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REV. 0

FINAL AUDIT REPORT OF REMEDIAL ACTION CONSTRUCTION AT THE UMTRA PROJECT FALLS CITY, TEXAS, SITE

May 1995

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

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DISCLAIMER

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EXECUTIVE SUMMARY

This final audit report for the Falls City, Texas, Uranium Mill Tailings Remedial Action Project site summarizes the radiological audits and the quality assurance (QA) in-process surveillances, audits, and final close-out inspection performed by the U.S. Department of Energy (DOE) and Technical Assistance Contractor (TAC). It also summarizes U.S. Nuclear Regulatory Commission (NRC) surveillances.

One radiological audit and three radiological surveillances were performed at the Falls City site (Section 2.0). These surveillances and audit, which resulted in 31 observations, focused primarily on processing site activities and were performed on the following dates: 3-6 August 1992, 29-30 October 1992, 22-26 March 1993, and 1-3 November 1993. All outstanding radiological issues were closed out at the completion of the construction activities.

Six QA in-process surveillances, which resulted in 71 observations, were performed at the Falls City site (Section 3.0) on the following dates: 22-24 July 1992, 23-25 November 1992, 17-19 May 1993, 16-18 August 1993, 13-15 October 1993, and 2-4 February 1994. All outstanding issues were closed out with the February surveillance on 3 March 1994.

The DOE/TAC remedial action close-out inspections of the Falls City site (Section 4.0), which resulted in 56 observations, were conducted 9-10 June 1994 and 26 July 1994. The inspections were closed out on 26 January 1995.

The NRC performed three on-site construction reviews (OSCR), resulting in seven observations of remedial action construction activities that occurred during site visits (Section 5.0). The OSCRs were performed 9 December 1992, 12 May 1993, and 25 October 1993.

Since all audit and surveillance observations and recommendations have been closed out, this final audit report segment of the site certification process is complete. The TAC therefore recommends that DOE certify the Falls City, Texas, remedial action site as being completed in conformance with applicable U.S. Environmental Protection Agency standards and the agreed-upon deviations from those standards.

TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION	1-1
	1.1 Radiological audits	1-1
	1.2 Quality assurance audits/surveillance	1-1
	1.3 Remedial action close-out inspections	1-1
	1.4 Other quality assurance audits/surveillances	1-1
	1.5 Audit procedures	1-3
	1.6 General standards	1-3
2.0	RADIOLOGICAL AUDITS/SURVEILLANCES	2-1
	2.1 Audit/surveillance objectives	2-1
	2.2 Audit results	2-2
	2.3 Summary and conclusions	2-4
3.0	QUALITY ASSURANCE IN-PROCESS SURVEILLANCES	3-1
	3.1 Surveillance objectives	3-1
	3.2 Surveillance results	3-1
	3.3 Summary and conclusions	3-4
4.0	REMEDIAL ACTION CLOSE-OUT INSPECTION	4-1
	4.1 Remedial action close-out inspection objectives	4-1
	4.2 Remedial action closeout inspection results	4-1
	4.3 Summary and conclusions	4-3
5.0	OTHER AUDITS AND CONSTRUCTION REVIEWS	5-1
	5.1 Quality assurance audits	5-1
	5.2 On-site construction reviews objectives	5-1
	5.3 On-site construction reviews results	5-1
	5.4 Summary and conclusions	5-5
6.0	SUMMARY AND CONCLUSIONS	6-1
7.0	LIST OF CONTRIBUTORS	7-1
8.0	REFERENCES	8-1

LIST OF TABLES

Table		Page
1.1	Summary of audits and surveillances	1-2

LIST OF ACRONYMS

Acronym	Definition
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FAR	final audit report
GTCC	Gilbert Texas Construction Corporation
HP	health physics
HPGe	high purity germanium
MKES	Morrison Knudson Environmental Services
MK-F	Morrison Knudson-Ferguson
NIST	U.S. National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
OSCR	on-site construction reviews
PCM	personal contamination monitor
PI	plasticity index
PID	Project Interface Document
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QDR	quality deficiency report
RAC	Remedial Action Contractor
RAP	remedial action plan
TAC	Technical Assistance Contractor
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act

1.0 INTRODUCTION

In this final audit report (FAR), the Technical Assistance Contractor (TAC) independently assesses remedial action activities performed by MK-Ferguson (MK-F) at the Falls City, Texas, Uranium Mill Tailings Remedial Action (UMTRA) Project site. This FAR focuses on remedial action compliance with approved plans, specifications and standards, and 40 CFR Part 192. Included here is the TAC recommendation to the U.S. Department of Energy (DOE) that the Falls City UMTRA site be certified as remediated, in accordance with 40 CFR Part 192, Subpart A.

1.1 RADIOLOGICAL AUDITS

The TAC performed one radiological audit and three radiological surveillances for the DOE at the Falls City site to independently assess whether the quality of remedial action work would meet U.S. Environmental Protection Agency (EPA) standards and other site-specific health physics requirements. Radiological audits and surveillances complement the quality assurance (QA) programs and surveillances and ensure that remedial action tasks comply with relevant specifications and standards. Radiological audits/surveillances were performed either once or twice a construction season. The results of the audit and surveillances and follow-up actions for the Falls City site are documented in Section 2.0. Table 1.1 summarizes the audits and surveillances.

1.2 QUALITY ASSURANCE AUDITS/SURVEILLANCE

Under the direction of the DOE, the TAC QA Department performed QA in-process surveillances at the Falls City site, to verify that procedures and systems required by the respective QA programs were implemented during remedial action. Approximately two QA in-process surveillances were performed per construction season for each organization and subcontractor supporting the UMTRA Project. Section 3.0 documents results of the in-process surveillances and follow-up actions for the Falls City site. A summary is provided in Table 1.1.

1.3 REMEDIAL ACTION CLOSE-OUT INSPECTIONS

The remedial action close-out inspections were conducted at the Falls City site after remedial action activities were complete. Close-out inspections were performed to verify that the site was constructed in compliance with the approved remedial action plan (RAP), remedial action inspection plan, and construction plans and specifications. Section 4.0 documents the results of the remedial action close-out inspections.

1.4 OTHER QUALITY ASSURANCE AUDITS/SURVEILLANCES

Section 5.0 documents on-site construction reviews (OSCR) performed by the Nuclear Regulatory Commission (NRC) at the Falls City site.

Table 1.1 Summary of audits and surveillances

Type/date of activity	Number of observations	Number of responses required	Date closed
DOE/TAC radiological audits			
3-6 August 1992	6	4	a
29-30 October 1992	13	9	14 June 1993
22-26 March 1993	6	5	16 February 1994
1-3 November 1993	6	3	a
DOE/TAC QA in-process surveillances			
22-24 July 1992	10	0	13 August 1992
23-25 November 1992	10	0	29 December 1992
17-19 May 1993	13	3	9 August 1993
16-18 August 1993	11	1	6 December 1993
13-15 October 1993	13	1	11 February 1994
2-4 February 1994	14	0	3 March 1994
DOE/TAC remedial action close-out inspections			
9-10 June 1994	22	21	26 January 1995
26 July 1994	34	8	26 January 1995
Other audits/surveillances			
9 December 1992	4	4	27 May 1993
12 May 1993	3	0	14 May 1993
25 October 1993	0	0	27 October 1993

[a]Radiological audits/surveillances were closed out at the completion of construction activities.

1.5 AUDIT PROCEDURES

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

1.6 GENERAL STANDARDS

In 1978, the U.S. Congress passed Public Law 95-604 (PL 95-604), the Uranium Mill Tailings Radiation Control Act (UMTRCA), declaring uranium mill tailings a potential health hazard to the public and requiring that certain sites, including the Falls City, Texas UMTRA Project site, be designated for remedial action. 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.

- Subpart A standards control the stabilization of radioactive materials at the disposal sites. These standards are addressed by the engineering design specifications developed by the DOE UMTRA Project for the disposal sites. Compliance with the Subpart A standards at the Falls City, Texas UMTRA site was accomplished by moving and stabilizing the residual radioactive material on site and in place.

- 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, and the results were compared to the cleanup standards for verification that contaminated materials had been removed. The TAC conducted radiological surveillances/audits at the Falls City UMTRA site to provide an independent evaluation of the RAC's verification efforts.

In addition, the site will be evaluated to determine if ground water restoration in accordance with Subpart B of the proposed ground water protection standards (60 FR 2854) is required. Ground water restoration, if necessary, will be accomplished under the UMTRA Ground Water Project.

2.0 RADIOLOGICAL AUDITS/SURVEILLANCES

The TAC performed one radiological audit and three radiological surveillances for the DOE UMTRA Project Office at the Falls City, Texas, UMTRA site. The audit and surveillances were performed to independently assess the quality of remedial action work and ensure that the work would comply with EPA standards and DOE Orders. The TAC's radiological audit and surveillances included, but were not limited to, a comprehensive review of the Remedial Action Contractor's (RAC) radiological/health physics (HP) procedures and measurements, instrument calibration records, data management, personnel monitoring, and operational performance of the contractors and subcontractors responsible for HP remedial action work at the former uranium ore processing sites and the uranium tailings disposal cells.

