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

MAR 22 1994

Mr. Joseph J. Holonich
Acting Chief, Uranium Recovery
Branch
Division of Low-Level Waste
Management and Decommissioning
Office of Nuclear Materials Safety
and Safeguards
Mail Stop 5E-4 OWFN
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Holonich

Enclosed are six sets of page changes for the Lowman, Idaho, Final Completion Report generated as a result of comments received from the Nuclear Regulatory Commission and from a technical review of MK-Ferguson responses to these comments by Jacobs Engineering Group. Due to the unfortunate fact that the two sets of comments cannot easily be combined, I suggest you make the page changes in the "A" envelope first, then proceed with the page changes in the "B" envelope, and lastly replace the "DRAFT" cover inserts with the "FINAL" cover inserts included in the "B" package. This request is also pursuant to recent phone conversations I have had with Mohammed Haque and Dan Gillen regarding this issue. Copies of the Comment and Response Document associated with these changes are included in the "B" envelope.

If you have any questions regarding this transmittal, please feel free to contact me at (505) 845-5637.

Sincerely,

L. A."Woody" Woodworth
Site Manager
Uranium Mill Tailings Remedial Action
Project Office

2 Enclosures:
Lowman, Idaho, Completion Report Response
Revision A (6)
Lowman, Idaho, Completion Report Response
Revision B (6)

cc: see page 2

WM-43
NH16

MAR 2 2 1994

cc w/o enclosures:
M. Haque, NRC
C. Smythe, UMTRA
D. Bierley, TAC
S. Cox, TAC
S. Martz, MK-F
B. Hindman, MK-F

ENGINEERS
AND
CONSTRUCTORS

MK-FERGUSON COMPANY
A MORRISON KN' COMPANY

HEADQUARTERS OFFICE
ONE ERIEVIEW PLAZA
CLEVELAND, OHIO U.S.A. 44114
PHONE: (216) 523-5600/TELEX: 985542

REPLY TO: MK-FERGUSON COMPANY
REMEDIAL ACTIONS
CONTRACTOR-UMTRA PROJECT
P.O. BOX 9136
ALBUQUERQUE, NEW MEXICO U.S.A. 87119

April 30, 1993 93-3050-293

Woody Woodworth
Site Manager
U.S. Department of Energy
Uranium Mill Tailings Remedial Action Project Office
First National Bank Building
5301 Central Avenue N.E.
Suite 1700
Albuquerque, New Mexico 87108

SUBJECT: Response to the Nuclear Regulatory Commission (NRC) Comments on the Lowman, Idaho Draft Completion Report

REFERENCE:

1) **Letter from Woody Woodworth to Steve Martz on March 17, 1993 (MK-F No. 3050-93-244).**

2) **MK-F, DOE and NRC telephone conversation dated February 10, 1993, with NRC: D. Jacoby, R. Conzalez, and E. Hawkins, DOE: R. Edge and MK-F: S. Martz and G. Doyle.**

3) **Contract No. DE-AC04-83AL18796**

Dear Mr. Woodworth:

Review of the Lowman, ID Draft Completion Report resulted in comments by the Nuclear Regulatory Commission (NRC), which require responses. The comments resulted in a modification to the Draft Completion Report, which have been addressed in the following text. Revisions to the initial attachments have been shaded for easy identification. The replacement pages are not shaded and are included behind the **tab** labeled "Replacement Pages" at the end of each attachment. Eight (8), three-holed copies of the replacement pages have been included for revision to the Draft Completion Report in the possession of DOE, NRC, and the State of Idaho.

NRC Open Issues

GEOTECHNICAL ENGINEERING

1. a) The RAP requirement that the organics in the lower lifts of the contaminated material be <5% by volume in any area. (Specification page 02200-16), was not discussed in the CR. DOE should address how field activities controlled this aspect or otherwise verification for this item.

b) The maximum 5% by volume organic/deleterious substance content for radon barrier material (Specification page 02200-8) was not discussed. As above, DOE should address how field activities controlled this aspect or otherwise provide verification for this item.

Response:

MK-Ferguson agrees that the method used for controlling organics in the fill should be addressed in the completion report. MK-F performed continuous visual inspection throughout placement of Contaminated Fill to ensure that not more than 5% organic material was placed, as documented in Daily Inspection Reports. The following was incorporated into Contaminated Fill section, Appendix E of the completion report:

> "During placement of Contaminated Fill materials, continuous visual inspection was performed to ensure that not more than 5% by volume of organics were placed throughout the fill, also"

In addition, the following statement was incorporated into the Radon Barrier section of Appendix E:

> "During Radon Barrier Material placement, continuous visual inspection was performed to ensure that not more than 5% by volume of organics and/or deleterious substances were placed."

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 3, Appendix E, turn to "Contaminated Fill Materials" section and remove the written text.

Step No. 2: **Obtain Attachment No. 1, and insert "Replacement Pages" after the "Contaminated Fill Material" title page.**

Step No. 3: **Turn to the "Radon Barrier Material" section and remove the written text.**

Step No. 4: **Obtain Attachment No. 2, and insert "Replacement Pages" after the "Radon Barrier Material" title page.**

2. Frequency distribution of testing for contaminated fill and radon barrier soils was not provided. DOE should address or provide verification for this item.

Response:

MK-F has provided Moisture/Density Testing Frequency Charts at the end of the Contaminated Fill and Radon Barrier Fill Materials sections of the completion report. (See previous steps provided under Comment No. 1)

3. For the bedding layer material it was stated that an "Average value of 4 tests was within specified limits." It is not stated whether any individual test results were out of specified limits. DOE should verify that on individual tests were outside of acceptable limits.

Response:

In Volume 3, Appendix E, titled "Bedding Material", eighth bullet item, found on Page 3, last sentence states in part "All 4 gradations tests passed the Design Specification requirements." Therefore, no gradation tests failed, which resolves the above open issue.

RADIATION PROTECTION/SITE CLEANUP

4. The RAS Report (pages 2, 6) states that the cell will cover 9 acres and approximately 18 acres will be restricted area. There is no map in Appendix D, As-Built Drawings, that indicates which 18 acres have restricted access or how the restricted area will be maintained. DOE should indicate the location and current/future status of this 18-acre area.

Response:

This open issue should be addressed by the Department of Energy (DOE).

5. As stated in a November 5, 1991, letter to DOE, NRC's concurrence on PID 12-S-07 was on the condition that the Completion Report contain data supporting the estimate that the average radium content of the additional material placed in the ditch at the north end of the disposal cell was below 25 pCi/g. A copy of an Inter-Office Communication was attached to PID 12-S-07, Revision 1, that was transmitted to NRC on September 25, 1991. That document stated that the additional 24,500 yd^3 of contaminated material contained less than 20 pCi/g in the top 10 feet DOE should present the data in the CR.

Response:

MK-Ferguson agrees that this data should be added to the CR. A paragraph describing the cell expansion area with a data table has been added to Appendix H of the CR.

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 4, turn to Appendix H tab, and remove Page No. 2 of the text.

Step No. 2: Obtain Attachment No. 3, and insert "Replacement Pages" after Page No. 1 titled "Post-Remedial Action Site Conditions".

6. As-built drawings do not show the locations of abandoned piezometers situated beneath the designed disposal cell. DOE should update the as-built drawings to include the locations of abandoned wells and piezometers. DOE should also provide the abandonment procedures for the piezometers, if those procedures varied for the well abandonment specification in the RAP.

Additionally, several monitoring wells described in the RAP are not shown on the As-built Drawing LOW-PS-10-1209, and not listed as being abandoned. Well 641 and the on-site perennial spring (561) are designated as monitoring points described in the RAP. DOE should revise Drawing LOW-PS-10-1209 to show the location of all wells remaining after completion of remedial activities.

Response:

Well No.s 571 and 581 were the only two wells designated for abandonment per the RAP. Piezometer No.s 022, 023, 024, 025, 026, and 027 were shown in the RAP but were not designated for abandonment. This disparity exists because these piezometers were abandoned in 1990 under a previous contract. The reason for this is that the specifications contained in the RAP also form the Subcontract Documents. Since the piezometers were already abandoned they were not designated for abandonment in the specifications making up the Final RAP. The piezometers were abandoned in accordance with the attached specification. (See "Step-By-Step" below)

The locations of the wells and piezometers were not added to the As-Built drawings since they are considered to be no longer in existence. As-Built drawings are generated to show the condition of the existing features of the site after remediation. The location of the wells and piezometers were indicated in the RAP. The Monitor wells that were still in existence at the end of remedial action are shown on As-Built Drawing LOW-PS-10-1209. This As-Built Drawing has been revised to show Well No. 641. (See "Step-By-Step" below)

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 2, Appendix C, turn to "Section 2090 Well Abandonment".

Step No. 2: Obtain Attachment No. 4, and insert "Replacement Pages" after Page 2090 - 5, and before "Section 02110 Site Clearing" section.

Step No. 3: Turn to Appendix D, titled "As-Built Drawings" and remove As-Built Drawing No. LOW-PS-10-1209.

Step No. 4: Obtain Attachment No. 5, and insert "Replacement Pages" after As-Built Drawing No. LOW-PS-10-1208 and before As-Built Drawing No. LOW-PS-10-1210.

7. DOE should revise tabulations of the measured quantities of water actually used for dust control and tailings material compaction.

Response:

Attached is a tabulation of the time engaged in dust suppression and resulting quantities of water expended for dust suppression on the tailings embankment. This tabulation was developed from site Daily Field Reports.

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 3, Appendix E, turn to the "Contaminated Fill Material"section.

Step No. 2: Obtain Attachment No. 6, and insert "Replacement Pages" after the last drawing titled "Contaminated Fill Material, Elevation - 3992".

8. DOE should provide the ground-water monitoring data collected during and immediately after the remedial activities. Additionally, an interpretive analysis of the monitoring results should be provided to document the impact that remedial activities may have on the ground-water quality.

Response:

DOE's Technical Assistance Contractor should provide this information, since the RAC did not perform ground-water activities during the course of remedial action.

General Comments

RADIATION PROTECTION/SITE CLEANUP

1. Appendix D as-built drawing LOW-PS-10-1208 should be revised as follows:

   a. The drawing indicates four "hot spots" in areas where supplemental standards were applied to leave low-level Ra-226. Note three on the drawing states that these spots are five feet in diameter and over the 5 pCi/g Ra-226 standard. More specific information such as volume and average Ra-226 level, or a reference to data on these spots should be provided on the drawing.

Response:

As noted in comment 1b below, the three hot spots along the access road were inadvertently left on the drawing. They have been removed from Drawing No. LOW-PS-10-1208 since they had been remediated in 1990. The statement in the RAS page 71 is correct. The average RA-226 concentration for the fourth "hot spot" southwest of the dry settling pond is shown on page 73 of the RAS Report. The average concentration is shown as 9 pCi/g. The drawing will not be revised since this information is included in the RAS Report and is located in the Supplemental Standards area.

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 2, Appendix D, titled "As-Built Drawings" and remove As-Built Drawing No. LOW-PS-10-1208.

Step No. 2: Obtain Attachment No. 7, and insert "Replacement Pages" after As-Built Drawing No. LOW-PS-10-1203 and before As-Built Drawing No. LOW-PS-10-1209.

b. The RAS report indicates on page 71 that three "hot spots" along the access road, in the southwest corner of the property, were removed. The three "hot spots" on Figure 6.2 of the RAS Report correspond in location to three of the "hot spots" on the drawing. DOE should determine if the three "hot spots" should be removed from the drawing. If the drawing is correct and therefore, the supplemental standard application is incorrect or incomplete, this becomes an open issue.

Response:

Reference the response for open issue 1.a. of General Comments.

c. The drawing should indicate that the areas marked 0.0 feet for depth of excavation are the supplemental standards areas where Ra-226 contamination is to remain.

Response:

MK-F agrees with the NRC Comment, therefore, As-Built Drawing No. LOW-PS-10-1208 has been revised and incorporated into the completion report. Reference the response and "step-by-step" for open issue 1.a. of General Comments.

2. Appendix K of the CR contains PID 12-S-09 which is the supplemental standard application for 0.5 acres along Clear Creek. NRC staff recommends that Appendix K be eliminated from the CR as presentation of entire PID's in the CR is inappropriate. Summary information related to the PID should be added to Appendix H or Appendix J (page four), which already contains discussion of supplemental standard areas.

Response:

MK-Ferguson agrees that Appendix K of the Lowman Completion Report should be removed. Summary information from PID 12-S-09 is already included in Appendix J on Page 5. Appendix K has been removed and the references to Appendix K have been changed to reference PID 12-S-09.

Step No. 1: Obtain Volume 4, turn to Appendix K, remove the tab and all of the text. This section has been discontinued.

Step No. 2: Obtain Attachment No. 10, and insert "Replacement Pages" in "Volume 4, Appendices F, G, H, I and J" in the binder.

3. Appendix J (page 1) indicates that the supplemental standards areas are on-site. However, as-built drawings LOW-PS-10-1203 and 1209 indicate that most of the supplemental standard areas are outside of the designated site boundary and the north windblown area is outside the property line. DOE should explain the statement in Appendix J and indicate the potential use of the supplemental standards areas.

Response:

The wording used to describe the location of the supplemental standards area was inaccurate. The statements should have explained that the supplemental standards areas are located around the disposal cell mostly within the former construction site boundary. The wording on page 1 of Appendix J has been changed to more accurately describe the supplemental standards area. The potential use of the supplemental standards area has been incorporated into the Appendix J text.

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 4, Appendix J and remove the written text.

Step No. 2: Obtain Attachment No. 8, and insert "Replacement Pages" after the Appendix J tab.

4. Given that a supplemental standard for uranium was described in the RAP, Appendix J should mention why uranium measurements are not included.

Response:

Mechanical processing was the only type of process used at the Lowman site. Generally, chemical processing is required to produce uranium activities that are out of equilibrium with radium activities. Sample analysis for uranium and radium at the Lowman site indicated that they were in equilibrium, therefore when radium was remediated to the EPA limits the uranium was also remediated to the RAP requirements. Due to the equilibrium of uranium to radium, uranium analysis was not performed on Lowman verification samples thereby eliminating unjustified analysis costs. MK-Ferguson has incorporated the following explanation in Appendix J of the completion report:

> "The Final RAP presented the standards for cleanup of Uranium to 10 pCi/g in the top 15 cm and 30 pCi/g in subsequent 15 cm layers. Mechanical processing was the only type of process used at the Lowman site. Generally, chemical processing is required to produce uranium activities. Sample analysis for uranium and radium at the Lowman site indicated that they were in equilibrium of uranium and radium. Sample analysis for uranium was not conducted on verification samples at the Lowman site, thereby eliminating unjustified analytical costs."

Reference the "Step-By-Step" that is provided in the response to NRC Comment No. 3 of General Comments for revising the completion report.

5. Volume 5B, Appendix B, Calculation 12-625-01-03 addendum Appendix C (DOE,1992a), is titled Field Radon Emanation Results. The data from 20 locations at various elevations, is presented as pCi/g. Radon emanation is the fraction of radon released in the pore space of the soil and would have no units. According to page AA-8, the data in Appendix C represents Ra-226 levels. DOE should correct the title page to this Appendix C.

Response:

MK-F agrees that Volume 5B, Appendix C, Calculation 12-625-01-03 title page should be revised. The title page was revised and incorporated into the completion report.

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 5B, Appendix B, turn to "12-625-01-03" section and remove the title page.

Step No. 2: Obtain Attachment No. 9, and insert "Replacement Pages" after the tab titled "12-625-01-03".

If DOE evaluates these changes as acceptable, please notify us so we can order new covers and spines which will state "Final Completion Report."

If you have any questions regarding this submittal, please contact Steven D. Martz at (505) 246-2571.

SDM/GJD

MK-FERGUSON COMPANY

Steven D. Martz
Project Quality Manager

cc: (w/o attachment)

C. Smythe - DOE/UMTRA

ATTACHMENT NO. 1

constructible thickness in such a manner as to prevent voids and provide adequate compaction between the larger particles.

- During placement of the contaminated fill material, continuous visual inspection was performed to ensure that not more than 5% by volume of organics were placed throughout the fill, also demolition debris, were evenly distributed throughout the pile to avoid concentrations in any area. Pieces of wood, concrete, masonry, and steel members were cut or broken up to be no greater than 10 feet in any dimension or no greater than 27 cubic feet in volume.

- Of the 129,421 cubic yards placed in the cell embankment, there were approximately 45,311 cubic yards of concrete, debris, asbestos material, and large contaminated material requiring encapsulation which could not be tested in accordance with ASTM D-698. Gradation samples of these materials revealed greater than 30% was retained on the 3/4" sieve. Therefore, the material was considered non-testable as outlined in ASTM D-698. Design specification compaction requirements for these non-testable materials were satisfied by 3 complete passes with an Ingersoll Rand SD100D vibratory roller with the vibrator set at high frequency amplitude, which was approved for use. The required compaction efforts were verified through routine daily QC inspections. Twelve gradations were performed on the 45,311 cubic yards of non-testable material placed, yielding an average test frequency of one gradation test for every 3,776 cubic yards of non-testable material placed. There was no specified frequency for performing these gradation tests.

- The required frequency for performing maximum density determination tests in accordance with ASTM D-698 was, prior to placement and supplemental tests to be conducted, at an approximate

density tests, provides an average test frequency of one in-place field density test performed for each 332 cubic yards of contaminated material fill placed. Reference the Moisture/Density Testing Frequency Charts at the end of this section.

- There were 20 failing in-place density tests at applicable areas within the embankment perimeter, all of which required rework in order to satisfy the specified compaction requirements. All areas which were known to require rework were reworked, retested, and accepted in accordance with the specified requirements.

- The contaminated fill material was moisture-conditioned at the excavation or in stockpiles as required to achieve acceptable compaction. This was accomplished by either the addition of water or by allowing the material to dry after scarification.

- No moisture was applied to contaminated fill material on the cell embankment for compaction purposes, as there was no specified moisture content requirement for contaminated fill materials. Moisture was applied to the cell embankment only when necessary for environmental dust control. Reference the tabulation sheet at the end of this section for the amount of water used for environmental dust control at the disposal site.

- Moisture content verification was accomplished by performing in-place moisture tests in accordance with ASTM D-4643 and D-2216.

- One oven-dried moisture test was required for every 10 microwave moisture tests performed. From 271 microwave moisture tests performed, 57 oven-dried moisture comparisons were

LOWMAN, IDAHO SITE

MOISTURE/DENSITY TESTING FREQUENCY CHART

CONTAMINATED MATERIAL FILL

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS PLACED	CUBIC YARDS PLACED AND COMPACTED	COMMENTS
04/26/91	0	0	150	150	NOT TESTABLE *
05/07/91	2	2,000	810	660	N/A
05/08/91	0	2,000	1,110	300	300 YDS.^{3} NOT TESTABLE*
05/13/91	4	6,000	3,000	1,890	250 YDS.^{3} NOT TESTABLE*
05/14/91	2	8,000	4,770	1,770	300 YDS.^{3} NOT TESTABLE*
05/16/91	6	14,000	8,702	3,932	N/A
05/17/91	2	16,000	9,646	944	N/A
05/20/91	4	20,000	11,308	1,662	N/A
5/21/91	4	24,000	14,174	2,866	N/A
05/22/91	5	29,000	17,144	2,970	N/A
05/23/91	5	34,000	20,644	3,500	N/A
05/24/91	5	39,000	24,042	3,398	N/A
05/28/91	2	41,000	25,572	1,530	N/A
05/29/91	6	47,000	30,426	4,854	N/A
05/31/91	5	52,000	32,516	2,090	N/A
06/03/91	5	57,000	35,876	3,360	N/A
06/04/91	6	63,000	39,882	4,006	N/A
06/06/91	6	69,000	43,382	3,500	N/A
06/07/91	6	75,000	47,417	4,035	N/A
06/10/91	6	81,000	51,712	4,295	1,150 YDS.^{3} NOT TESTABLE*
06/11/91	6	87,000	55,102	3,390	N/A
06/12/91	6	93,000	58,452	3,350	N/A
06/13/91	6	99,000	61,887	3,435	N/A
06/14/91	5	104,000	65,487	3,600	N/A

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY. FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS PLACED	CUBIC YARDS PLACED AND/OR COMPACTED	COMMENTS
06/17/91	4	108,000	70,042	4,555	4,555 YDS.^{3} NOT TESTABLE *
06/18/91	2	110,000	75,510	5,468	5,468 YDS.^{3} NOT TESTABLE *
06/19/91	6	116,000	80,228	4,718	N/A
06/20/91	6	122,000	86,165	5,937	1,800 YDS.^{3} NOT TESTABLE *
06/21/91	6	128,000	89,074	2,909	N/A
06/24/91	6	134,000	90,856	1,782	N/A
06/25/91	6	140,000	92,397	1,541	N/A
06/26/91	4	144,000	95,000	2,603	N/A
07/01/91	3	146,000	98,433	3,433	2,200 YDS.^{3} NOT TESTABLE *
07/02/91	5	151,000	103,218	4,785	1,600 YDS.^{3} NOT TESTABLE *
07/03/91	6	157,000	106,377	3,159	1,800 YDS.^{3} NOT TESTABLE *
07/08/91	5	163,000	108,800	2,423	800 YDS.^{3} NOT TESTABLE *
07/09/91	4	167,000	112,729	3,929	450 YDS.^{3} NOT TESTABLE *
07/10/91	4	171,000	115,826	3,097	N/A
07/11/91	4	175,000	118,428	2,602	1,100 YDS.^{3} NOT TESTABLE *
07/12/91	3	178,000	87,881	1,833	1,500 YDS.^{3} NOT TESTABLE *
07/15/91	3	181,000	121,793	1,532	950 YDS.^{3} NOT TESTABLE *
07/16/91	2	183,000	89,413	850	N/A
07/17/91	4	187,000	91,646	2,233	N/A
07/18/91	3	190,000	93,407	1,761	N/A
07/19/91	3	193,000	95,312	1,905	N/A
07/22/91	3	196,000	97,586	2,274	N/A

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY. FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS	CUBIC YARDS PLACED AND/OR COMPACTED	COMMENTS
07/23/91	3	196,000	98,986	1,400	N/A
07/24/91	0	196,000	100,123	1,137	1,137 YDS.^{3} NOT TESTABLE *
07/25/91	0	196,000	101,440	1,317	1,317 YDS.^{3} NOT TESTABLE *
07/26/91	0	196,000	103,249	1,809	1,809 YDS.^{3} NOT TESTABLE *
07/29/91	0	196,000	103,735	486	486 YDS.^{3} NOT TESTABLE *
07/30/87	3	199,000	104,215	480	N/A
08/09/91	0	199,000	106,205	1,990	1,990 YDS.^{3} NOT TESTABLE *
08/10/91	0	199,000	108,503	2,298	2,298 YDS.^{3} NOT TESTABLE *
08/12/91	0	199,000	114,038	5,535	5,535 YDS.^{3} NOT TESTABLE *
08/13/91	3	202,000	118,646	4,608	2,100 YDS.^{3} NOT TESTABLE *
08/14/91	0	202,000	122,312	3,666	3,666 YDS.^{3} NOT TESTABLE *
08/15/91	7	209,000	287,000	4,497	N/A
08/16/91	7	216,000	129,488	2,679	N/A
08/17/91	8	224,000	130,730	1,242	600 YDS.^{3} NOT TESTABLE *
08/19/91	7	231,000	132,224	1,494	N/A
08/20/91	2	233,000	133,124	900	N/A
08/21/91	5	238,000	134,330	1,206	N/A
08/22/91	8	245,000	135,338	1,008	N/A
09/03/91	2	247,000	135,338	0	NO PLACEMENT
09/05/91	2	249,000	130,189**	0	* *

* "NOT TESTABLE", refers to over-size material in which roller passes of compaction equipment was observed.

** Year-End Survey - 130,189

CONTAMINATED FILL MATERIAL

- Prior to the placement of contaminated fill material, the contaminated subgrade (existing grade of the tailings embankment) was verified to have been proof-rolled a minimum of four passes with a minimum 20-ton pneumatic-tired roller or contractor approved substitute.

- The proof-rolled contaminate subgrade surface of the tailings embankment was scarified to a depth of 1 inch to 2 inches just prior to placement of the overlying loose lift of contaminated fill material. The contaminated subgrade preparation was approved and inspected prior to placement of contaminated material to ensure that a minimal disturbance had taken place.

- All contaminated material and debris resulting from the demolition of the old mill foundation and associated structures, and from off-site vicinity properties were cut or broken up into sizes that met the specified requirements.

- The contaminated fill material requiring encapsulation was placed and compacted with the following equipment: 490 and 790 John Deere, Kamatsu PC-220 LC, and Caterpillar 627 B for excavating; end dumps and Caterpillar 627B for hauling; Caterpillar D-6, Caterpillar 14G, and Dresser TD-15C for spreading; and Ingersoll Rand SD-100D for compaction.

- Loose lift thickness measurements were performed which verified that the loose lift thickness of the contaminated fill material did not exceed 10 inches. Where contaminated fill material contained individual particles larger than 10 inches, the loose lift was kept to a minimum

constructible thickness in such a manner as to prevent voids and provide adequate compaction between the larger particles.

- During placement of the contaminated fill material, continuous visual inspection was performed to ensure that not more than 5% by volume of organics were placed throughout the fill, also demolition debris, were evenly distributed throughout the pile to avoid concentrations in any area. Pieces of wood, concrete, masonry, and steel members were cut or broken up to be no greater than 10 feet in any dimension or no greater than 27 cubic feet in volume.

- Of the 129,421 cubic yards placed in the cell embankment, there were approximately 45,311 cubic yards of concrete, debris, asbestos material, and large contaminated material requiring encapsulation which could not be tested in accordance with ASTM D-698. Gradation samples of these materials revealed greater than 30% was retained on the 3/4" sieve. Therefore, the material was considered non-testable as outlined in ASTM D-698. Design specification compaction requirements for these non-testable materials were satisfied by 3 complete passes with an Ingersoll Rand SD100D vibratory roller with the vibrator set at high frequency amplitude, which was approved for use. The required compaction efforts were verified through routine daily QC inspections. Twelve gradations were performed on the 45,311 cubic yards of non-testable material placed, yielding an average test frequency of one gradation test for every 3,776 cubic yards of non-testable material placed. There was no specified frequency for performing these gradation tests.

- The required frequency for performing maximum density determination tests in accordance with ASTM D-698 was, prior to placement and supplemental tests to be conducted, at an approximate

frequency of one test for every 10 or 15 in-place field density tests performed.

- Forty four maximum dry density determination tests were performed in accordance with ASTM D-698. With 253 in-place field density tests performed, an average test frequency of one maximum dry density determination test was performed for each 5.8 in-place density tests.

- The required average test frequency for performing one-point proctor tests was a minimum of one one-point proctor test for each 5 in-place density tests performed. Ninety eight one-point proctor tests were performed to ensure that the correct maximum density was utilized when performing in-place field density tests. With 253 in-place field density tests performed, an average test frequency of one one-point proctor test for each 2.6 in-place field density tests was performed.

- The required degree of compaction for contaminated fill materials was 90% of the maximum dry density, in accordance with ASTM D-698, with the top 2 feet below the radon barrier requiring 95% compaction. The required frequency for verifying compaction was an in-place field density test for each 1,000 cubic yards of material placed.

- Compaction verification was accomplished by performing in-place field density tests in accordance with ASTM D-1556.

- The average percent compaction obtained was 98.9%, which was determined from a total of 253 in-place field density tests meeting specified requirements. Approximately 84,110 cubic yards of testable contaminated fill material was placed, which divided by 253 acceptable in-place field

density tests, provides an average test frequency of one in-place field density test performed for each 332 cubic yards of contaminated material fill placed. Reference the Moisture/Density Testing Frequency Charts at the end of this section.

- There were 20 failing in-place density tests at applicable areas within the embankment perimeter, all of which required rework in order to satisfy the specified compaction requirements. All areas which were known to require rework were reworked, retested, and accepted in accordance with the specified requirements.

- The contaminated fill material was moisture-conditioned at the excavation or in stockpiles as required to achieve acceptable compaction. This was accomplished by either the addition of water or by allowing the material to dry after scarification.

- No moisture was applied to contaminated fill material on the cell embankment for compaction purposes, as there was no specified moisture content requirement for contaminated fill materials. Moisture was applied to the cell embankment only when necessary for environmental dust control. Reference the tabulation sheet at the end of this section for the amount of water used for environmental dust control at the disposal site.

- Moisture content verification was accomplished by performing in-place moisture tests in accordance with ASTM D-4643 and D-2216.

- One oven-dried moisture test was required for every 10 microwave moisture tests performed. From 271 microwave moisture tests performed, 57 oven-dried moisture comparisons were

performed, providing an average test frequency of one oven dried moisture test for every 4.8 microwave oven moisture tests performed.

- The contaminated fill material finish grade was verified to have been bladed to a uniform smooth grade and track-walked up and down the slopes of the embankment with a Caterpillar D-6 dozer or a contractor-approved equivalent, prior to placement of radon barrier.

- In addition to the average testing frequency requirements, a minimum of two in-place moisture density tests were performed each day whenever more than 150 cubic yards of material were placed. Sand cone density test sand was calibrated twice a day and at the beginning of each new bag of sand.

- All measuring and testing equipment used during the course of remedial action was calibrated against equipment having a known valid relationship to National Institute of Standards & Technology (NIST) or other nationally recognized standards. Calibrated testing equipment included: scales, proctor molds/hammers, sand cones, NIST-traceable test weights, and calipers.

- The test frequencies stated herein were derived from the total quantity referenced, divided by the total number of tests taken for that quantity. It should be noted that during remedial action, material quantities are not continually surveyed during production, placement, and/or compaction but rather surveyed at various milestones (e.g., completion of first lift, for pay quantities, to verify survey coordinates). Therefore, daily material quantities are estimated by load counts or conveyor belt rates until final or partial surveys are obtained. Once survey quantities are obtained, the estimated material quantities are adjusted to reflect the actual test frequency. All quantities stated herein between tests were estimated during remedial action to never exceed the

frequency specified by the Design Specifications and Remedial Action Inspection Plan; were proportionally taken throughout production, placement, and/or compaction; and were not taken all in one given time frame.

- All tests and inspections were performed in accordance with the specified requirements.

- The following data has been provided identifying each contaminated fill material moisture/density test location.

