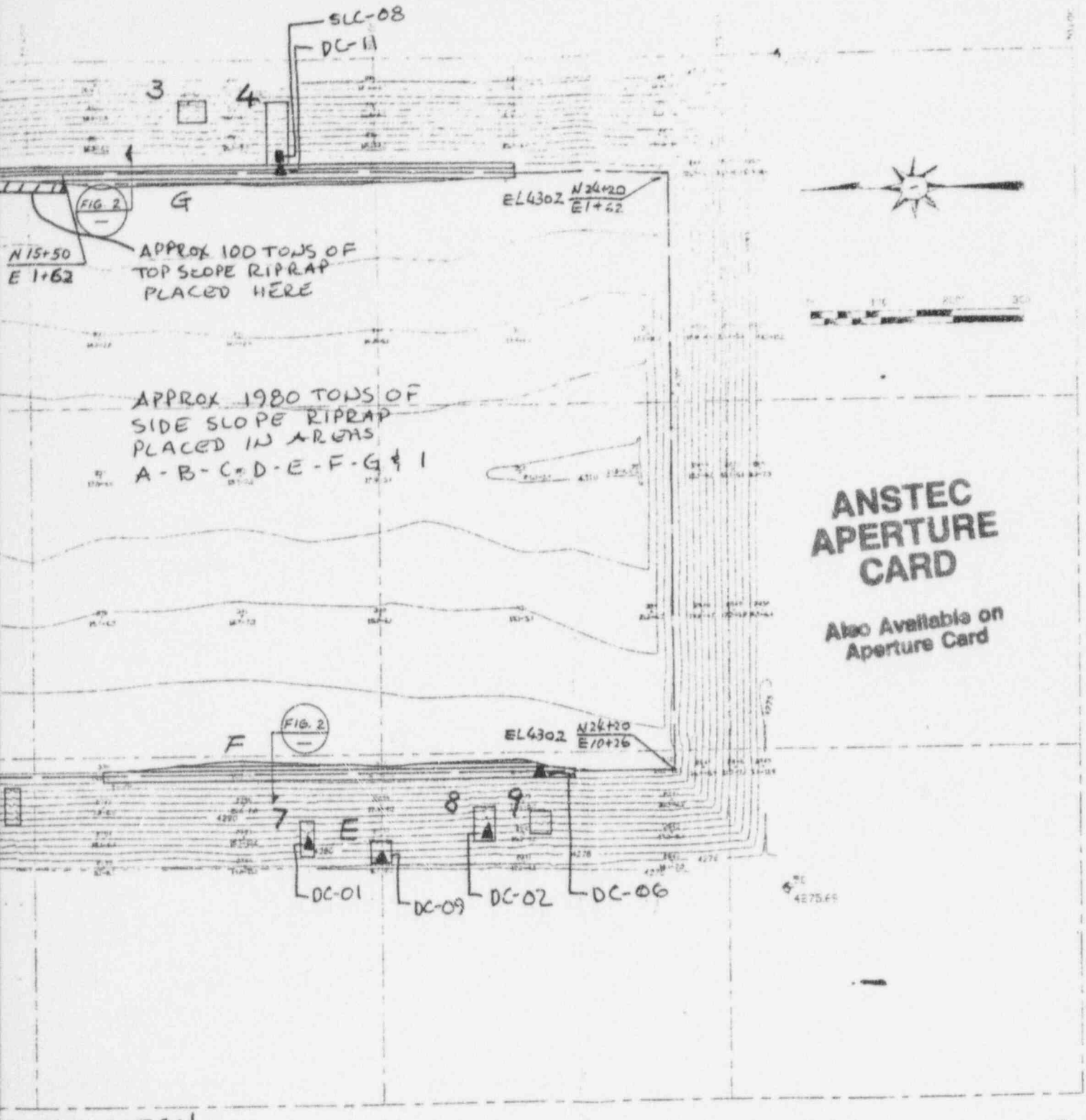
1. ALL LOCATIONS AND ELEVATIONS, INCLUDING THE PROPOSED BASE LINE LOCATIONS, ARE APPROXIMATE AND SHALL BE VERIFIED BY THE SUBCONTRACTOR IN THE FIELD, SUBJECT TO CONTRACTOR S APPROVAL.
2. COORDINATES AT CORNER POINTS OF RECONSTRUCTION AREAS SHALL BE REFERENCED TO THE SCOPE OF WORK.
3. THE SUBCONTRACTOR SHALL ESTABLISH SURVEY CONTROL POINTS IN THE FIELD AS REQUIRED TO CONTROL THE WORK AND AS DIRECTED BY THE CONTRACTOR.

LEGEND

A — RECONSTRUCTION AREA AND DESIGNATION

4300 — EXISTING FEATURES AND CONTOURS

3 — REGRADING AREA AND NUMBER (NOT IN SUBCONTRACT)



■ - GRADATION
▲ - DEPTH CHECK

12-4-9

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED / DRAWN	SOUTH CLIVE DISPOSAL SITE SALT LAKE CITY, UTAH
CHECKED	REGRADING AND RECONSTRUCTION PLA FOR RIPRAP COVER
INSPECTED	
RECOMMENDED	
APPROVED / DATE / DOE PROJECT ENGINEER	
MORRISON KNUDSEN CORPORATION ENVIRONMENTAL GROUP UMTRA PROJECT ONE MARKET, STEUART TOWER, SUITE 400, SAN FRANCISCO, CA 94105	PROJECT NO DE-AC04-83AL1879 FIGURE 1

NO.	DATE	REVISION	BY	CK	ENG MGR	ENG MGR	QA MGR	DOE APP

9705140449-03

ATTACHMENT 12

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATION OFFICE
CONTRACT NO. DE-AC04-83AL18796

SALT LAKE CITY, UTAH

FINAL COMPLETION REPORT

VOLUME 1
Appendices A, C, and D

REMEDIAL ACTION CONTRACTOR
FOR THE URANIUM MILL TAILINGS
REMEDIAL ACTION PROJECT

MAY 1997

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATION OFFICE
CONTRACT NO. DE-AC04-83AL18796

SALT LAKE CITY, UTAH

FINAL COMPLETION REPORT

VOLUME 2A
Appendix E

REMEDIAL ACTION CONTRACTOR
FOR THE URANIUM MILL TAILINGS
REMEDIAL ACTION PROJECT

MAY 1997

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATION OFFICE
CONTRACT NO. DE-AC04-83AL18796

SALT LAKE CITY, UTAH

FINAL COMPLETION REPORT

VOLUME 2B
Appendix B

REMEDIAL ACTION CONTRACTOR
FOR THE URANIUM MILL TAILINGS
REMEDIAL ACTION PROJECT

MAY 1997

MK FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATION OFFICE
CONTRACT NO. DE-AC04-83AL18796

SALT LAKE CITY, UTAH

FINAL COMPLETION REPORT

VOLUME 3
Appendices F thru J

REMEDIAL ACTION CONTRACTOR
FOR THE URANIUM MILL TAILINGS
REMEDIAL ACTION PROJECT

MAY 1997

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATION OFFICE
CONTRACT NO. DE-AC04-83AL18796

SALT LAKE CITY, UTAH

FINAL COMPLETION REPORT

VOLUME 4
Appendices K and L

REMEDIAL ACTION CONTRACTOR
FOR THE URANIUM MILL TAILINGS
REMEDIAL ACTION PROJECT

MAY 1997

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY