

UMTRA - DOE/AL

United States Department of Energy



**Final Audit Report
Remedial Action Construction
UMTRA Project
Lowman, Idaho**

Preparation Date - December 1992

U.S. Department of Energy
UMTRA Project Office
Albuquerque, New Mexico



Uranium Mill Tailings Remedial Action Project

9302120235 930108
PDR WASTE
WM-43 PDR

FINAL AUDIT REPORT
REMEDIAL ACTION CONSTRUCTION
UMTRA PROJECT
LOWMAN, IDAHO

DECEMBER 1992

U.S. Department of Energy
UMTRA Project Office
Albuquerque, New Mexico

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 SUMMARY	1
2.0 INTRODUCTION	3
2.1 Quality assurance audits	3
2.2 Radiological and in-process surveillance reports	3
2.3 Remedial action closeout inspections	3
2.4 Other quality assurance audits/surveillances	3
2.5 Audit procedures	5
2.6 General standards	5
3.0 RADIOLOGICAL SURVEILLANCES	7
3.1 Surveillance objectives	7
3.2 Surveillance results	8
3.3 Summary and conclusions	8
4.0 QUALITY ASSURANCE IN-PROCESS SURVEILLANCES	9
4.1 Surveillance objectives	9
4.2 Surveillance results	9
4.3 Summary and conclusions	10
5.0 REMEDIAL ACTION CLOSEOUT INSPECTION	11
5.1 Remedial action closeout inspection objectives	11
5.2 Remedial action closeout inspection results	11
5.3 Summary and conclusions	12
6.0 QUALITY ASSURANCE AUDITS	13
6.1 Audit objectives	13
6.2 Audit results	13
6.3 Summary and conclusions	13
7.0 OTHER AUDITS/SURVEILLANCES	15
7.1 Surveillance objectives	15
7.2 NRC surveillance results	15
7.3 Summary and conclusions	15
8.0 SUMMARY AND CONCLUSIONS	17
9.0 REFERENCES	19
9.1 Code of Federal Regulations	19
9.2 Federal Register	20
ACRONYMS	21

LIST OF TABLES

<u>Table</u>	<u>Page</u>
2.1 Summary of audits and surveillances	4

1.0 SUMMARY

This final audit report summarizes the results of all Quality Assurance (QA) audits and in-process surveillances, radiological surveillances and remedial action closeout inspections conducted at the Lowman, Idaho, Uranium Mill Tailings Remedial Action (UMTRA) Project site.

Since all audit or surveillance findings or recommendations have been closed, this final audit report segment of the site certification process is complete. Based on this final audit report and the fact that no open issues remain, the Technical Assistance Contractor (TAC) recommends that the U.S. Department of Energy (DOE) certify the Lowman, Idaho, remedial action site as being completed in conformance with applicable EPA standards or to the agreed-upon deviations from those standards.

2.0 INTRODUCTION

This final audit report consists of a summary of the QA audit, radiological surveillance, and in-process surveillance reports prepared by the TAC, as well as a summary of the reports of other surveillances conducted by the U.S. Nuclear Regulatory Commission (NRC). This report provides an independent assessment by the TAC of the remedial action compliance with approved plans, specifications, and standards. A recommendation to the DOE to certify that the Lowman site has been remediated in accordance with 40 CFR Part 192, Subpart A is included.

2.1 QUALITY ASSURANCE AUDITS

QA audits are conducted periodically by the TAC QA Department, under the direction of the DOE, to verify that the procedures and systems required by the respective QA programs are being implemented during remedial action. The QA audits are performed at the frequency of approximately one per year for each organization and subcontractor conducting work in support of the UMTRA Project. The results of the audits and follow-up actions for the Lowman site are documented in Section 6.0; a summary is given in Table 2.1.

2.2 RADIOLOGICAL AND IN-PROCESS SURVEILLANCE REPORTS

Radiological and in-process surveillances are conducted for the DOE by the TAC to provide an independent assessment that the quality of remedial action work is sufficient to ensure that the U.S. Environmental Protection Agency (EPA) standards and other site-specific requirements are met. These performance surveillances complement the QA programs and audits, and provide assurance that the remedial action tasks are accomplished in compliance with relevant specifications and standards. Performance surveillances are conducted at processing sites a minimum of once per construction season, or at least twice during the site remedial action. The results of the surveillances and follow-up actions for the Lowman site are documented in Sections 3.0 and 4.0; a summary is given in Table 2.1.

2.3 REMEDIAL ACTION CLOSEOUT INSPECTIONS

Remedial action closeout inspections are conducted upon completion of remedial action activities at UMTRA Project sites to verify that the sites are constructed in compliance with the approved remedial action plan (RAP), and construction plans and specifications. Summaries of the remedial action closeout inspection conducted by the DOE and the TAC are included in Section 5.0 and summarized in Table 2.1.

2.4 OTHER QUALITY ASSURANCE AUDITS/SURVEILLANCES

Summaries of QA audits and surveillances conducted by the DOE and the TAC are included in Sections 4.0 and 6.0 and summarized in Table 2.1. Audits or surveillances conducted at the Lowman site by other organizations or agencies are included in Section 7.0 and summarized in Table 2.1.

Table 2.1 Summary of audits and surveillances

Type/date of activity	Number of findings	Number of observations	Date closed
DOE/TAC radiological surveillances			
December 17-18, 1990 ^a	0	5	02/27/91
July 8-12, 1991 ^b	1	10	10/24/91
DOE/TAC in-process surveillances			
July 8-9, 1991 ^c	0	18	07/31/91
September 4-6, 1991 ^d	2	10	01/27/92
DOE/TAC remedial action closeout inspections			
December 9, 1991 ^e	1	13	01/08/92
June 16, 1992 ^e	5	11	08/11/92
June 22, 1992 ^e	0	5	08/11/92
DOE/TAC quality assurance audits			
MK-Ferguson (Albuquerque)			
None	N/A	N/A	N/A
MK-Environmental Services (SF, CA)			
October 17-18, 1991 ^f	4	15	01/16/92
Other audits/surveillances			
U.S. Nuclear Regulatory Commission			
June 12, 1990 ^g	0	4	06/12/90
June 18, 1991 ^h	0	4	06/18/91
September 18, 1991 ⁱ	0	7	09/18/91
October 29, 1991 ⁱ	2	6	To be closed out by NRC concurrence in the site completion report

^aDOE, 1990.^dDOE, 1991c.^gNRC, 1990.ⁱNRC, 1991c.^bDOE, 1991a.^eDOE, 1992.^hNRC, 1991a.^cDOE, 1991b.^fDOE, 1991d.ⁱNRC, 1991b.

2.5 AUDIT PROCEDURES

Criteria and procedures for conducting UMTRA Project audits and surveillances are provided in the "UMTRA Project Audit/Surveillance Program Plan" (DOE, 1988).

2.6 GENERAL STANDARDS

In 1978, the U.S. Congress passed Public Law 95-604 (PL 95-604), the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978, declaring uranium mill tailings a potential health hazard to the public, and requiring that certain sites be designated for remedial action. The Lowman site was included as one of these. The EPA was directed to promulgate radiological and nonradiological standards for decontamination of the sites, the DOE was authorized to initiate and manage the remedial actions, and the NRC was charged with concurring in the remedial actions and licensing the disposal sites. The standards that apply to all UMTRA Project sites, as promulgated by the EPA, are given in Subparts A and B of 40 CFR Part 192:

- The standards in Subpart A are directed at controlling the stabilization of radioactive materials at the disposal sites, and are addressed by the engineering design specifications developed by the DOE UMTRA Project Office for the disposal sites. Compliance with the Subpart A standards at the Lowman site was accomplished by stabilizing the residual radioactive material (RRM) at the Lowman disposal site.
- Subpart B standards define the conditions under which a site has been adequately decontaminated. In situ measurements and analyses of soil samples from excavated areas were conducted by the Remedial Action Contractor (RAC), and the results were compared to the cleanup standards for verification that contaminated materials had been removed. The TAC conducted radiological surveillances at the Lowman site to provide an independent evaluation of the RAC's verification efforts.

In addition, the site will be evaluated to determine if groundwater restoration in accordance with Subpart B of the proposed groundwater protection standards (52 FR 36000; September 24, 1987) is required. Groundwater restoration, if necessary, will be accomplished under the UMTRA Groundwater Project.

3.0 RADIOLOGICAL SURVEILLANCES

Two radiological surveillances were performed for the DOE UMTRA Project Office at the Lowman site to provide an independent assessment that the quality of remedial action work was sufficient to ensure that the EPA standards were met. While QA programs and audits provided a high degree of assurance that procedures were followed, radiological surveillances addressed whether the work actually would result in a site that meets EPA standards.

One radiological surveillance of the remedial actions performed by the RAC at the Lowman site was performed by the TAC and the DOE on December 17-18, 1990, at the RAC offices in Albuquerque, New Mexico (DOE, 1991a). The 2-day surveillance was conducted by a two-person audit team from the TAC Radiological Services Group. The surveillance included a comprehensive review of the RAC's radiological procedures and measurements, instrument calibration records, data management, and personnel monitoring.

A second radiological surveillance of the RAC was conducted at the processing site and vicinity properties in Lowman on July 8-12, 1991 (DOE, 1991b). The 5-day surveillance was conducted by a two-person audit team from the TAC Radiological Services Group. The auditors collected split verification samples from four 100-square-meter plots on the Lowman site, in addition to observing the sampling technique used by the RAC. The surveillance also included a comprehensive review of the RAC's radiological procedures and measurements, instrument calibration, QA and quality control (QC), and data management and analysis.

The following sections provide additional information regarding the radiological surveillance activities, and summarize the surveillance findings and resolutions.

3.1 SURVEILLANCE OBJECTIVES

Radiological surveillances have three distinct objectives. The first objective is to verify that remedial actions are meeting the EPA cleanup standards or other cleanup standards specified in the remedial action planning documents. The second objective is to evaluate excavation control methods used by the RAC to ensure that contaminated areas are not overexcavated. Prevention of overexcavation avoids increased quantities of material for disposal and potential escalated remediation costs. The final objective of a surveillance is to review the general data management methods and procedures of the RAC, and provide a pathway for the exchange of ideas for technological improvements in the program.

The results of the radiological surveillance were documented as either findings or observations, with the former related to noncompliance items, and the latter relating to items of proficiency, noncritical deficiency, or developmental activities. Findings presented in a radiological surveillance are based on one of the following criteria:

- Noncompliance with requirements of the site RAP, vicinity properties management and implementation manual, engineering design, or UMTRA Project Office directives applicable to the site.
- Evidence that the existing radiological measurement methods may result in residual contamination levels in excess of established limits (underexcavation).

- Evidence that the existing radiological measurement methods may result in the removal of materials not contaminated in excess of the limits (overexcavation). The soil contamination limits are those specified by EPA standards, including site-specific modifications agreed to by the NRC or mandated by UMTRA Project Office directives.
- Evidence that some aspects of the contractor's radiological survey plans and procedures, measurement techniques, or data management capabilities are insufficient to allow eventual certification of the site.
- Evidence that activities are not in compliance with applicable DOE Orders.

Observations are comments considered appropriate by the auditors to document topics of concern to the UMTRA Project Office, and to note noncritical areas where improvements in techniques or procedures could be made. Comments on proficiency, favorable comparisons or developmental activities may be included as observations.

3.2 SURVEILLANCE RESULTS

During the radiological surveillance conducted December 17-18, 1990, five observations were identified, three of which document the positive aspects of data management, documentation of information, and accuracy of the radium-226 results obtained through the Opposed Crystal System (OCS) compared to radiochemical analysis for verification samples from vicinity properties. The remaining two observations resulted in recommendations regarding the need to determine the appropriate derived air concentrations (DAC) for thorium-232 (Th-232) and to analyze 10 percent of collected verification samples for Th-232 by developed OCS methodologies.

During the radiological surveillance conducted July 8-12, 1991, one finding and ten observations were identified. The finding cited contaminated material being transported into the supplemental standards area by site runoff. The diversion ditch was subsequently rebuilt, and the contaminated material that had been deposited was excavated and placed into the disposal cell. The ten observations included three that confirmed the RAC's ability to accurately measure samples, and properly manage archived samples. Two observations involved the OCS and noted a need for written procedures and calibration certificates for reference materials. Two observations were made of the laboratory: 1) a need for drying-temperature measurements and 2) a general technician health and safety issue. Two observations focused on the use of proper DAC for Th-232. Finally, one observation covered the need to replace a generic correction factor that was likely to be conservative with a site-specific factor.

3.3 SUMMARY AND CONCLUSIONS

Two radiological surveillances were conducted in conjunction with the Lowman UMTRA Project site during remedial action activities. The overall conclusion of the radiological surveillances was that the health physics aspects of the remedial action program were well organized and effectively performed according to written procedures and documented requirements. Follow-up of findings and observations confirm that all issues have been resolved to the satisfaction of the TAC and the DOE UMTRA Project Office. All issues of the radiological surveillances were satisfactorily closed out.

4.0 QUALITY ASSURANCE IN-PROCESS SURVEILLANCES

To ensure that the approved construction plans and specifications were being properly followed and that the preplanned inspection points established by the NRC and DOE were being observed, the DOE/TAC team performed in-process surveillances at the Lowman site. The in-process surveillances were conducted during remedial action activities. These surveillances were independent of the contractor performing the work and did not relieve the contractor from any inspection or checking responsibilities that were required. Under the approved remedial action inspection plan (RAIP), these surveillances were performed by a team led by the TAC QA Department. QA surveillances were conducted at the Lowman site in July and September 1991 (DOE, 1991b and c).

During the TAC surveillances, materials, records, and construction activities were verified using the approved RAIP, RAP, and specifications and drawings for the Lowman site. The following sections provide additional information regarding the surveillance activities and summarize the surveillance findings and resolutions.

4.1 SURVEILLANCE OBJECTIVES

The QA surveillances had three distinct objectives. The first objective was to verify compliance by the RAC with the approved RAP for the Lowman site. To accomplish this, the approved RAP (and modifications) was reviewed by the TAC QA Department surveillance team leader and members, and a checklist was established consisting of key construction activities and the methods used to perform them. The second objective was to verify that the RAC was in compliance with the approved plans and specifications. The surveillance team accomplished this objective by reviewing documentation and observing construction activities as they were being performed. The final objective of the surveillance was to verify that the approved RAIP for the Lowman site was being implemented. The surveillance team accomplished this objective by reviewing QC records and witnessing the performance of testing and inspection activities in the field as they were being performed.

4.2 SURVEILLANCE RESULTS

In-process surveillance results are documented as either findings/recommendations or observations, with the former relating to noncompliance items and the latter relating to items observed during the site visit. The results of the surveillances performed at the Lowman site included 2 findings/recommendations and 28 observations. All of the findings/recommendations were corrected to the satisfaction of the UMTRA Project Office. The two findings/recommendations noted during the surveillances required the following:

- Initiating a project interface document and revising the site RAIP to modify the Lowman specification deleting the requirement for conducting hydrometer tests. [Note: The use of American Society for Testing and Materials Standard D-422 was required on the Lowman site, and this standard includes the requirement for conducting hydrometer tests. The site engineer issued guidance deleting the hydrometer requirement, but the site specifications needed to be formally revised].

- Revising the site RAIP eliminated the requirement for conducting Schmidt rebound hardness and splitting tensile durability tests for bedding material. Bedding material is not large enough to enable these tests to be conducted. (Note: These tests were required to be conducted on larger rock when/if bedding material was produced from larger material by means of crushing and screening processes).

4.3 SUMMARY AND CONCLUSIONS

Follow-up activities of findings/recommendations confirmed that all required actions were taken by the RAC and all findings/recommendations were resolved to the satisfaction of the TAC and the DOE UMTRA Project Office.

5.0 REMEDIAL ACTION CLOSEOUT INSPECTION

To ensure that the Lowman remedial action site was constructed in accordance with approved construction plans and specifications, the DOE/TAC team conducted a remedial action closeout inspection at the site. This inspection was conducted upon written notification from the RAC to the DOE UMTRA Project Office that remedial action at the site was complete.

The closeout inspection was conducted in three parts. The first part of this process was conducted in December 1991 and involved an inspection and thorough review of the QA/QC test and inspection records generated during remedial action activities at the site.

The second part of this process consisted of the on-site inspection. A DOE/TAC inspection team is composed of site management, engineering, environmental, and QA professionals visited the Lowman site and conducted an in-depth site walk-through and inspection in June 1992 (DOE, 1992).

The final part of this process consisted of a visit by a DOE/TAC team to the RAC Albuquerque UMTRA Project Office. This visit was conducted after the on-site remedial action closeout inspection. The purpose of this visit was to review documentation not available at the Lowman site at the time of the on-site inspection, and to close out those items that could not be verified during the site visit.

5.1 REMEDIAL ACTION CLOSEOUT INSPECTION OBJECTIVES

Remedial action closeout inspections have two distinct objectives. The first objective is to verify that the site was constructed in accordance with approved RAP and construction plan and specification requirements. The second objective is to ensure that all documents and records necessary to verify that the site was constructed in accordance with approved plans and specifications have been maintained and are available in Project files.

5.2 REMEDIAL ACTION CLOSEOUT INSPECTION RESULTS

Remedial action closeout inspection results are identified in the inspection report as open issues and require resolution before the DOE UMTRA Project Office considers the site remedial action complete. During the DOE/TAC QA/QC test and inspection documentation review, conducted in the RAC Albuquerque UMTRA Project Office, one item was not available for review. During the on-site inspection, five items were discussed that could not be verified or closed out until documentation could be reviewed. These documents were subsequently located and verified during the second DOE/TAC visit to the RAC, Albuquerque UMTRA Project Office, and were not available for review on the site during the inspection. In total, the results of the closeout inspections resulted in 6 open items and 29 observations. The six items that remained open after the documentation review and the site inspection are as follows:

- The RAC should provide photographs of the placement and thickness verifications for the upper slope apron for the DOE/TAC remedial action closeout inspection team.

- The MK-Ferguson (RAC) site engineer needs to check the survey coordinates of survey/boundary monuments SM-1/BMT-1, SM-2/BMT-2, and SM-4/BMT-4.
- The actual 28-day compressive strength tests on the concrete poured for the site/boundary monuments listed above should be reviewed. The slump of the concrete as sampled was 2.5 inches (6.3 cm), and the specifications called for a 3- to 5-inch (7.6- to 12.7-cm) slump.
- The foundation diameter of the survey/boundary monuments should be verified to ensure that the monuments were embedded, and the top surface diameters were constructed as specified.
- The minimum post embedment of the perimeter and entrance signs should be reviewed to verify that posts are embedded the minimum of 3 feet 2 inches (0.9 m 5.1 cm) into concrete.
- The final survey records for embankment cover thickness verification should be reviewed for contaminated material, radon barrier material, bedding material, and Types A and B riprap materials.

The documents listed above were examined and verified during the DOE/TAC visit to the RAC Albuquerque UMTRA Project Office. This visit was conducted after completion of the site remedial action closeout inspection.

5.3 SUMMARY AND CONCLUSIONS

Follow-up activities of the issues identified during the site remedial action closeout inspection confirmed that all required actions were taken by the RAC and all open issues were resolved to the satisfaction of the TAC and the DOE UMTRA Project Office.

6.0 QUALITY ASSURANCE AUDITS

During the performance of remedial action activities at the Lowman site, there was one audit conducted of the MK-Environmental Services design activities in San Francisco, California. This audit was performed October 16-17, 1991, by the TAC QA Department with support from the DOE UMTRA Project Office (DOE, 1991d).

6.1 AUDIT OBJECTIVES

QA audits have two objectives. The first objective is to verify compliance by the RAC and its design engineer with their approved Quality Assurance Program Plans (QAPP) and supporting operating procedures. The second objective is to provide objective evidence of the effectiveness of the implementation of the approved QAPPs and supporting operating procedures.

6.2 AUDIT RESULTS

Audit results are documented as findings/recommendations and/or observations, with the former relating to noncompliance items and the latter relating to items observed during the audit. The MK-Environmental Services audit resulted in 4 findings/recommendations and 15 observations. The four findings noted during the audit required the following actions:

- Conducting internal surveillances at the frequency specified in the MK-Environmental Services UMTRA Project Procedures Manual.
- Providing indoctrination and training for all employees assigned to the UMTRA Project, whether they are part-time or full-time staff.
- Completing site reliability reports within the time schedule specified in the MK-Environmental Services UMTRA Project Procedures Manual.
- Making several editorial changes to the MK-Environmental Services Computer Validation Plan and the MK-Environmental Services UMTRA Project Procedures Manual when these manuals are reviewed and revised.

6.3 SUMMARY AND CONCLUSIONS

Follow-up activities of findings/recommendations confirmed that all required actions were performed by MK-Environmental Services. In addition, all findings/recommendations were resolved to the satisfaction of the TAC and the DOE UMTRA Project Office.

7.0 OTHER AUDITS/SURVEILLANCES

To ensure that the approved construction plans, specifications, and RAIP for the Lowman site were being properly followed, the NRC conducted four surveillances during remedial action activities. These surveillances were independent of the contractor performing the work and did not relieve the contractor from any inspection or checking responsibilities that were required. The NRC surveillances were conducted June 12, 1990 (NRC, 1990), June 18, 1991 (NRC, 1991a), September 18, 1991 (NRC, 1991b), and October 29, 1991 (NRC, 1991c).

These surveillances conducted by the NRC involved approximately a 1-day site visit. During these surveillances, materials, records, and construction activities were verified using the approved RAIP and RAP for the Lowman site.

7.1 SURVEILLANCE OBJECTIVES

The NRC surveillances had three distinct objectives. The first objective was to assess the effectiveness of the construction and QC program to ensure compliance with the RAP and EPA standards. The second objective was to verify compliance with the approved plans and specifications. This objective was accomplished by reviewing documentation and observing construction activities as they were being performed. The final objective was to verify that the approved RAIP for the Lowman site was being implemented. This was accomplished by qualified personnel witnessing the performance of testing and inspection activities by staff in the field.

7.2 NRC SURVEILLANCE RESULTS

Surveillance results in the NRC reports are documented as observations and recommendations. The results of the surveillances performed at the Lowman site included 21 observations and 2 recommendations. The recommendations are as follows:

- Provide additional justification of the adequacy of the Type B riprap in the Lowman completion report where test results failed to comply with the minimum score of 80.
- Place additional rock in the gully to prevent further erosion along the southwest corner of the cell.