LOWMAN, IDAHO SITE
MOISTURE/DENSITY TESTING FREQUENCY CHART

CONTAMINATED MATERIAL FILL

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS PLACED	CUBIC YARDS PLACED AND COMPACTED	COMMENTS
04/26/91	0	0	150	150	NOT TESTABLE *
05/07/91	2	2,000	810	660	N/A
05/08/91	0	2,000	1,110	300	300 YDS.^{3} NOT TESTABLE*
05/13/91	4	6,000	3,000	1,890	250 YDS.^{3} NOT TESTABLE*
05/14/91	2	8,000	4,770	1,770	300 YDS.^{3} NOT TESTABLE*
05/16/91	6	14,000	8,702	3,932	N/A
05/17/91	2	16,000	9,646	944	N/A
05/20/91	4	20,000	11,308	1,662	N/A
5/21/91	4	24,000	14,174	2,866	N/A
05/22/91	5	29,000	17,144	2,970	N/A
05/23/91	5	34,000	20,644	3,500	N/A
05/24/91	5	39,000	24,042	3,398	N/A
05/28/91	2	41,000	25,572	1,530	N/A
05/29/91	6	47,000	30,426	4,854	N/A
05/31/91	5	52,000	32,516	2,090	N/A
06/03/91	5	57,000	35,876	3,360	N/A
06/04/91	6	63,000	39,882	4,006	N/A
06/06/91	6	69,000	43,382	3,500	N/A
06/07/91	6	75,000	47,417	4,035	N/A
06/10/91	6	81,000	51,712	4,295	1,150 YDS.^{3} NOT TESTABLE*
06/11/91	6	87,000	55,102	3,390	N/A
06/12/91	6	93,000	58,452	3,350	N/A
06/13/91	6	99,000	61,887	3,435	N/A
06/14/91	5	104,000	65,487	3,600	N/A

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY. FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS PLACED	CUBIC YARDS PLACED AND/OR COMPACTED	COMMENTS
06/17/91	4	108,000	70,042	4,555	4,555 YDS.^{3} NOT TESTABLE *
06/18/91	2	110,000	75,510	5,468	5,468 YDS.^{3} NOT TESTABLE *
06/19/91	6	116,000	80,228	4,718	N/A
06/20/91	6	122,000	86,165	5,937	1,800 YDS.^{3} NOT TESTABLE *
06/21/91	6	128,000	89,074	2,909	N/A
06/24/91	6	134,000	90,856	1,782	N/A
06/25/91	6	140,000	92,397	1,541	N/A
06/26/91	4	144,000	95,000	2,603	N/A
07/01/91	3	146,000	98,433	3,433	2,200 YDS.^{3} NOT TESTABLE *
07/02/91	5	151,000	103,218	4,785	1,600 YDS.^{3} NOT TESTABLE *
07/03/91	6	157,000	106,377	3,159	1,800 YDS.^{3} NOT TESTABLE *
07/08/91	5	163,000	108,800	2,423	800 YDS.^{3} NOT TESTABLE *
07/09/91	4	167,000	112,729	3,929	450 YDS.^{3} NOT TESTABLE *
07/10/91	4	171,000	115,826	3,097	N/A
07/11/91	4	175,000	118,428	2,602	1,100 YDS.^{3} NOT TESTABLE *
07/12/91	3	178,000	87,881	1,833	1,500 YDS.^{3} NOT TESTABLE *
07/15/91	3	181,000	121,793	1,532	950 YDS.^{3} NOT TESTABLE *
07/16/91	2	183,000	89,413	850	N/A
07/17/91	4	187,000	91,646	2,233	N/A
07/18/91	3	190,000	93,407	1,761	N/A
07/19/91	3	193,000	95,312	1,905	N/A
07/22/91	3	196,000	97,586	2,274	N/A

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY. FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS	CUBIC YARDS PLACED AND/OR COMPACTED	COMMENTS
07/23/91	3	196,000	98,986	1,400	N/A
07/24/91	0	196,000	100,123	1,137	1,137 YDS.^{3} NOT TESTABLE *
07/25/91	0	196,000	101,440	1 317	1,317 YDS.^{3} NOT TESTABLE *
07/26/91	0	196,000	103,249	1,809	1,809 YDS.^{3} NOT TESTABLE *
07/29/91	0	196,000	103,735	486	486 YDS.^{3} NOT TESTABLE *
07/30/87	3	199,000	104,215	480	N/A
08/09/91	0	199,000	106,205	1,990	1,990 YDS.^{3} NOT TESTABLE *
08/10/91	0	199,000	108,503	2,298	2,298 YDS.^{3} NOT TESTABLE *
08/12/91	0	199,000	114,038	5,535	5,535 YDS.^{3} NOT TESTABLE *
08/13/91	3	202,000	118,646	4,608	2,100 YDS.^{3} NOT TESTABLE *
08/14/91	0	202,000	122,312	3,666	3,666 YDS.^{3} NOT TESTABLE *
08/15/91	7	209,000	287,000	4,497	N/A
08/16/91	7	216,000	129,488	2,679	N/A
08/17/91	8	224,000	130,730	1,242	600 YDS.^{3} NOT TESTABLE *
08/19/91	7	231,000	132,224	1,494	N/A
08/20/91	2	233,000	133,124	900	N/A
08/21/91	5	238,000	134,330	1,206	N/A
08/22/91	8	245,000	135,338	1,008	N/A
09/03/91	2	247,000	135,338	0	NO PLACEMENT
09/05/91	2	249,000	130,189**	0	" "

* "NOT TESTABLE", refers to over-size material in which roller passes of compaction equipment was observed.

** Year-End Survey - 130,189

ATTACHMENT NO. 2

- There were 13 maximum density determination tests performed in accordance with ASTM D-698. With 73 in-place field density tests performed, an average test frequency of the maximum density determination test performed for each 5.6 in-place field density tests. Maximum density determinations were initiated prior to placement activities.

- The primary equipment used for excavation, placement, moisture conditioning and compaction of the radon barrier material was as follows: Caterpillar 627B scrapers, a Caterpillar 14G grader, a Dresser TD-15C dozer, a Case tractor towing a disk, and a Caterpillar 815C tamping foot roller.

- It was required that radon barrier be placed on top of the track-walked finish grades of the contaminated fill material in a minimum of two lifts, with a maximum loose lift thickness of 12 inches for a final depth of 1.5 feet.

- Continuous monitoring was performed during material placement to ensure that the loose lift thickness did not exceed 12 inches, that the compacted lift thickness did not exceed 9 inches, and that the first lift of radon barrier was spread with a bull dozer as specified.

- During Radon Barrier Material placement, contiuous visual inspection was performed to ensure that not more than 5% by volume of organics and/or deleterious substances were placed.

- The required degree of compaction for the radon barrier material was 95% of the maximum dry density as determined in accordance with ASTM D-698. The required frequency for verifying compaction was one in-place field density for each 500 cubic yards of radon barrier material placed.

- Compaction control was accomplished by performing in-place sand cone density tests in accordance with ASTM D-1556.

- The average percent compaction obtained was 98.4%, which was determined from a total of 73 passing in-place field density tests. There were 17,929 cubic yards of radon barrier material placed, which divided by 73 passing tests, equals one in-place field density test performed for each 246 cubic yards of radon barrier material placed. Reference the Moisture\Density Testing Frequency Charts at the end of this section.

- There were 5 failing in-place field density tests within 5 different areas of the embankment perimeter, all of which required rework in order to satisfy the compaction requirements. All areas known to require rework were reworked, retested, and accepted in accordance with the specified requirements.

- Due to rainfall, a portion of the top lift of radon barrier material had to be disced and recompacted. After this rework was completed, a total of 7 reverification field density tests were performed in those areas which passed all moisture/density requirements.

- The required frequency for one-point proctor tests was a minimum of one one-point proctor test for each 5 in-place field density tests.

- There were 22 one-point proctor tests performed on radon barrier material to ensure that the correct maximum dry density value was utilized when performing in-place field density tests.

LOWMAN, IDAHO SITE
MOISTURE/DENSITY TESTING FREQUENCY CHART

RADON BARRIER

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY. FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS PLACED	CUBIC YARDS PLACED AND COMPACTED	COMMENTS
08/28/91	2	1,000	350	350	N/A
08/29/91	4	3,000	1,852	1,502	N/A
08/30/91	6	6,000	3,240	1,388	N/A
08/31/91	6	9,000	4,410	1,170	N/A
09/03/91	2	10,000	4,500	90	N/A
09/05/91	3	11,500	5,600	1,100	N/A
09/06/91	8	15,500	8,516	2,916	N/A
09/07/91	8	19,500	10,100	1,584	N/A
09/10/91	6	22,500	11,708	1,608	N/A
09/12/91	2	23,500	12,332	624	N/A
09/13/91	6	26,500	14,556	2,224	N/A
09/14/91	7	30,000	16,092	1,536	N/A
09/16/91	7	33,500	17,052	960	N/A
09/17/91	4	35,500	17,340	288	N/A
09/20/91	2	36,500	17,929 *	N/A	N/A

* Final Survey Quantity - 17,929 yds.^{3}

- There were 13 maximum density determination tests performed in accordance with ASTM D-698. With 73 in-place field density tests performed, an average test frequency of the maximum density determination test performed for each 5.6 in-place field density tests. Maximum density determinations were initiated prior to placement activities.

- The primary equipment used for excavation, placement, moisture conditioning and compaction of the radon barrier material was as follows: Caterpillar 627B scrapers, a Caterpillar 14G grader, a Dresser TD-15C dozer, a Case tractor towing a disk, and a Caterpillar 815C tamping foot roller.

- It was required that radon barrier be placed on top of the track-walked finish grades of the contaminated fill material in a minimum of two lifts, with a maximum loose lift thickness of 12 inches for a final depth of 1.5 feet.

- Continuous monitoring was performed during material placement to ensure that the loose lift thickness did not exceed 12 inches, that the compacted lift thickness did not exceed 9 inches, and that the first lift of radon barrier was spread with a bull dozer as specified.

- During Radon Barrier Material placement, contiuous visual inspection was performed to ensure that not more than 5% by volume of organics and/or deleterious substances were placed.

- The required degree of compaction for the radon barrier material was 95% of the maximum dry density as determined in accordance with ASTM D-698. The required frequency for verifying compaction was one in-place field density for each 500 cubic yards of radon barrier material placed.

- Compaction control was accomplished by performing in-place sand cone density tests in accordance with ASTM D-1556.

- The average percent compaction obtained was 98.4%, which was determined from a total of 73 passing in-place field density tests. There were 17,929 cubic yards of radon barrier material placed, which divided by 73 passing tests, equals one in-place field density test performed for each 246 cubic yards of radon barrier material placed. Reference the Moisture\Density Testing Frequency Charts at the end of this section.

- There were 5 failing in-place field density tests within 5 different areas of the embankment perimeter, all of which required rework in order to satisfy the compaction requirements. All areas shown to require rework were reworked, retested, and accepted in accordance with the specified requirements.

- Due to rainfall, a portion of the top lift of radon barrier material had to be disced and recompacted. After this rework was completed, a total of 7 reverification field density tests were performed in those areas which passed all moisture/density requirements.

- The required frequency for one-point proctor tests was a minimum of one one-point proctor test for each 5 in-place field density tests.

- There were 22 one-point proctor tests performed on radon barrier material to ensure that the correct maximum dry density value was utilized when performing in-place field density tests.

LOWMAN, IDAHO SITE
MOISTURE/DENSITY TESTING FREQUENCY CHART

RADON BARRIER

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY. FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS PLACED	CUBIC YARDS PLACED AND COMPACTED	COMMENTS
08/28/91	2	1,000	350	350	N/A
08/29/91	4	3,000	1,852	1,502	N/A
08/30/91	6	6,000	3,240	1,388	N/A
08/31/91	6	9,000	4,410	1,170	N/A
09/03/91	2	10,000	4,500	90	N/A
09/05/91	3	11,500	5,600	1,100	N/A
09/06/91	8	15,500	8,516	2,916	N/A
09/07/91	8	19,500	10,100	1,584	N/A
09/10/91	6	22,500	11,708	1,608	N/A
09/12/91	2	23,500	12,332	624	N/A
09/13/91	6	26,500	14,556	2,224	N/A
09/14/91	7	30,000	16,092	1,536	N/A
09/16/91	7	33,500	17,052	960	N/A
09/17/91	4	35,500	17,340	288	N/A
09/20/91	2	36,500	17,929 *	N/A	N/A

* Final Survey Quantity - 17,929 yds.^{3}

RADON BARRIER

- The radon barrier material for the Lowman site was obtained from an on-site borrow area. MK-Environmental Services and Jacobs Engineering had both investigated the source prior to use and approval.

- The gradation requirement for the in situ radon barrier material was a maximum of 35% retained on the #4 sieve and a minimum of 15% passing the #200 sieve, when tested in accordance with ASTM D-422. The specifications eliminated the requirement for using the hydrometer to determine the distribution of particle sizes smaller than the #200 sieve.

- The required frequency for performing gradation tests was a minimum of one test for each 1,000 cubic yards of radon barrier material placed.

- There were 23 passing gradation tests performed on radon barrier material, all of which met the specified requirements. Considering there were 17,929 cubic yards of radon barrier material placed, this provides an average test frequency of one gradation test for each 780 cubic yards of material placed.

- After the radon barrier material had passed the required gradation tests, maximum density determination tests were performed in accordance with ASTM D-698.

- The required frequency for performing maximum density determinations was, prior to placement, and supplemental tests to be conducted for each 10 to 15 in-place field density tests performed during placement.

- There were 13 maximum density determination tests performed in accordance with ASTM D-698. With 73 in-place field density tests performed, an average test frequency of the maximum density determination test performed for each 5.6 in-place field density tests. Maximum density determinations were initiated prior to placement activities.

- The primary equipment used for excavation, placement, moisture conditioning and compaction of the radon barrier material was as follows: Caterpillar 627B scrapers, a Caterpillar 14G grader, a Dresser TD-15C dozer, a Case tractor towing a disk, and a Caterpillar 815C tamping foot roller.

- It was required that radon barrier be placed on top of the track-walked finish grades of the contaminated fill material in a minimum of two lifts, with a maximum loose lift thickness of 12 inches for a final depth of 1.5 feet.

- Continuous monitoring was performed during material placement to ensure that the loose lift thickness did not exceed 12 inches, that the compacted lift thickness did not exceed 9 inches, and that the first lift of radon barrier was spread with a bull dozer as specified.

- During Radon Barrier Material placement, contiuous visual inspection was performed to ensure that not more than 5% by volume of organics and/or deleterious substances were placed.

- The required degree of compaction for the radon barrier material was 95% of the maximum dry density as determined in accordance with ASTM D-698. The required frequency for verifying compaction was one in-place field density for each 500 cubic yards of radon barrier material placed.

- Compaction control was accomplished by performing in-place sand cone density tests in accordance with ASTM D-1556.

- The average percent compaction obtained was 98.4%, which was determined from a total of 73 passing in-place field density tests. There were 17,929 cubic yards of radon barrier material placed, which divided by 73 passing tests, equals one in-place field density test performed for each 246 cubic yards of radon barrier material placed. Reference the Moisture\Density Testing Frequency Charts at the end of this section.

- There were 5 failing in-place field density tests within 5 different areas of the embankment perimeter, all of which required rework in order to satisfy the compaction requirements. All areas known to require rework were reworked, retested, and accepted in accordance with the specified requirements.

- Due to rainfall, a portion of the top lift of radon barrier material had to be disced and recompacted. After this rework was completed, a total of 7 reverification field density tests were performed in those areas which passed all moisture/density requirements.

- The required frequency for one-point proctor tests was a minimum of one one-point proctor test for each 5 in-place field density tests.

- There were 22 one-point proctor tests performed on radon barrier material to ensure that the correct maximum dry density value was utilized when performing in-place field density tests.

Considering that there were 73 passing in-place field density tests performed, an average test frequency of one one-point proctor test for each 3.3 in-place field density tests performed.

- Moisture content control was accomplished by performing in-place moisture tests in accordance with ASTM D-4643 and D-2216.

- Prior to placement, the radon barrier material was required to be moisture-conditioned; and the moisture content was required to be maintained above optimum moisture, as determined by ASTM D-698, for a minimum of two (2) hours.

- There were a total of 16 moisture content tests taken to ensure that the moisture content of the radon barrier material was above optimum moisture content 2 hours prior to placement.

- During compaction, the radon barrier was required to have a moisture content between optimum to plus three percent of optimum moisture, as determined by ASTM D-698.

- There were 73 passing moisture density tests performed on the radon barrier which met the specified moisture and density requirements. From these 73 tests, the average moisture content was 12.8%, with a high of 14.1% and a low of 11. 7%. The optimum moisture content used ranged from a high of 12.7% to a low of 11.7%.

- The moisture content of the preceding in-place radon barrier lifts, with the exception of the top 2 inches, was required to be maintained at not less than minus one percent of optimum moisture content, as determined by ASTM D-698, until the succeeding radon barrier lift or bedding layer was placed.

- There were 51 moisture content tests performed on preceding lifts of radon barrier material, all of which met the specified requirements.

- One oven-dried moisture test was required for every ten microwave moisture tests performed.

- From 114 microwave moisture tests performed 28 oven-dried moisture comparisons were performed, providing an average test frequency of one oven dried moisture test for every 4.1 microwave oven moisture tests performed.

- The radon barrier finish grade was verified to have been bladed to a uniform smooth grade and track-walked perpendicular to the slope of the disposal cell with a Caterpillar D-6 dozer or a contractor-approved equivalent prior to the placement of the bedding material.

- In addition to the testing frequency requirements, a minimum of one gradation test was performed each day whenever more than 150 cubic yards of material were placed. A minimum of two in-place moisture/density tests were performed each day whenever more than 150 cubic yards of material were placed. Sand cone density test sand was calibrated twice a day and at the beginning of each new bag of sand.

- All measuring and testing equipment used during the course of remedial action was calibrated against equipment having a known valid relationship to NIST or other nationally recognized standards. Calibrated testing equipment included scales, proctor molds/hammers, sand cones, NIST-traceable test weights, and calipers.

- The test frequencies stated herein were derived from the total quantity referenced, divided by the total number of tests taken for that quantity. It should be noted that during remedial action, material quantities are not continually surveyed during production, placement, and/or compaction but rather surveyed at various milestones (e.g., completion of first lift, for pay quantities, to verify survey coordinates). Therefore, daily material quantities are estimated by load counts or conveyor belt rates until final or partial surveys are obtained. Once survey quantities are obtained, the estimated material quantities are adjusted to reflect the actual test frequency. All quantities stated herein between tests were estimated during remedial action to never exceed the frequency specified by the Design Specifications and Remedial Action Inspection Plan; were proportionally taken throughout production, placement, and/or compaction, and were not taken all in one given time frame.

- With various design slopes associated with the cell, and staggered lift placements, it is feasible to test each lift and, thereby, have certain horizontal elevations void of in-place field density and moisture tests.

- All tests and inspections were performed in accordance with the specified requirements.

- The following data identifies each radon barrier material test location: (NOTE: The seven (7) reverification moisture/density test plots are the last plots shown in this section.)

LOWMAN, IDAHO SITE
MOISTURE/DENSITY TESTING FREQUENCY CHART

RADON BARRIER

DATE	NUMBER OF TESTS TAKEN	CUMULATIVE QTY. FROM TESTS TAKEN	CUMULATIVE CUBIC YARDS PLACED	CUBIC YARDS PLACED AND COMPACTED	COMMENTS
08/28/91	2	1,000	350	350	N/A
08/29/91	4	3,000	1,852	1,502	N/A
08/30/91	6	6,000	3,240	1,388	N/A
08/31/91	6	9,000	4,410	1,170	N/A
09/03/91	2	10,000	4,500	90	N/A
09/05/91	3	11,500	5,600	1,100	N/A
09/06/91	8	15,500	8,516	2,916	N/A
09/07/91	8	19,500	10,100	1,584	N/A
09/10/91	6	22,500	11,708	1,608	N/A
09/12/91	2	23,500	12,332	624	N/A
09/13/91	6	26,500	14,556	2,224	N/A
09/14/91	7	30,000	16,092	1,536	N/A
09/16/91	7	33,500	17,052	960	N/A
09/17/91	4	35,500	17,340	288	N/A
09/20/91	2	36,500	17,929 *	N/A	N/A

* Final Survey Quantity - 17,929 yds.^{3}

ATTACHMENT NO. 3

Areas to the north of the windblown area also had supplemental standards applied to them. This was done because the areas in question were heavily forested with trees and underbrush and were also inaccessible to standard excavation equipment. Supplemental standards were applied in this are to prevent excessive environmental harm resulting from the removal of the residual radioactive material.

The disposal cell design capacity was reached prior to placement of all of the contaminated materials. An additional 24,500 cubic yards of contaminated material was placed in an expansion trench located along the north side of the disposal cell. Contaminated materials were placed in the trench in lifts. Using this method of placement produces consistent radionuclide concentrations within any individual layer due to the processing of the soil during placement. Soil samples were collected from one location of the expansion area at depth intervals of two feet. Each sample was composited over two vertical feet. All sample results in the top 10 feet of the contaminated material were below 20 pCi/g. The cell emanation sample data for the expansion area is presented in Table H.1.

Table H.1.

Cell Expansion Sample Data

Depth of Sample Feet	Ra226 Concentration (pCi/g)
0 - 2	5.0
2 - 4	7.1
4 - 6	4.3
6 - 8	8.2
8 - 10	18.7

Areas to the north of the windblown area also had supplemental standards applied to them. This was done because the areas in question were heavily forested with trees and underbrush and were also inaccessible to standard excavation equipment. Supplemental standards were applied in this area to prevent excessive environmental harm resulting from the removal of the residual radioactive material.

The disposal cell design capacity was reached prior to placement of all of the contaminated materials. An additional 24,500 cubic yards of contaminated material was placed in an expansion trench located along the north side of the disposal cell. Contaminated materials were placed in the trench in lifts. Using this method of placement produces consistent radionuclide concentrations within any individual layer due to the processing of the soil during placement. Soil samples were collected from one location of the expansion area at depth intervals of two feet. Each sample was composited over two vertical feet. All sample results in the top 10 feet of the contaminated material were below 20 pCi/g. The cell emanation sample data for the expansion area is presented in Table H.1.

Table H.1.

Cell Expansion Sample Data

Depth of Sample Feet	Ra226 Concentration (pCi/g)
0 - 2	5.0
2 - 4	7.1
4 - 6	4.3
6 - 8	8.2
8 - 10	18.7

ATTACHMENT NO. 4

During the course of monitor well and piezometer abandonments, the site was performing well abandonment activities in accordance with Preconstruction Design Specification "02090 Well Abandonment, Revision B". Attached for review is a copy of the Well Abandonment Specification that was used at that time.

SECTION 02090

WELL ABANDONMENT

PART 1 - GENERAL

1.1 SCOPE

A. This Specification Section describes the requirements for abandonment of existing wells by sealing.

B. All known wells to be abandoned are listed in Table 02090-1, and their approximate locations are shown on the Subcontract Drawings. All other wells shall be protected, unless otherwise directed by the Contractor.

1.2 RELATED WORK

Section 02050 - Demolition

1.3 APPLICABLE PUBLICATIONS

A. The Publications listed below form a part of this Specification to the extent referenced. The Publications are referred to in the text by the basic designation only:

1. Environmental Protection Agency (EPA): Manual of Water Well Construction Practices, EPA-570/9-75-001.

2. American Society for Testing and Materials (ASTM): C150-86 Standard Specification for Portland Cement.

3. Idaho Water Commission: Permanent Rules, Water Well Drillers; Idaho Administrative Code, applicable Sections.

1.4 SITE CONDITIONS

Subcontract Drawings show all known wells on and in the vicinity of the site and work areas. Wells not designated to be abandoned shall be protected to prevent damage or contamination with foreign substances during construction. Such wells, if damaged, shall be reconstructed by the Subcontractor at no cost to the Contractor.

TABLE 02090-1

WELLS TO BE ABANDONED

Well* No.	Depth of Well (feet)	Bore-hole Dia. (in)	Casing Dia. & Type (in)	Casing Depth (ft)	Screen Interval (feet)	Approximate Coordinates North	Approximate Coordinates East
022	70.0	6.5	2.0 PVC	66.8		11,200	11,010
023	56.5	6.5	2.0 PVC	51.0		11,035	10,920
024	60.0	6.5	2.0 PVC	27.7		10,670	10,765
025	67.5	6.5	2.0 PVC	35.9		10,520	11,145
026	68.0	6.5	2.0 PVC	34.4		10,640	10,960
027	80.0	6.5	2.0 PVC	58.0		10,780	11,090

* These wells are piezometers set in exploratory boreholes.

1.5 QUALITY CONTROL

Well abandonment operations shall be performed by a well drilling contractor licensed by the State of Idaho.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement used for sealing mixtures shall meet the requirements of ASTM C150 "Standard Specification for Portland Cement," type V (high sulfate resistance).

B. Cement grout shall be composed of one sack of Portland Cement (94 pounds), with 3 to 5 percent, by weight, of commercially processed sodium bentonite, to not more than 6 gallons of potable water in order to achieve a weight of not less than 15 pounds per gallon. The weight of the neat cement shall be sufficient to prevent flow of water into the well from any aquifer penetrated. Calcium chloride may be added to a Portland cement grout to accelerate the set, but it shall not exceed two (2) pounds per sack of dry cement.

PART 3 - EXECUTION

3.1 GENERAL

All wells to be abandoned shall be sealed in a manner that is compatible with the well design and so as not to act as a conduit for future contamination of groundwater. Detailed well sealing criteria are outlined in the Environmental Protection Agency (EPA) Manual of Water Well Construction Practices, EPA-570/9-75-001, Article 56, pages 133-142. The basic premise of the EPA criteria is to seal abandoned wells and to restore, as much as possible, the geohydrologic regime in existence before the well was constructed. Therefore, all wells shall be sealed in such a manner that they will not act as a conduit for fluids to flow from the specific strata in which they were originally encountered.

3.2 LOCATING WELLS

A. All wells to be abandoned shall be located in the field and sealed by the Subcontractor prior to the beginning of stripping, grading or other surface-disturbing activities that will hinder the detection and sealing of wells. If any well cannot be located after a reasonable search, the Subcontractor shall, prior to the commencement of the well sealing operations, submit to the Contractor a written report documenting the well number, the areas covered and the effort spent in the search.

B. Upon discovery of any unknown wells during the earthwork operations, the Subcontractor shall give the Site Manager immediate verbal notice followed by written confirmation within 24 hours.

3.3 WELL SEALING PROCEDURES

A. The Subcontractor shall check each well to be sealed for obstructions that may interfere with the sealing operation and shall remove any such obstructions and notify the Contractor prior to starting filling operations.

B. In order to seal the well properly it is preferable to remove the well casings by method approved by the Contractor as outlined in Article 56 of the EPA Manual of Water Well Construction Practices. Upon removal, if the casings or the materials are found to be contaminated, they shall be decontaminated as required by the Contractor, or disposed of in the tailings embankment as specified in Section 02050. If casing removal is not

feasible, the casing shall be perforated, ripped or otherwise disintegrated by methods outlined in Article 56 of the EPA Manual, to ensure grouting of the entire annular space between the casing and the borehole.

C. The approved methods for the placement of a grout seal shall be as follows:

1. In wells where casing is removed, the cement grout shall be introduced at the bottom of the well or interval to be sealed (or filled) and placed progressively upward to the top of the well. The grout shall be placed by the use of grout pipe, drop pipe, tremie, cement bucket or dump bailer, in such a way as to avoid segregation or dilution of the sealing materials. Dumping grout material from the top of the well will not be permitted.

2. In wells where casing is not removed, the calculated amount of neat cement grout required to fill the well interval plus the annular space outside the lining shall be placed within the space to be cemented. The cement shall be introduced into the well through a tremie pipe placed to the bottom of the well. The cement shall be introduced to fill both the inside of the pipe and any voids around the outside of the pipe. The well shall be cemented all the way up to ground surface.

3.4 DESIGN OF ABANDONED WELLS

For all wells to be sealed, existing casings and cement grout seals shall be removed to a minimum depth of 2 feet below the existing grade surface, or as required by the Contractor. Grouting shall extend from the bottom of the hole to 2 feet below the existing grade. The interval from the top of the grout to the existing grade surface shall be filled with a mixture of uncontaminated fine-grained (ML or CL) soil and a minimum of 25 percent by weight of commercially processed sodium bentonite and shall be hand-tamped, as required. A sketch of this well abandonment design is shown in Figure 02090-1.

3.5 NOTIFICATIONS

A. In addition to the notifications that may be required as described above in Article 3.2, the Subcontractor shall provide the following notification of the well sealing operation:

1. The Subcontractor shall notify the Contractor at least one week prior to commencement of well sealing operations.

2. Upon completion of well sealings, the Subcontractor shall submit a Plugging Report for each abandoned well to the State of Idaho. These reports shall be filed on the applicable State form and within the time period required by the Idaho Administrative Code. A copy of the reports shall be submitted to the Contractor.

PART 4 - MEASUREMENT AND PAYMENT

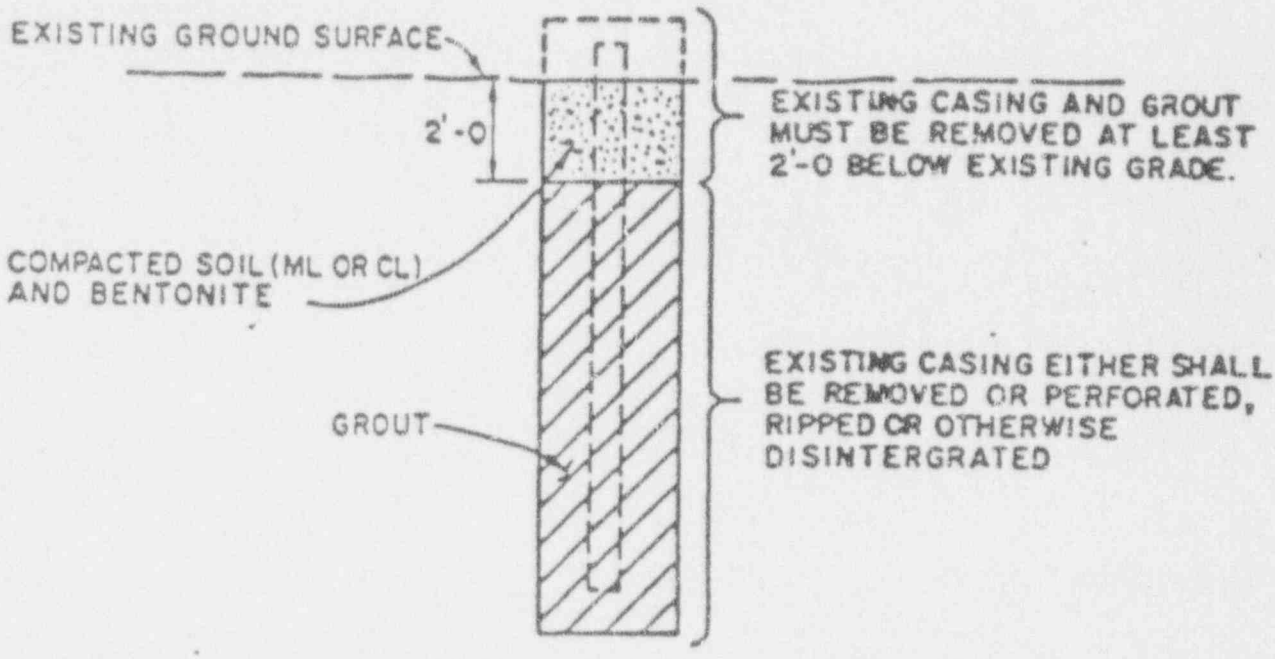
4.1 MEASUREMENT

Measurement for payment for well abandonment will be by the linear feet of wells sealed. The measurement will be from bottom of well to the top of seal.

4.2 PAYMENT

Payment for well abandonment will be by the unit price per linear foot quoted therefor in the Bid Schedule. The price quoted shall include full compensation for furnishing all materials, equipment, tools, accessories, incidentals, labor, and for performing the work specified in this Section including decontamination and disposal of materials and equipment.

END OF SECTION 02090



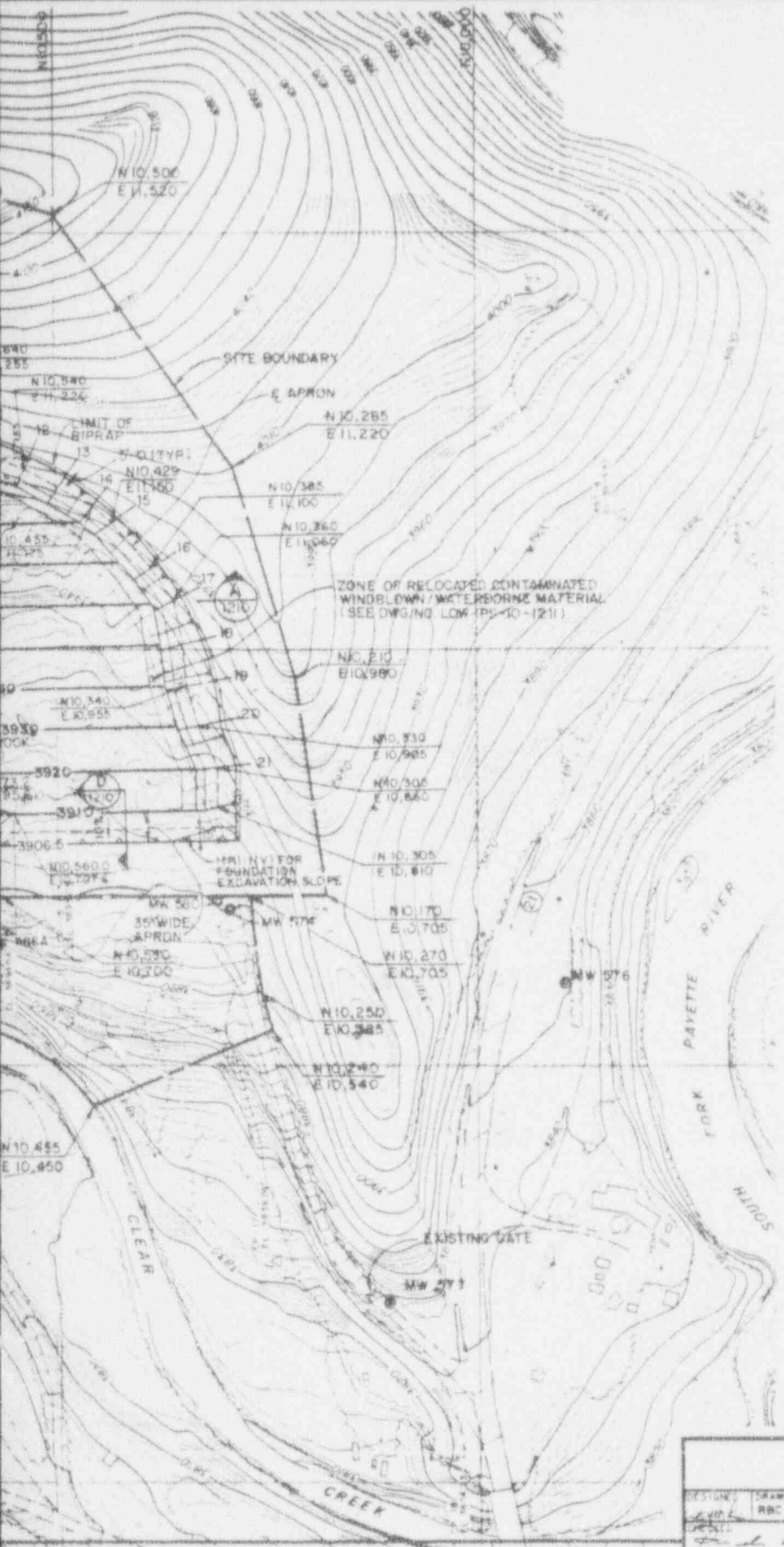
ABANDONED WELLS IN AREAS OF PLANNED FILL

FIGURE 02090-1

SKETCH OF WELL ABANDONMENT DESIGN

ATTACHMENT NO. 5


N12,000
N11,800
N11,600
N11,500
E11,500
E11,000
E10,800
E10,500
E10,000
N11,240
E11,750
EXISTING GULLY
SEE NOTE 2
LIMIT OF DISTURBED AREA
25' WIDE APRON
35' WIDE APRON
DISPOSAL CELL FOR ADDITIONAL CONTAMINATED MATERIAL
SMALL ROCK (TYPE A)
CLEAR CREEK
MW 572
MW 573
MW 574
MW 575
MW 579
MW 580
MW 581
MW 582
MW 583
MW 584
MW 585
4010
4000
3990
3980
3970
3960
3950
3940
3930
3920
3910
3900
3890
3880
3870
3860
3850
3840



NOTES:

1. MULCH WAS APPLIED TO ALL FINAL GRADES AND THE DISTURBED AREAS EXCEPT THE TAILINGS EMBANKMENT.
2. THE EXISTING TRAIL AND GULLIES ABOVE THE TAILINGS EMBANKMENT WERE RESTORED TO ORIGINAL CONTOURS WITH GENERAL FILL AND MULCH COVER.
3. FOR AS-BUILT SURFACE CONTOURS IN ALL AREAS REFER TO AS-BUILT TOPOGRAPHIC MAP, DWG NO LOW-PS-10-1217.
4. THERE IS SOME TRANSITIONING BETWEEN THE DIFFERENT SECTIONS SHOWN ON DRAWINGS LOW-PS-10-1210 AND LOW-PS-10-1211.

9404010080-01

REFERENCE DRAWINGS:

LOW-PS-10-1203	SITE PLAN
LOW-PS-10-1208	CONTAMINATED MATERIAL EXCAVATION PLAN AND DEMOLITION
LOW-PS-10-1210	TAILINGS EMBANKMENT SECTIONS

RECORD DRAWING

This drawing incorporates changes identified to have occurred during construction. The certifying engineer has reviewed these changes and has determined that they do not adversely affect design or operations. Users are cautioned that some changes occurring during construction may not have been identified and may not have been incorporated into this drawing.

LEGEND:

- 3910 — ORIGINAL SITE FEATURES AND CONTOURS
- 3980 — FINAL CONTOURS
- N11,000 — CONSTRUCTION GRID COORDINATE
- (21) — STATE HIGHWAY
- 490-1 — SURVEY MONUMENT (BRASS CAP)
- SITE BOUNDARY
- MW 582 — MONITOR WELLS
- 3 — SURVEY LOCATION

REGISTERED PROFESSIONAL ENGINEER — STATE OF IDAHO — E. S. SMITH

DA REVIEW for QUALITY ASSURANCE: Richard L. Cook 11/24/94

100 0 100 200 SCALE FEET

E.S.Sm.H.

NO.	REVISIONS	BY	CK.	ENG MGR	CHIEF ENG.	QA MGR.	DOE APP.
10-95	AS-BUILT (REVISED)	PYL	WYL	DRJ			
9-95	AS-BUILT (REVISED)	PYL	WYL	DRJ			
1-95	RECORD	PYL	WYL	DRJ			
0-94	REVISED PER P.I.D. NOS 12-5-07, 12-5-10 AND 12-5-11	WYL	PYL				
7-94	REVISED PER P.I.D. NO 12-5-02	WYL	PYL				
8-91	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED: RBC
DRAWN:
TRACED:
CHECKED:
APPROVED:

LOWMAN SITE
LOWMAN, IDAHO

FINAL GRADING PLAN AND RESTORATION

APPROVALS	DATE			DOE PROJECT ENGINEER	DATE
	11/4/94	E.S.Sm.H.	C.W. Worden 11/22/94		11/22/94

MORRISON-KNUDSEN ENGINEERS, INC.
UMTRA PROJECT

PROJECT NO. DE-AC04-83AL18796

DRAWING NO. LOW-PS-10-1209 REV. —

ATTACHMENT NO. 6

LOWMAN, IDAHO SITE

ENVIRONMENTAL DUST CONTROL USED ON THE TAILINGS EMBANKMENT
TABULATIONS

DATE	HOURS	LOADS/HR	#LOADS	GAL/LOAD	TOTAL/GAL	ACCUM/GAL
05/21/91	0.25	4	1	3,500	3,500	3,500
05/22/91	0.25	4	1	3,500	3,500	7,000
05/23/91	0.50	4	2	3,500	7,000	14,000
05/24/91	0.50	4	2	3,500	7,000	21,000
06/07/91	0.50	4	2	3,500	7,000	28,000
06/11/91	0.50	4	2	3,500	7,000	35,000
06/12/91	0.50	4	2	3,500	7,000	42,000
06/13/91	0.50	4	2	3,500	7,000	49,000
06/14/91	0.75	4	3	3,500	10,500	59,500
06/17/91	1.00	4	4	3,500	14,000	73,500
06/18/91	1.00	4	4	3,500	14,000	87,500
06/19/91	1.00	4	4	3,500	14,000	101,500
06/20/91	1.00	4	4	3,500	14,000	115,500
06/21/91	1.00	4	4	3,500	14,000	129,500
06/25/91	0.50	4	2	3,500	7,000	136,500
07/10/91	1.00	4	4	3,500	14,000	150,500
07/11/91	1.00	4	4	3,500	14,000	164,500
07/12/91	1.00	4	4	3,500	14,000	178,500
07/15/91	1.00	4	4	3,500	14,000	192,500
07/18/91	0.50	4	2	3,500	7,000	199,500
07/22/91	1.00	4	4	3,500	14,000	213,500
07/30/91	1.00	4	4	3,500	14,000	227,500
07/31/91	1.00	4	4	3,500	14,000	241,500
08/01/91	1.00	4	4	3,500	14,000	255,500
08/02/91	1.00	4	4	3,500	14,000	269,500

DATE	HOURS	LOADS/HR	#LOADS	GAL/LOAD	TOTAL/GAL	ACCUM/GAL
08/03/91	1.50	4	6	3,500	21,000	290,500
08/05/91	1.00	4	4	3,500	14,000	304,500
08/12/91	1.00	4	4	3,500	14,000	318,500
08/14/91	1.00	4	4	3,500	14,000	332,500
08/19/91	1.50	4	6	3,500	21,000	353,500
08/20/91	1.50	4	6	3,500	21,000	374,500
08/21/91	1.00	4	4	3,500	14,000	388,500
08/22/91	2.00	4	8	3,500	28,000	416,500
08/30/91	0.50	4	2	3,500	7,000	423,500
08/31/91	0.50	4	2	3,500	7,000	430,500
09/03/91	1.00	4	4	3,500	14,000	444,500
09/04/91	0.50	4	2	3,500	7,000	451,500
09/05/91	1.00	4	4	3,500	14,000	465,500
09/06/91	1.00	4	4	3,500	14,000	*479,500

* Total Gallons of Water Used - 479,500

LOWMAN, IDAHO SITE

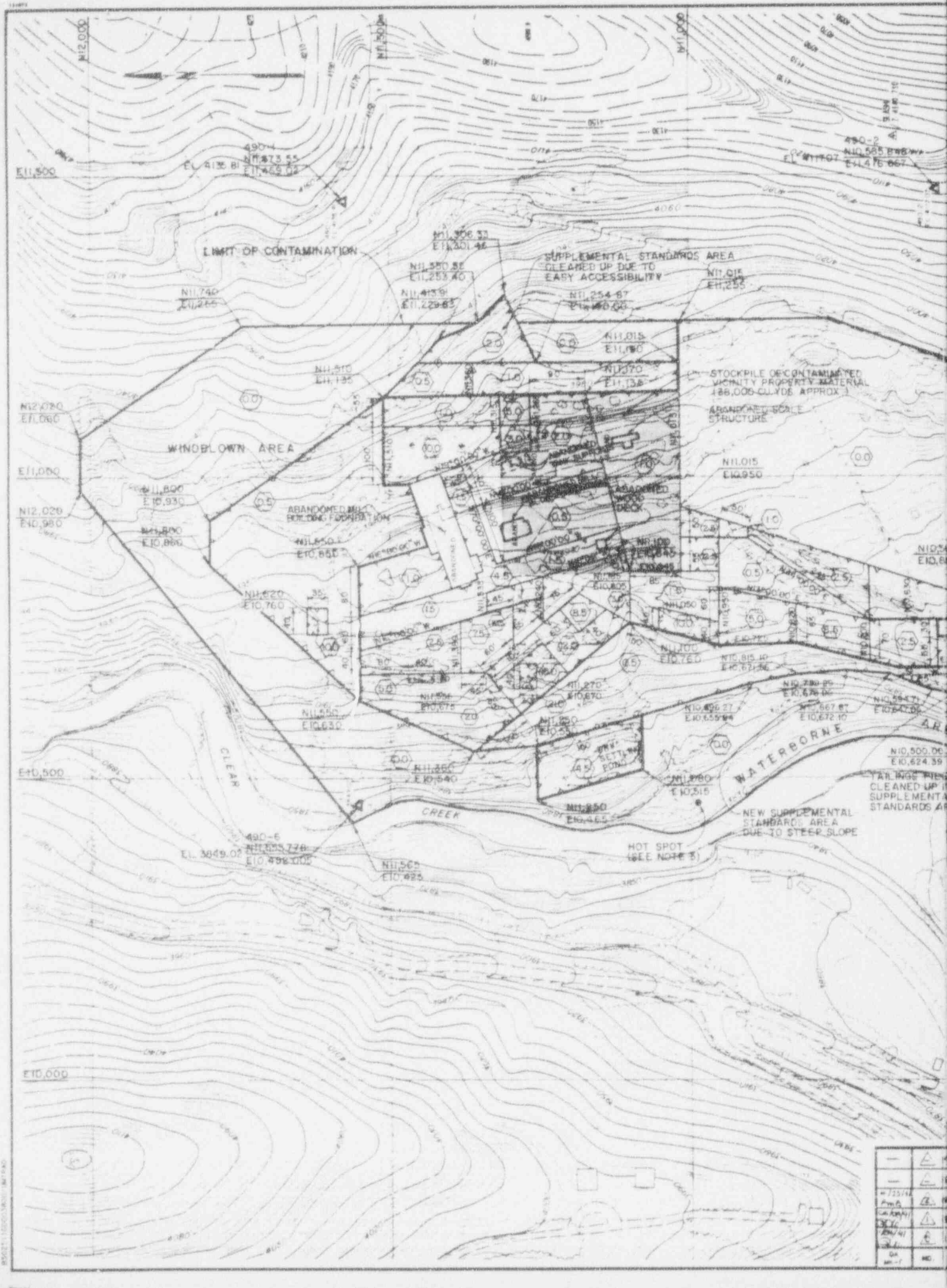
ENVIRONMENTAL DUST CONTROL USED ON THE TAILINGS EMBANKMENT
TABULATIONS

DATE	HOURS	LOADS/HR	#LOADS	GAL/LOAD	TOTAL/GAL	ACCUM/GAL
05/21/91	0.25	4	1	3,500	3,500	3,500
05/22/91	0.25	4	1	3,500	3,500	7,000
05/23/91	0.50	4	2	3,500	7,000	14,000
05/24/91	0.50	4	2	3,500	7,000	21,000
06/07/91	0.50	4	2	3,500	7,000	28,000
06/11/91	0.50	4	2	3,500	7,000	35,000
06/12/91	0.50	4	2	3,500	7,000	42,000
06/13/91	0.50	4	2	3,500	7,000	49,000
06/14/91	0.75	4	3	3,500	10,500	59,500
06/17/91	1.00	4	4	3,500	14,000	73,500
06/18/91	1.00	4	4	3,500	14,000	87,500
06/19/91	1.00	4	4	3,500	14,000	101,500
06/20/91	1.00	4	4	3,500	14,000	115,500
06/21/91	1.00	4	4	3,500	14,000	129,500
06/25/91	0.50	4	2	3,500	7,000	136,500
07/10/91	1.00	4	4	3,500	14,000	150,500
07/11/91	1.00	4	4	3,500	14,000	164,500
07/12/91	1.00	4	4	3,500	14,000	178,500
07/15/91	1.00	4	4	3,500	14,000	192,500
07/18/91	0.50	4	2	3,500	7,000	199,500
07/22/91	1.00	4	4	3,500	14,000	213,500
07/30/91	1.00	4	4	3,500	14,000	227,500
07/31/91	1.00	4	4	3,500	14,000	241,500
08/01/91	1.00	4	4	3,500	14,000	255,500
08/02/91	1.00	4	4	3,500	14,000	269,500

DATE	HOURS	LOADS/HR	#LOADS	GAL/LOAD	TOTAL/GAL	ACCUM/GAL
08/03/91	1.50	4	6	3,500	21,000	290,500
08/05/91	1.00	4	4	3,500	14,000	304,500
08/12/91	1.00	4	4	3,500	14,000	318,500
08/14/91	1.00	4	4	3,500	14,000	332,500
08/19/91	1.50	4	6	3,500	21,000	353,500
08/20/91	1.50	4	6	3,500	21,000	374,500
08/21/91	1.00	4	4	3,500	14,000	388,500
08/22/91	2.00	4	8	3,500	28,000	416,500
08/30/91	0.50	4	2	3,500	7,000	423,500
08/31/91	0.50	4	2	3,500	7,000	430,500
09/03/91	1.00	4	4	3,500	14,000	444,500
09/04/91	0.50	4	2	3,500	7,000	451,500
09/05/91	1.00	4	4	3,500	14,000	465,500
09/06/91	1.00	4	4	3,500	14,000	*479,500

* Total Gallons of Water Used - 479,500

ATTACHMENT NO. 7


LIMIT OF CONTAMINATION
SUPPLEMENTAL STANDARDS AREA
CLEANED UP DUE TO
EASY ACCESSIBILITY
STOCKPILE OF CONTAMINATED
VICINITY PROPERTY MATERIAL
(36,000 CU YDS APPROX.)
ABANDONED
DECK
ABANDONED
FOUNDATION
WINDBLOWN AREA
CLEAR
CREEK
WATERBORNE
NEW SUPPLEMENTAL
STANDARDS AREA
DUE TO STEEP SLOPE
HOT SPOT
(SEE NOTE 3)
490-4
490-2
490-6
N12,000
N11,500
N11,000
E11,500
E11,000
E10,500
E10,000

NOTES:

1. TOPOGRAPHIC BASE MAP WAS FURNISHED BY JACOBS ENGINEERING GROUP, INC., ON SEPTEMBER 25, 1989.
2. ALL EXCAVATION SLOPES WERE 2(H):1(V) MAXIMUM UNLESS NOTED OTHERWISE.
3. THE HOT SPOT INDICATES AN AREA OF 5' IN DIAMETER WHERE THE Ra-226 CONCENTRATION WITHIN 1.5 FEET IN DEPTH IN SOIL WAS OVER 5pci/g ABOVE BACKGROUND.
4. AREAS MARKED 0.0 FEET FOR DEPTH OF EXCAVATION ARE THE SUPPLEMENTAL STANDARDS AREAS WHERE Ra-226 CONTAMINATION IS TO REMAIN.