7.3 SUMMARY AND CONCLUSIONS

Follow-up activities of the observations and recommendations made by the NRC confirmed that all required actions were taken by the RAC, and all observations and recommendations were satisfactorily resolved. The concern regarding the adequacy of the Type B riprap has been addressed in the Lowman Completion Report as requested by the NRC. The placement of additional rock in the gully along the southwest corner of the cell was verified during the DOE/TAC remedial action closeout inspection conducted in June 1992.

8.0 SUMMARY AND CONCLUSIONS

Two radiological surveillances, one QA audit, two QA in-process surveillances, one closeout inspection of quality records, and one final remedial action closeout inspection were conducted during remedial action construction at the Lowman UMTRA Project site. In addition, the NRC conducted four on-site surveillances at the Lowman site. A total of 13 findings/recommendations and 87 observations were noted during TAC activities, and 2 findings/recommendations and 21 observations were noted during NRC activities. Follow-up activities of findings/recommendations and observations confirmed that all required actions were taken by the RAC, and all findings/recommendations were satisfactorily resolved. Since all audit or surveillance findings or recommendations have been closed, this final audit report segment of the site certification process is complete. Based on this final audit report and the fact that no issues remain open, the TAC recommends that the DOE certify the Lowman, Idaho, remedial action site as being completed in conformance with applicable EPA standards or to the agreed-upon deviations from those standards.

9.0 REFERENCES

- DOE (U.S. Department of Energy), 1991a. Radiological Surveillance of Remedial Action Activities at the Lowman, Idaho Processing Site and Vicinity Properties, July 1991, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1991b. Report of Quality Assurance Surveillance of MK-Ferguson Company Remedial Action Construction, DOE UMTRA Project, Lowman Idaho, July 1991, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1991c. Report of Quality Assurance Surveillance of MK-Ferguson Company Remedial Action Construction, DOE UMTRA Project, Lowman, Idaho, September, 1991, DOE UMTRA Project Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1991d. Report of Quality Assurance Audit of Morrison-Knudsen Environmental Services, Inc., October 1991, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1988. UMTRA Project Audit/Surveillance Program Plan, UMTRA-DOE/AL-400326.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- NRC (U.S. Nuclear Regulatory Commission), 1991a. Report of Construction Inspection at Lowman UMTRA Site, Memorandum, October 1991, Washington, D.C.
- NRC (U.S. Nuclear Regulatory Commission), 1991b. Report of Inspection of Lowman UMTRA Site, Memorandum, September 1991, Washington, D.C.
- NRC (U.S. Nuclear Regulatory Commission) 1991c. Construction Inspections at Lowman, Idaho and Grand Junction, Colorado UMTRA Project Sites, Memorandum, June 1991, Washington, D.C.
- NRC (U.S. Nuclear Regulatory Commission) 1990. Lowman Informal Site Visit/Meeting, Memorandum, June 1990, Washington, D.C.

9.1 CODE OF FEDERAL REGULATIONS

- PL 95-604 (Public Law 95-604), 1978. Uranium Mill Tailings Radiation Control Act of 1978, 42 USC 7901, November 8, 1978, 95th Congress of the United States of America, Washington, D.C.
- 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," Code of Federal Regulations, Vol. 40, Part 192, U.S. Environmental Protection Agency, Office of the Federal Register National Archives and Records Administration, Washington, D.C.

9.2 FEDERAL REGISTER

52 FR 36000, "EPA's Proposed Standards for Remedial Action at the Uranium Processing Sites with Groundwater Contamination," September 24, 1987, Federal Register, Office of the Federal Register National Archives and Records Administration, Washington, D.C.

ACRONYMS

DAC	derived air concentration
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
NRC	U.S. Nuclear Regulatory Commission
OCS	Opposed Crystal System
QA	quality assurance
QAPP	quality assurance program plan
QC	quality control
RAC	Remedial Action Contractor
RAIP	remedial action inspection plan
RAP	remedial action plan
TAC	Technical Assistance Contractor
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act