940401008O-02

REFERENCE DRAWINGS:

LOW-PS-10-1203	SITE PLAN
LOW-PS-10-1209	FINAL GRADING PLAN AND RESTORATION
LOW-PS-10-1210	TAILINGS EMBANKMENT-SECTIONS

REQUIRED REVIEWS

This drawing incorporates changes identified to have occured during construction. The construction engineer has reviewed these changes and has determined that they do not adversely affect design or operations. Users are cautioned that some changes occuring during construction may not have been identified and may not have been incorporated into this drawing.

LEGEND:

- 3910 — PRE-CONSTRUCTION SITE FEATURES AND CONTOURS
- N11,000 — CONSTRUCTION GRID COORDINATE
- (21) — STATE HIGHWAY
- (1.0) — APPROX. DEPTH OF EXCAVATION OF CONTAMINATED MATERIAL, IN FEET
- A490-1 — SURVEY MONUMENT (BRASS CAP)
- STRUCTURE/FACILITY DEMOLISHED, REMOVED AND PLACED IN THE TAILINGS EMBANKMENT.
- EXCAVATION

REGISTERED PROFESSIONAL ENGINEER STATE OF IDAHO R. E. S. SMITH 3962

DA REVIEWED FOR QUALITY REQUIREMENTS BY: [illegible] 6/20/91

100 0 100 200 SCALE FEET

E.S. Smith

NO.	REVISION	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.	DATE
93	AS-BUILT (REVISED)	PYL	WYL	[illegible]	[illegible]	[illegible]	[illegible]	—
92	RECORD	PYL	WYL	[illegible]	[illegible]	[illegible]	[illegible]	—
91	REVISED PER P.I.D. NO. 12-5-09	WYL	PYL	[illegible]	[illegible]	[illegible]	[illegible]	4/91
91	REVISED PER P.I.D. NO. 12-5-02	WYL	PYL	[illegible]	[illegible]	[illegible]	[illegible]	1/91
91	ISSUED FOR CONSTRUCTION	—	—	—	—	—	—	—
NO.	REVISIONS	BY	CK	E&D MGR.	CHIEF ENG.	QA MGR.	DOE APP.	DATE

U. S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

LOWMAN SITE
LOWMAN, IDAHO

CONTAMINATED MATERIAL EXCAVATION PLAN AND DEMOLITION

DES. SUPV.	DRAWN: RBC			
CHECKED: [illegible]				
INSPECTED: [illegible]				
APPROVED: [illegible]	DATE: 6/20/91	E.S. Smith	11/30/90	DATE: 12/91

MORRISON-KNUDSEN ENGINEERS, INC.
A MEMBER OF THE MORRISON-KNUDSEN GROUP
UMTRA PROJECT
100 [illegible] ST. BOISE, IDAHO 83705

PROJECT NO. DE-AC04-83AL18796

DRAWING NO. LOW-PS-10-1208 REV. —

ATTACHMENT NO. 8

APPENDIX J

Verification Measurements

This appendix contains radiological verification data and supporting quality control data for the Lowman Idaho site. This data indicates that soil measurements following remedial action at the Lowman site have met the 5 and 15 pCi/g above background Ra^{226} standards established by the EPA in Title 40 of the Code of Federal Regulations (CFR), Part 192. The 5 pCi/g standard is based on a 100 square meter area averaged over the first 15 centimeters of soil. The 15 pCi/g standard is based on a 100 square meter area average over 15 centimeter thick layers of soil more than 15 centimeters below the surface. Thorium-232 standards similar to the ^{226}Ra standards of 5 and 15 pCi/g above background were established in the Lowman Health Physics Monitoring plan. This appendix also contains soil verification data indicating Th^{230} concentrations along with the Ra^{226} concentrations, after 1000 years of decay, will not exceed the 5 and 15 pCi/g standards for Ra^{226}. Supplemental standards were applied to some locations around the disposal site, mostly within the former construction site boundry, based on the requirements in 40 CFR 192, the criteria in the Lowman remedial action plan (RAP), and RAP Modification PID #12-55-09. Transient recreational use is the only potential use anticipated for the supplemental standards areas. ~~Specifics regarding the application of the supplemental standards are provided in Appendix K.~~

Along with the verification data in this appendix, there are three site-specific verification grid drawings. The soil samples in the accompanying soil verification data table correspond to the grid identification from the associated drawings. Some portions of the areas did not require excavation, or supplemental standards were applied. The excavation plan is provided with the site verification drawings.

Radon flux measurements were performed on the disposal cell after the final layers of radon barrier were in place as required by the National Emissions Standards for Hazardous Air Pollutants (NESHAP)

Radiological soil analyses performance criteria are specified in the Lowman RAP. The Lowman RAP requirement of ± 30% error limits at the 95% confidence level was met with the opposed crystal soil analysis systems (OCS) utilized on the Lowman site. Error limits were empirically determined, utilizing reference material counts (5.12 pCi/g ^{226}Ra and 10.2 pCi/g ^{232}Th), routinely during the verification process. The background ^{226}Ra concentration, as presented in the Lowman Final RAP, is 1.2 pCi/g. Minimum detectable activity for the Lowman OCS systems was 1.2 pCi/g for ^{226}Ra and 1.0 pCi/g for ^{232}Th. Two OCS systems were utilized at the Lowman site. Plots of the 5.12 pCi/g ^{226}Ra reference standard data are presented in Figures J.3 and J.4. Plots of the 10.2 pCi/g ^{232}Th reference standard data are presented in Figures J.5 and J.6. Summaries of all the reference data are presented in Table J.3 (^{226}Ra) and Table J.4 (^{232}Th).

The Final RAP presented the standards for cleanup of Uranium to 10 pCi/g in the top 15 cm and 30 pCi/g in subsequent 15 cm layers. Mechanical processing was the only type of process used at the Lowman site. Generally, chemical processing is required to produce uranium activities. Sample analysis for uranium and radium at the Lowman site indicated that they were in equilibrium of uranium and radium. Sample analysis for uranium was not conducted on verification samples at the Lowman site, thereby eliminating unjustified analytical costs.

Reference material was supplied to MK-F/CWMFES by the Technical Measurements Center (TMC) in Grand Junction, Colorado. Analysis of the TMC standards can be found in report # GJ/TMC-10/83 UC-70A.

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for greater than 15 centimeter soil sample. This assumption is based on a project value derived from a site-specific correction of the unequilibrated value.

(Unequilibrated value)(Site Correction Factor) = Cal. Equilibrated Value

$$(3.6)(2.0) = 7.1 \text{ pCi/g}$$

Radon flux measurements were performed using in-situ charcoal canisters placed at 100 regularly spaced locations on the completed radon barrier of the disposal cell for a prescribed length of time. The canisters were then taken to the on-site lab, and analyzed on an OCS gamma spectrometer that was previously calibrated using known charcoal standards within established 95% confidence levels.

2. Remedial Action Plan Modifications

The Lowman site approved RAP UMTRA-DOE/AL 050512.0000, September 1991, allows supplemental standards to be applied to approximately 9.1 acres. This area immediately adjacent to the site provides protection of Clear Creek riparian habitat and prevents destruction of existing vegetation on the steeply sloped areas around the disposal cell.

The RAP Modification PID #12-S-09 added an area approximately 0.5 acre to the RAP supplemental standards areas. This area west of the cell is characterized by a steep slope with large trees and thick vegetation. The toe of the slope discharges directly into Clear Creek. Remediation of the excluded area would have required destruction of the soil-supporting vegetation, leaving a bare, mostly rock slope which would have contributed to Clear Creek

turbidity. Use of standard excavation equipment would have been precluded, necessitating the use of hand tools. This requirement presented a risk of injury to workers in addition to irreparable damage to the environment. Estimated volumes of contaminated material, area, supporting documentation and average ^{226}Ra concentrations are contained in ~~Appendix K PID #12-S-09~~.

3. Quality Control of Radiological Measurements

The quality control program for radiological measurements complies with the criteria set forth in the UMTRA Project Quality Assurance Plan, the RAC Quality Assurance Procedures, and DOE Order 5700.6B.

The QA/QC program for ^{226}Ra radiological measurements requires 4% of all soil verification samples to be re-analyzed by an off-site independent laboratory. Ten percent of all verification samples were required to be analyzed on-site for ^{232}Th and 4% of these samples to be reanalyzed at an off-site independent laboratory. This service was performed by Barringer Laboratories, Golden, Colorado for the Lowman site. Barringer Laboratories is certified by EPA Region VIII to perform radiochemical analysis. Each analytical report received from Barringer Laboratories is accompanied by a quality control data sheet which specifies lower limits of detection. Also included are duplicate sample results (10%), and results for quality control standards (5%), including the Barringer result, certified result, acceptable target range and relative deviation from the known value (acceptable deviation $\pm$ 5%). All original Barringer reports for soil analyses are available in DOE-archived records. Tables in J.5A and J.5B summarize this data.

APPENDIX J

Verification Measurements

This appendix contains radiological verification data and supporting quality control data for the Lowman Idaho site. This data indicates that soil measurements following remedial action at the Lowman site have met the 5 and 15 pCi/g above background Ra^{226} standards established by the EPA in Title 40 of the Code of Federal Regulations (CFR), Part 192. The 5 pCi/g standard is based on a 100 square meter area averaged over the first 15 centimeters of soil. The 15 pCi/g standard is based on a 100 square meter area average over 15 centimeter thick layers of soil more than 15 centimeters below the surface. Thorium-232 standards similar to the ^{226}Ra standards of 5 and 15 pCi/g above background were established in the Lowman Health Physics Monitoring plan. This appendix also contains soil verification data indicating Th^{230} concentrations along with the Ra^{226} concentrations, after 1000 years of decay, will not exceed the 5 and 15 pCi/g standards for Ra^{226}. Supplemental standards were applied to some locations around the disposal site, mostly within the former construction site boundry, based on the requirements in 40 CFR 192, the criteria in the Lowman remedial action plan (RAP), and RAP Modification PID #12-S-09. Transient recreational use is the only potential use anticipated for the supplemental standards areas.

Along with the verification data in this appendix, there are three site-specific verification grid drawings. The soil samples in the accompanying soil verification data table correspond to the grid identification from the associated drawings. Some portions of the areas did not require excavation, or supplemental standards were applied. The excavation plan is provided with the site verification drawings.

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regulations promulgated in 40 CFR 61, Subpart T. Data presented in this appendix indicates the NESHAP requirement of less than an annual average release rate of 20 pCi/m^2-s radon emission have been met.

A. Soil Verification

1. Radiological Verification Measurement Methods

Approved procedures for soil measurements on the Lowman site are included in this section. RAC Health Physics Procedure RAC-015 provides the basis of the verification measurement and sampling methodology. Figure J.1 is a plot of all soil verification Ra^{226} data versus random sample number. Table J.1 presents an average of all ^{226}Ra results. Table J.2 presents an average of all ^{232}Th results.

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All radon flux measurements were performed in accordance with RAC Health Physics Procedure

RAC-025, radon flux measurements. Radon flux measurement duplicates (10%) were counted documented the reproduceability of the counting technique. The results are presented in Table J.6. All radon flux measurements were reviewed by qualified health physics personnel.

4. Backfill Material

The Lowman site did not use borrow pit material as backfill. Uncontaminated material from areas released by soil verification was used for site grading and backfill.

5. Radon Flux Measurement

Radon flux measurements are not to exceed 20 pCi/m^2-s as required by 40 CFR 61, Subpart T of the NESHAP regulations. Individual radon flux measurements ranged from -0.043 to 0.411 pCi/m^2-s Figure J.7 shows the approximate location of the 100 flux measurement points on the 28,000 square meter Lowman disposal cell. The radon flux measurements for Lowman are presented in Table J.7 and clearly indicate compliance with NESHAP requirements.

ATTACHMENT NO. 9

APPENDIX C

RA-226 LEVELS

(Ref R-1)

ENGINEERS
AND
CONSTRUCTORS

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

HEADQUARTERS OFFICE
1500 WEST 3RD STREET
CLEVELAND, OHIO U.S.A. 44113-1406
PHONE: (216) 523-5600/TELEX: 985542

REPLY TO: MK-FERGUSON COMPANY
REMEDIAL ACTIONS
CONTRACTOR-UMTRA PROJECT
P.O. BOX 9136
ALBUQUERQUE, NEW MEXICO U.S.A. 87119

93-3050-550

August 27, 1993

Woody Woodworth
Site Manager
U.S. Department of Energy
Uranium Mill Tailings Remedial Action Project Office
First National Bank Building
5301 Central Avenue N.E.
Suite 1700
Albuquerque, New Mexico 87108

SUBJECT: Response to the Department of Energy (DOE) Comments of Responses to the Nuclear Regulatory Commission (NRC) Comments on the Lowman, Idaho Draft Completion Report

REFERENCE:

1) **Letter from Steve Martz to Woody Woodworth dated April 30, 1993 (MK-F No. 93-3050-293).**

2) **Letter from Woody Woodworth to C.R. Spencer on June 25, 1993 (MK-F No. 3050-93-610).**

3) **Contract No. DE-AC04-83AL18796**

Dear Mr. Woodworth:

The Department of Energy's (DOE) review of the MK-Ferguson responses to the Nuclear Regulatory Commission (NRC) comments on the Lowman, ID Draft Completion Report, resulted in additional comments by DOE. The response to these comments has resulted in a modification to the Draft Completion Report, which are addressed in the following text. Revisions have been shaded for easy identification as shown in the initial attachments. The replacement pages are not shaded and are included behind the **tab** labeled "Replacement Pages" at the end of each attachment.

Eight (8), three-holed copies of the replacement pages have been included for revision to the Draft Completion Report in the possession of DOE, NRC, and the State of Idaho.

DOE Open Issues

GEOTECHNICAL ENGINEERING - OPEN ISSUES

- DOE concurs with MK-F responses to Items 1 through 3.

RADIATION PROTECTION/SITE CLEANUP - OPEN ISSUES

- Item 4: MK-F indicated that DOE should respond to this open issue. A proposed response is as follows:

  "The information requested by NRC, a plan view map of the restricted area and text detailing how the restricted area is to be maintained, will be provided in the Lowman Long-Term Surveillance Plan (LTSP). This document is currently under review by the NRC. The DOE believes that this information is not required in a Completion Report since it is provided in the LTSP."

  MK-F RESPONSE

  MK-F agrees that this information should be provided in the (LTSP) and not a Completion Report.

- Item 5: The response and proposed revision is considered adequate with the exception of the last sentence in the second paragraph. The word "emanation" should be deleted because the data in the table is for radium concentration, not radon emanation.

  MK-F RESPONSE

  In Appendix H titled "Post-Remedial Action Site Conditions", Page 2 of the Completion Report, the word "emanation" has been deleted from the last sentence in the second paragraph.

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 4, turn to Appendix H tab, and remove the written text.

Step No. 2: Obtain Attachment No. 1, and insert "Replacement Pages" after "Post-Remedial Action Site Conditions" title page.

- DOE concurred with MK-F response to Items 6 and 7.

- Item 8: MK-F indicated that TAC should respond to this open issue. A proposed is as follows:

  "The information requested NRC, groundwater monitoring data collected during and immediately after the remedial action, will be provided under separate cover. The data collected during remedial action will be forwarded to NRC by July, 1993. The post-remedial action quarterly compliance sampling is on-going, and will be provided to NRC when complete. The DOE believes that this type of information is not appropriate data to be included in a Completion Report."

RADIATION PROTECTION/SITE CLEANUP - GENERAL COMMENTS

- DOE concurs with MK-F response to Item 1.

- Item 2: The MK-F response to this item is not considered complete. The NRC staff recommendation to eliminate Appendix K was implemented but the summary information related to the PID was not added to Appendix H or Appendix J, as suggested. The proposed revision simply referenced the PID in place of Appendix K.

MK-F Response:

Additional summary information has been added to the text in Appendix J concerning PID #12-S-09, as follows:

"Characterization data from the 0.5 acre area indicates ^{226}Ra concentrations in the soil range from 2.3 to 42 pCi/g. Composite soil samples indicated average ^{226}Ra concentrations of 19 and 11 pCi/g for

surface 0-6 inch depth and 6-12 inch depth, respectively. When surface ^{226}Ra concentrations for the 0.5 acre area are averaged with all other supplemental standard area concentrations, the resulting average of 7.2 Pci/g is statistically indistinguishable from EPA clean up standard of 5 Pci/g above background. The estimated volume of contaminated materials in this area is 378 cubic yards. Estimated gamma radiation, radon gas and air particulate exposures from the supplemental standards area are insignificant and if the contamination were remediated, the benefits would be negligible."

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 4, Appendix J and remove the written text.

Step No. 2: Obtain Attachment No. 2, and insert "Replacement Pages" after the Appendix J tab.

- DOE concurs with MK-F response to Item 3.

- Item 4: The MK-F response may be adequate (see "Note" below), but if so, the proposed revision is considered not to be adequate. The proposed revision does not include a key point in the response that the RAP requirements for uranium were met by satisfying the EPA radium limits as both nuclides were present in equilibrium concentrations. It is suggested that wording from the response be added to the revision as follows:

  "The final RAP presented the standards for cleanup of uranium to 10 pCi/g in the top 15 cm and 30 pCi/g in subsequent 15 cm layers. Mechanical processing was the only type of process used at the Lowman site. Generally, chemical processing is required to produce uranium activities that are out of equilibrium with radium activities. Sample analysis for uranium and radium at the Lowman site (Table?) indicated that they were in equilibrium, therefore, when radium was remediated to the EPA limits the uranium was also remediated to the RAP requirements. Due to the equilibrium of uranium to radium, sample analysis for uranium was not conducted on verification samples at the Lowman site, thereby eliminating unjustified analytical costs."

NOTE: The proposed revision does not reference the sample data used to conclude that radium and uranium were in equilibrium at the Lowman site.

The general statement that sample results showed radium and uranium in equilibrium is not consistent with the Bendix radiological characterization data reported in the UNC report "Radiological Characterization of the Lowman, Idaho, Uranium Mill Tailings Remedial Action Site." Page 14 of this report states "These analyses [Appendix B, Table B-2] suggest that radium-226 and thorium-230 are in equilibrium. However, in most cases natural or chemical uranium is substantially out of equilibrium with equivalent uranium (its daughter products), in favor of the daughter products."

In order to support the MK-F response this will need to be addressed by specific reference to the sample data used to make the conclusion in the response. If the sample data is not available, the response would appear to be inaccurate in regard to the equilibrium of uranium with progeny. In this case, it appears that justification may be based on the lack of a mechanism to mobilize uranium and concentrate it over radium activities and the Bendix data which indicates that uranium activities were generally not found to be enhanced, compared to radium, in the borehole samples.

MK-F RESPONSE:

The text to Appendix J was modified to demonstrate that characterization data for the Lowman site indicates uranium and radium are out of equilibrium in favor of radium. The point was also made that by cleaning up radium to the EPA limits uranium would also be cleaned up to the RAP requirements. Modifications are as follows:

> **"Generally, chemical processing is required to produces elevated uranium activities. Sample analysis results for uranium and radium from the Lowman site characterization report indicated that uranium was out of equilibrium with radium in favor of radium. Therefore, when radium was remediated to the EPA limits, uranium was also remediated to the RAP requirements. Based on this information, sample analysis for uranium was not conducted on verification samples at the Lowman site, thereby eliminating additional analytical costs."**

For revising the Completion Report, reference the "Step-by-Step" provided in the MK-F Response to Item 2 above.

- DOE concurs with MK-F response to Item 5.

If DOE evaluates these changes as acceptable, please notify us so we can order new covers and spines which will state "Final Completion Report."

If you have any questions regarding this submittal, please contact Steven D. Martz at (505) 246-2571.

SDM/GJD

MK-FERGUSON COMPANY

for SDM

Steven D. Martz
Project Quality Manager

cc: (w/o attachment)

C. Smythe - DOE/UMTRA

ATTACHMENT NO.1

Areas to the north of the windblown area also had supplemental standards applied to them. This was done because the areas in question were heavily forested with trees and underbrush and were also inaccessible to standard excavation equipment. Supplemental standards were applied in this area to prevent excessive environmental harm resulting from the removal of the residual radioactive material.

The disposal cell design capacity was reached prior to placement of all of the contaminated materials. An additional 24,500 cubic yards of contaminated material was placed in an expansion trench located along the north side of the disposal cell. Contaminated materials were placed in the trench in lifts. Using this method of placement produces consistent radionuclide concentrations within any individual layer due to the processing of the soil during placement. Soil samples were collected from one location of the expansion area at depth intervals of two feet. Each sample was composited over two vertical feet. All sample results in the top 10 feet of the contaminated material were below 20 pCi/g. The cell ~~emanation~~ sample data for the expansion area is presented in Table H.1.

Table H.1.

Cell Expansion Sample Data

Depth of Sample Feet	Ra226 Concentration (pCi/g)
0 - 2	5.0
2 - 4	7.1
4 - 6	4.3
6 - 8	8.2
8 - 10	18.7

APPENDIX H

Post-Remedial Action

Site Conditions

After UMTRA remedial actions were completed, a total quantity of 129,421 cubic yards of contaminates, including material from the site and all vicinity properties, had been relocated to the designed disposal cell on the Lowman site. Contaminated building foundations, rubble and debris were removed and buried in the lower lifts of the disposal cell.

Approximately 40,000 cubic yards of unco ninated soil were used to recontour the site to provide proper drainage following the removal of the contaminated material. All disturbed areas were mulched after being final graded and no seed was applied, because it was felt that the site would naturally revegetate itself over a period of time.

Supplemental standards were applied to the areas adjacent to Clear Creek so as to prevent destruction of the existing riparian habitat. Remediation of these areas would require costly excavation of the steep and inaccessible locations. Due to the nature of these areas, a lot of the work would have to have been done by hand instead of standard excavation equipment. This would have presented an increased risk of injury to remedial action workers that could not be justified by the corresponding reduction in long-term health risks.

Furthermore, destruction of existing vegetation in the steeply sloped areas between the disposal cell and Clear Creek would have caused increased erosion and geomorphological instability.

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ATTACHMENT NO. 2

APPENDIX J

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2. Remedial Action Plan Modifications

The Lowman site approved RAP UMTRA-DOE/AL 050512.0000, September 1991, allows supplemental standards to be applied to approximately 9.1 acres. This area immediately adjacent to the site provides protection of Clear Creek riparian habitat and prevents destruction of existing vegetation on the steeply sloped areas around the disposal cell.

The RAP Modification PID #12-S-09 added an area approximately 0.5 acre to the RAP supplemental standards areas. This area west of the cell is characterized by a steep slope with large trees and thick vegetation. The toe of the slope discharges directly into Clear Creek. Remediation of the excluded area would have required destruction of the soil-supporting vegetation, leaving a bare, mostly rock slope which would have contributed to Clear Creek turbidity. Use of standard excavation equipment would have been precluded, necessitating the use of hand tools. This requirement presented a risk of injury to workers in addition to irreparable damage to the environment. ~~Estimated volumes of contaminated material, area, supporting documentation and average ^{226}Ra concentrations are contained in PID #12-S-09.~~

Characterization data from the 0.5 acre area indicates ^{226}Ra concentrations in the soil range from 2.3 to 42 pCi/g. Composite soil samples indicate average ^{226}Ra concentrations of 19 and 11 pCi/g for surface 0-6 inch depth and 6-12 inch depth, respectively. When surface ^{226}Ra concentrations for the 0.5 acre area are averaged with all other supplemental standard area

concentrations the resulting average of 7.2 pCi/g is statistically indistinguishable from the EPA clean up standard of 5 pCi/g above background. The estimated volume of contaminated materials in this area is 378 cubic yards. Estimated gamma radiation, radon gas and air particulate exposures from the supplemental standards area are insignificant and if the contamination were remediated, the benefits would be negligible.

3. Quality Control of Radiological Measurements

The quality control program for radiological measurements complies with the criteria set forth in the UMTRA Project Quality Assurance Plan, the RAC Quality Assurance Procedures, and DOE Order 5700.6B.

The QA/QC program for ^{226}Ra radiological measurements requires 4% of all soil verification samples to be re-analyzed by an off-site independent laboratory. Ten percent of all verification samples were required to be analyzed on-site for ^{232}Th and 4% of these samples to be reanalyzed at an off-site independent laboratory. This service was performed by Barringer Laboratories, Golden, Colorado for the Lowman site. Barringer Laboratories is certified by EPA Region VIII to perform radiochemical analysis. Each analytical report received from Barringer Laboratories is accompanied by a quality control data sheet which specifies lower limits of detection. Also included are duplicate sample results (10%), and results for quality control standards (5%), including the Barringer result, certified result, acceptable target range and relative deviation from the known value (acceptable deviation $\pm$ 5%). All original Barringer reports for soil analyses are available in DOE-archived records. Tables in J.5A and J.5B summarize this data.

All radon flux measurements were performed in accordance with RAC Health Physics Procedure RAC-025, radon flux measurements. Radon flux measurement duplicates (10%) were counted documented the reproduceability of the counting technique. The results are presented in Table J.6. All radon flux measurements were reviewed by qualified health physics personnel.

4. Backfill Material

The Lowman site did not use borrow pit material as backfill. Uncontaminated material from areas released by soil verification was used for site grading and backfill.

5. Radon Flux Measurement

Radon flux measurements are not to exceed 20 pCi/m^2-s as required by 40 CFR 61, Subpart T of the NESHAP regulations. Individual radon flux measurements ranged from -0.043 to 0.411 pCi/m^2-s Figure J.7 shows the approximate location of the 100 flux measurement points on the 28,000 square meter Lowman disposal cell. The radon flux measurements for Lowman are presented in Table J.7 and clearly indicate compliance with NESHAP requirements.

APPENDIX J

Verification Measurements

This appendix contains radiological verification data and supporting quality control data for the Lowman Idaho site. This data indicates that soil measurements following remedial action at the Lowman site have met the 5 and 15 pCi/g above background ^{226}Ra standards established by the EPA in Title 40 of the Code of Federal Regulations (CFR), Part 192. The 5 pCi/g standard is based on a 100 square meter area averaged over the first 15 centimeters of soil. The 15 pCi/g standard is based on a 100 square meter area average over 15 centimeter thick layers of soil more than 15 centimeters below the surface. Thorium-232 standards similar to the ^{226}Ra standards of 5 and 15 pCi/g above background were established in the Lowman Health Physics Monitoring plan. This appendix also contains soil verification data indicating ^{230}Th concentrations along with the ^{226}Ra concentrations, after 1000 years of decay, will not exceed the 5 and 15 pCi/g standards for ^{226}Ra. Supplemental standards were applied to some locations around the disposal site, mostly within the former construction site boundry, based on the requirements in 40 CFR 192, the criteria in the Lowman remedial action plan (RAP), and RAP Modification PID #12-S-09. Transient recreational use is the only potential use anticpated for the supplemental standards areas.

Along with the verification data in this appendix, there are three site-specific verification grid drawings. The soil samples in the accompanying soil verification data table correspond to the grid identification from the associated drawings. Some portions of the areas did not require excavation, or supplemental standards were applied. The excavation plan is provided with the site verification drawings.

Radon flux measurements were performed on the disposal cell after the final layers of radon barrier were in place as required by the National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations promulgated in 40 CFR 61, Subpart T. Data presented in this appendix indicates the NESHAP requirement of less than an annual average release rate of 20 pCi/m^2-s radon emission have been met.

A. Soil Verification

1. Radiological Verification Measurement Methods

Approved procedures for soil measurements on the Lowman site are included in this section. RAC Health Physics Procedure RAC-015 provides the basis of the verification measurement and sampling methodology. Figure J.1 is a plot of all soil verification ^{226}Ra data versus random sample number. Table J.1 presents an average of all ^{226}Ra results. Table J.2 presents an average of all ^{232}Th results.

Four percent of the Lowman verification samples were analyzed for ^{230}Th by Barringer Laboratories. No areas were found to contain soils contaminated with ^{230}Th in the absence of ^{226}Ra contamination. Additional samples were collected in suspect areas, (raffinate ponds, etc.), and analyzed for ^{230}Th. These results supported the conclusion that ^{230}Th was not present in the absence of excess ^{226}Ra.

The Radiologic Characterization of the Lowman site showed ^{232}Th to be present in contaminated materials in elevated concentrations. The Lowman Health Physics Monitoring Plan states that ten percent of all verification grids will be analyzed for ^{232}Th. Four percent of these samples were then sent to Barringer Laboratories for ^{232}Th analysis.

Radiological soil analyses performance criteria are specified in the Lowman RAP. The Lowman RAP requirement of $\pm$ 30% error limits at the 95% confidence level was met with the opposed crystal soil analysis systems (OCS) utilized on the Lowman site. Error limits were empirically determined, utilizing reference material counts (5.12 pCi/g ^{226}Ra and 10.2 pCi/g ^{232}Th), routinely during the verification process. The background ^{226}Ra concentration, as presented in the Lowman Final RAP, is 1.2 pCi/g. Minimum detectable activity for the Lowman OCS systems was 1.2 pCi/g for ^{226}Ra and 1.0 pCi/g for ^{232}Th. Two OCS systems were utilized at the Lowman site. Plots of the 5.12 pCi/g

^{226}Ra reference standard data are presented in Figures J.3 and J.4. Plots of the 10.2 pCi/g ^{232}Th reference standard data are presented in Figures J.5 and J.6. Summaries of all the reference data are presented in Table J.3 (^{226}Ra) and Table J.4 (^{232}Th).

The Final RAP presented the standards for cleanup of Uranium to 10 pCi/g in the top 15 cm and 30 pCi/g in subsequent 15 cm layers. Mechanical processing was the only type of process used at the Lowman site. Generally, chemical processing is required to produce elevated uranium activities. Sample analysis results for uranium and radium from the Lowman site characterization report indicated that uranium was out of equilibrium with radium in favor or radium. Therefore, when radium was remediated to the EPA limits uranium was also remediated to the RAP requirements. Based on this information sample analysis for uranium was not conducted on verification samples at the Lowman site, thereby eliminating additional analytical costs.

Reference material was supplied to MK-F/CWMFES by the Technical Measurements Center (TMC) in Grand Junction, Colorado. Analysis of the TMC standards can be found in report # GJ/TMC-10/83 UC-70A.

The sample collected from grid A-13-07 was inadvertently destroyed prior to an equilibrated OCS count. This grid, which is under the tailings pile and radon barrier material, meets EPA criteria for greater than 15 centimeter soil sample. This assumption is based on a project value derived from a site-specific correction of the unequilibrated value.

(Unequilibrated value)(Site Correction Factor) = Cal. Equilibrated Value

$$(3.6)(2.0) = 7.1 \text{ pCi/g}$$

Radon flux measurements were performed using in-situ charcoal canisters placed at 100 regularly spaced locations on the completed radon barrier of the disposal cell for a prescribed length of time. The canisters were then taken to the on-site lab, and analyzed on an OCS gamma spectrometer that was previously calibrated using known charcoal standards within established 95% confidence levels.

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MKO/UMT/1293/0674

ENGINEERS
AND
CONSTRUCTORS

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

HEADQUARTERS OFFICE
1500 WEST 3RD STREET
CLEVELAND, OHIO U.S.A. 44113-1406
PHONE: (216) 523-5600/TELEX: 985542

REPLY TO: MK-FERGUSON COMPANY
REMEDIAL ACTIONS
CONTRACTOR-UMTRA PROJECT
P.O. BOX 9136
ALBUQUERQUE, NEW MEXICO U.S.A. 87119

December 8, 1993

93-3050-796

Woody Woodworth
Site Manager
U.S. Department of Energy
Uranium Mill Tailings Remedial Action Project Office
2155 Louisiana, N.E. Suite 10,000
Albuquerque, New Mexico 87110

SUBJECT: Submittal of the Lowman, Idaho Final Completion Report

REFERENCE: 1) **Per Conversation between Woody Woodworth of DOE and Greg Doyle of MK-F dated November 18, 1993.**

2) **Contract No. DE-AC04-83AL18796**

Dear Mr. Woodworth:

Per the conversation between yourself and Greg Doyle on November 18, 1993, the Department of Energy (DOE) has reviewed and concurred with the Lowman, Idaho Draft Completion Report, therefore, MK-F is transmitting the covers and spines for the Lowman, Idaho "Final Completion Report" for your review and concurrence.

The following steps have been provided for revising the completion report:

Step No. 1: Obtain Volume 1, titled, "Draft Completion Report" and remove the front cover and spine.

Step No. 2: Obtain Attachment No. 1, insert "Replacement Pages" titled, "Final Completion Report".

Step No. 3: Obtain Volume 2, titled, "Appendices A, B, C and D" of the Draft Completion Report and remove the cover and spine.

Step No. 4: Obtain Attachment No. 2, insert "Replacement Pages" titled, "Final Completion Report".

Step No. 5: Obtain Volume 3, titled, "Appendix E" of the Draft

Completion Report and remove the cover and spine.

Step No. 6: Obtain Attachment No. 3, insert "Replacement Pages" titled, "Final Completion Report.

Step No. 7: Obtain Volume 4, titled "Appendices F, G, H, I, and J" of the Draft Completion Report and remove the cover and spine.

Step No. 8: Obtain Attachment No. 4, insert "Replacement Pages" titled, "Final Completion Report".

Step No. 9: Obtain Volume 5, titled, "Appendix B" of the Draft Completion Report and remove the cover and spines.

Step No. 10: Obtain Attachment No. 5, insert "Replacement Pages" titled, "Final Completion Report".

Step No. 11: Obtain Volume 5A, titled, "Appendix B" of the Draft Completion Report and remove the cover and spine.

Step No. 12: Obtain Attachment No. 6, insert "Replacement Pages" titled, "Final Completion Report".

Step No. 13: Obtain Volume 5B, titled, "Appendix B" of the Draft Completion Report and remove the cover and spine.

Step No. 14: Obtain Attachment No. 7, insert "Replacement Pages" titled, "Final Completion Report".

Step No. 15: Obtain Volume 6, titled, "Appendix E Photographs" of the Draft Completion Report.

Step No. 16: Obtain Attachment No. 8, insert "Replacement Pages" titled, "Final Completion Report".

This revision to the completion report will update the Lowman, Idaho Completion Report to "Final" status.

If you have any questions regarding this submittal, please contact myself of Greg Doyle at (505) 246-2571.

SDM/GJD
MK-FERGUSON COMPANY

for SDM

Steven D. Martz
Project Quality Manager

cc: (w/o attachment) C. Smythe - DOE/UMTRA

ATTACHMENT NO. 1

ATTACHMENT NO. 2

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

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 1

Remedial Action
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

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

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 2
APPENDICES A, B, C and D

Remedial Action
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

ATTACHMENT NO. 3

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

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 3
APPENDIX E

Remedial Action
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

ATTACHMENT NO. 4

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

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 4
APPENDICES F, G, H, I and J

Remedial Action
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

ATTACHMENT NO. 5

DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATIONS OFFICE

CONTRACT NO DE-AC04-83AL18796

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 5
APPENDIX B

Remedial Action
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

ATTACHMENT NO. 6

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

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 5A
APPENDIX B

Remedial Action
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

ATTACHMENT NO. 7

ATTACHMENT NO. 8

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

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 5B
APPENDIX B

Remedial Action
Contractor
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Uranium Mill Tailings
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NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

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

LOWMAN, IDAHO

FINAL

Completion Report

VOLUME 6
APPENDIX E Photographs

Remedial Action
Contractor
for the
Uranium Mill Tailings
Remedial Actions
Project

NOVEMBER, 1993

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issues - Geotechnical Engineering No. 1
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

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a) The RAP requirement that the organics in lower lifts of the contaminated material be <5% by volume in any area. (Specification page 02200-16), was not discussed in the CR. DOE should address how field activities controlled this aspect or otherwise provide verification for this item.

b) The maximum 5% by volume organic/deleterious substance content for radon barrier material (Specification page 02200-8) was not discussed. As above, DOE should address how field activities controlled this aspect or otherwise provide verification for this item.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: April 30, 1993

DOE agrees that the method used for controlling organics in the fill should be addressed in the completion report. DOE performed continuous visual inspection throughout placement of Contaminated Fill to ensure that not more than 5% organic material was placed, as documented in Daily Inspection Reports. The following was incorporated into Contaminate Fill section, Appendix E of the completion report:

"During placement of Contaminated Fill materials, continuous visual inspection was performed to ensure that not more than 5% by volume of organics were placed throughout the fill, also"

In addition, the following statement was incorporated into the Radon Barrier section of Appendix E:

"During Radon Barrier Material placement, continuous visual inspection was performed to ensure that not more than 5% by volume of organics and/or deleterious substances were placed."

PLANS FOR IMPLEMENTATION

The text has been revised as noted above.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issues - Geotechnical Engineering No. 2
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

Frequency distribution of testing for contaminated fill and radon barrier soils was not provided. DOE should address or provide verification for this item.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: April 30, 1993

DOE has provided Moisture/Density Testing Charts at the end of the Contaminated Fill and Radon Barrier Fill Materials sections of the completion report.

PLANS FOR IMPLEMENTATION

The text has been revised as noted above.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issue - Geotechnical Engineering No. 3
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

For the bedding layer material it was stated that an "Average value of 4 tests was within specified limits." It is not stated whether any individual test results were out of specified limits. DOE should verify that on individual tests were outside of acceptable limits.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: April 30, 1993

In Volume 3, Appendix E, titled "Bedding Material", eighth bullet item, found on Page 3, last sentence states in part "All 4 gradations tests passed the Design Specifications requirements." Therefore, no gradation tests failed, which resolves the above open issue.

PLANS FOR IMPLEMENTATION

None.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issues - Radiation Protection/Site Cleanup No. 4
COMMENTOR: Nuclear Regulatory Commission
DATE:

The RAS Report (pages 2,6) states that the cell will cover 9 acres and approximately 18 acres will be restricted area. There is no map in Appendix D, As-Built Drawings, that indicates which 18 acres have restricted access or how the restricted area will be maintained. DOE should indicate the location and current/future status of this 18-acres area.

RESPONSE

RESPONSE BY: Technical Assistance Contractor
DATE: May 19, 1993

The information requested by the NRC, a plan view map of the restricted area and text detailing how the restricted area is to be maintained, will be provided in the Lowman Long-Term Surveillance Plan (LTSP). This document is currently under review by the NRC. The DOE believes that this information is not required in a site Completion Report since it is provided in the site LTSP.

PLANS FOR IMPLEMENTATION

None.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issues - Radiation Protection/Site Cleanup No. 5
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

As stated in a November 5, 1991, letter to DOE, NRC's concurrence on PID 12-S-07 was on the condition that the Completion Report contain data supporting the estimate that the average radium content of the additional material placed in the ditch at the north end of the disposal cell was below 25 pCi/g. A copy of an Inter-Office Communication was attached to PID 12-S-07, Revision 1, that was transmitted to NRC on September 25, 1991. That document stated that the additional 24,500 yd^3 of contaminated material contained less that 20 pCi/g in the top 10 feet. DOE should present the data in the CR.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: August 27, 1993

The DOE agrees that this data should be added to the Completion Report. A paragraph describing the cell expansion area with a data table has been added to Appendix H of the Completion Report.

PLANS FOR IMPLEMENTATION

As noted in above response.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issues - Water Resources Protection/Groundwater Hydrology No. 6
COMMENTOR: Nuclear Regulatory Commission
DATE: March 6, 1993

As-Built drawings do not show the locations of abandoned wells listed in the specification; or a listing of abandoned piezometers situated beneath the designated disposal cell. DOE should update the As-Built drawings to include the locations of abandoned wells and piezometers. DOE should also provided the abandonment procedures for the piezometers, if those procedures varied from the well abandonment specification in the RAP.

Additionally, several monitoring wells described in the RAP are not shown on the As-Built Drawing LOW-PS-10-1209, and not listed as being abandoned. Well 641 and the on-site perennial spring (561) are designated monitoring points described in the RAP. DOE should revise Drawing LOW-PS-10-1209 to show the location of all wells remaining after completion of remedial activities.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: April 30, 1993

Well No.'s 571 and 581 were the only two wells designated for abandonment per the RAP. Piezometer No.'s 022, 023, 024, 025, 026 and 027 were shown in the RAP but were not designated for abandonment. This disparity exists because these piezometers were abandoned in 1990 under a previous contract. The reason for this is that the specifications contained in the RAP also form the Subcontract Documents. Since the piezometers were already abandoned they were not designated for abandonment in the specifications making up the Final RAP. The piezometers were abandoned in accordance with the attached specifications.

The locations of the wells and piezometers were not added to the As Built drawings since they are considered to be no longer in existence. As Built drawings are generated to show the condition of the existing features of the site after remediation. The location of the wells and piezometers were indicated

in the RAP. The Monitor wells that were still in existence at the end of remedial action are shown on As Built Drawing LOW-PS-10-1209. This As Built Drawing has been revised to show Well No. 641.

PLANS FOR IMPLEMENTATION

As noted in the above response.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issues - Water Resources Protection/Groundwater Hydrology No. 7
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

DOE should provide tabulations of the measured quantities of water actually used for dust control and tailings material compaction.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: April 30, 1993

A tabulation of the time engaged in dust suppression and resulting quantities of water expended for dust suppression on the tailings embankment has been provided. This tabulation was developed from the site Daily Field Reports.

PLANS FOR IMPLEMENTATION

As noted in the above response (Volume 3, Appendix E).

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: Open Issues - Water Protection/Groundwater Hydrology No. 8
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

DOE should provide the ground-water monitoring data collected during and immediately after the remedial activities. Additionally, an interpretive analysis of the monitoring results should be provided to document the impact that remedial activities may have had on the ground-water quality.

RESPONSE

RESPONSE BY: Technical Assistance Contractor
DATE: May 19, 1993

The information requested by the NRC, groundwater monitoring data collected during and immediately after the remedial action, will be provided under separate cover. The data collected during remedial action has been forwarded to NRC by the DOE. The post-remedial action compliance sampling is on-going and will be provided in the annual UMTRA Project Office Lowman Water Sampling and Analysis Plan, as well as the Annual Environmental Monitoring Report for Lowman. The DOE believes that this type of information is not appropriate data to be included in a Completion Report.

PLANS FOR IMPLEMENTATION

None.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: General Comments - Radon Protection/Site Cleanup No. 1
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

Appendix D as-built drawing LOW-PS-10-1208 should be revised as follows:

a. The drawing indicates four "hot spots" in areas where supplemental standards were applied to leave low-level Ra-226. Note three on the drawing states that these spots are five feet in diameter and over the 5 pCi/g Ra-226 standard. More specific information such as volume and average Ra-226 level, or a reference to data on these spots should be provided on the drawing.

b. The RAS Report indicates on page 71 that three "hot spots" along the access road, in the southwest corner of the property, were removed. The three "hot spots" on Figure 6.2 of the RAS Report correspond in location to three of the "hot spots" on the drawing. DOE should determine if the three "hot spots" should be removed from the drawing. If the drawing is correct and therefore, the supplemental standard application is incorrect or incomplete, this becomes an open issue.

c. The drawing should indicate that the areas marked 0.0 feet for depth of excavation are the supplemental standards areas where Ra-226 contamination is to remain.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: April 30, 1993

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a. As noted in comment 1b above, the three hot spots along the access road were inadvertently left on the drawing. They have been removed from Drawing No. LOW-PS-10-1208 since they had been remediated in 1990. The statement in the RAS page 71 is correct. The average Ra-226 concentration for the fourth hot spot southwest of the dry settling pond is shown on page 73 of the

RAS report. The average concentration is shown as 9 pCi/g. The drawing will not be revised since this information is included in the RAS report and is located in the Supplemental Standards area.

b. Reference the response for issue 1a of General Comments above.

c. The DOE agrees with the NRC comment, therefore, As-Built Drawing No. LOW-PS-10-1208 has been revised and incorporated into the completion report. Reference the response for issue 1a of General Comments above.

PLANS FOR IMPLEMENTATION

As noted in the above response.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: General Comments - Radiation Protection/Site Cleanup No. 2
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

Appendix K of the CR contains PID 12-S-09 which is the supplemental standard application for 0.5 acres along Clear Creek. NRC staff recommends that Appendix K be eliminated form the CR as presentation of entire PID's in the CR is inappropriate. Summary information related to the PID should be added to Appendix H or Appendix J (page 4), which already contains discussion of supplemental standard areas.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: August 27, 1993

The DOE agrees that Appendix K of the CR should be removed. Summary information form PID 12-S-09 is already included in Appendix J on page 5. Appendix K has been removed and the references to Appendix K have been changed to reference PID 12-S-09.

Additional summary information has been added to the text in Appendix J concerning PID 12-S-09, as follows:-

"Characterization data from the 0.5 acre area indicates ^{226}Ra concentrations in the soil range from 2.3 to 42 pCi/g. Composite soil samples indicated average ^{226}Ra concentrations of 19 and 11 pCi/g for surface 0-6 inch depth and 6-12 inch depth, respectively. When surface ^{226}Ra concentrations for

the 0.5 acre area are averaged with all other supplemental standard area concentrations, the resulting average of 7.2 pCi/g is statistically indistinguishable from EPA clean up standards of 5 pCi/g above background. The estimated volume of contaminated materials in this area is 378 cubic yards. Estimated gamma radiation, radon gas and air particulate exposures from the supplemental standards area are insignificant and if the contamination were remediated, the benefits would be negligible."

PLANS FOR IMPLEMENTATION

Revised as noted above.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Lowman, Idaho
DOCUMENT:	Draft Completion Report
COMMENT NO.:	General Comments - Radiation Protection/Site Cleanup No. 3
COMMENTOR:	Nuclear Regulatory Commission
DATE:	March 8, 1993

Appendix J (page 1) indicates that the supplemental standards areas are on-site. However, as-built drawings LOW-PS-10-1203 and 1209 indicate that most of the supplemental standard areas are outside of the designated site boundary and the north windblown area is outside the property line. DOE should explain the statement in Appendix J and indicate the potential use of the supplemental standards areas.

RESPONSE

RESPONSE BY:	Remedial Action Contractor
DATE:	April 30, 1993

The wording used to describe the location of the supplemental standards area was inaccurate. The statements should have explained that the supplemental standards areas are located around the disposal cell mostly within the former construction site boundary. The wording on page 1 of Appendix J has been changed to more accurately describe the supplemental standards area. The potential use of the supplemental standards area has been incorporated into the Appendix J text.

PLANS FOR IMPLEMENTATION

Revised as indicated in above response.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: General Comments - Radiation Protection/Site Cleanup No. 4
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

Given that a supplemental standard for uranium was described in the RAP, Appendix J should mention why uranium measurements are not included.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: August 27, 1993

The text to Appendix J was modified to demonstrate that characterization data for the Lowman site indicates uranium and radium are out of equilibrium in favor of radium. The point was also made that by cleaning up radium to the EPA limits, uranium would also be cleaned up to the RAP requirements. Modifications are as follows:

"Generally, chemical processing is required to produce elevated uranium activities. Sample analysis results for uranium and radium from the Lowman site characterization report indicated that uranium was out of equilibrium with radium in favor of radium. Therefore, when radium was remediated to the EPA limits, uranium was also remediated to the RAP requirements. Based on this information, sample analysis for uranium was not conducted on verification samples at the Lowman site, thereby eliminating additional analytical costs."

PLANS FOR IMPLEMENTATION

Revised as indicated in the above response.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Lowman, Idaho
DOCUMENT: Draft Completion Report
COMMENT NO.: General Comments - Radiation Protection/Site Cleanup No. 5
COMMENTOR: Nuclear Regulatory Commission
DATE: March 8, 1993

Volume 5B, Appendix B, Calculation 12-625-01-03 Addendum Appendix C (DOE, 1992a), is titled Field Radon Emanation Results. The data from 20 locations at various elevations, is presented as pCi/g. Radon emanation is the fraction of radon released into the pore space of the soil and would have no units. According to page AA-8, the data in Appendix C represents Ra-226 levels. DOE should correct the title page to this Appendix C.

RESPONSE

RESPONSE BY: Remedial Action Contractor
DATE: April 30, 1993

The DOE agrees that Volume 5B, Appendix C, Calculation 12-625-01-03 title page should be revised.

PLANS FOR IMPLEMENTATION

The title page was revised and incorporated into the completion report.