2.1 AUDIT/SURVEILLANCE OBJECTIVES

The TAC radiological audit and surveillance program has evolved considerably since it was first performed in 1991. The process involves a complete inventory of office and site radiological conditions at the time of the audit/surveillance. The findings, observations, and recommendations are used to identify site-specific and programmatic conditions. That information is then used to identify positive attributes and address deficiencies to improve the overall radiological controls at the site.

The discussion information used to determine compliance with applicable procedures and requirements is obtained from interviewing RAC field personnel, reviewing office activities, and touring field facilities. Reviewing applicable records and documentation provides additional verification of HP activities.

Radiological audits/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 control methods used by the RAC to prevent overexcavation of areas, which also avoids increased quantities of material for disposal and potential escalated remediation costs. The final objective 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 to the program.

Findings and observations presented in a radiological audit/surveillance include but are not limited to the following:

- Noncompliance with requirements of the site RAP, vicinity property 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 noncontaminated materials 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 the auditors consider appropriate to document topics of concern to the UMTRA Project Office and to note improvements in techniques or procedures to noncritical areas. Comments on proficiency, favorable comparisons, or developmental activities may be included as observations.

2.2 AUDIT RESULTS

The first radiological surveillance, conducted by the TAC from 3-6 August 1992 (DOE 1992b), was performed by D. McCarthy and T. Kraus. The DOE representative was F. Bosiljevac. The focus of this surveillance was equipment calibrations, staff training and qualifications, the site radiological laboratory, personnel contamination survey procedures, radium-226 analysis, and housekeeping activities. Six observations were identified, two of which documented the positive aspects of equipment calibration, air sample results, swipe surveys, and maintenance of bioassay results, as well as qualified, trained staff personnel. The remaining four observations resulted in recommendations for the following: standard operating procedures for the germanium system, the installation of a new personnel contamination monitor, recalibration of both opposed crystal system units, and improved housekeeping activities in the QA trailer.

A second radiological audit was performed by TAC members T. Kraus and J. Hylko for the DOE at the Falls City site from 29-30 October 1992 (DOE, 1992d). The DOE was represented by F. Bosiljevac and R. Cornish. The focus of this audit was on documentation of radiological surveys and qualified and trained staff members, review of the on-site radiological laboratory, sample retrievability, radium-226 analyses, site procedures, and personnel contamination monitoring.

During this audit, 13 observations/findings were identified, 4 of which point out the following: the positive aspects of documentation of radiological surveys, trained and qualified staff personnel, a well-organized and maintained radiological laboratory, and retrievability of radiological samples. The remaining nine observations resulted in the following recommendations: recalibrating the high purity germanium (HPGe) detector system, verifying software validation and site-specific calculations, providing training on the HPGe detector system, obtaining a U.S. National Institute of Standards and Technology (NIST) traceable source for radium-226, revising RAC procedures, and providing training on the new personal contamination monitor (PCM) system.

The third radiological audit was performed by TAC members B. James and J. Hylko from 22-26 March 1993 (DOE, 1993a). The DOE was represented by F. Bosiljevac and R. Cornish. The focus of this audit was on radiological respiratory protection and air sampling programs, external dose rate monitoring, soil verification sampling, uranium ore identification samples, occupational air sampling procedural compliance, and the standardized quality control verification sample tracking system.

Six observations were identified, one of which documents the positive aspects of external dose rate monitoring, contamination control relating to heavy machinery, and radiation detection equipment calibration. The remaining five observations resulted in recommendations that the RAC do the following: evaluate the need to have a larger number of approved respirator wearers, determine the cause for a low bias in the opposed crystal system, re-evaluate the grid size for sampling, designate the grab samples as area samples only, and standardize the radiological quality control (QC) verification sample tracking and recording system.

The fourth and final radiological activity was an audit performed by J. Hylko and B. James at the Falls City site from 1-3 November 1993 (DOE, 1993e). The DOE was represented by A. Nguyen. The focus of this audit was on monitoring for radon-222 emissions, and reviewing the temporary radioactive materials storage area, site verification data ("red material"), and the opposed crystal system.

Six observations were identified, three of which document the positive aspects of monitoring for radon-222, verification and determination of radium-226 and thorium-230, and site cleanup verification data. The remaining three observations recommended the RAC revise the chain-of-custody requirements section of their procedure for monitoring radon-222; evaluate the need for temporary radioactive materials storage areas, and expedite activities to finalize the technical basis documentation regarding the verification methodology of the red material.

2.3 SUMMARY AND CONCLUSIONS

One radiological audit and three radiological surveillances were conducted during remedial action activities. It was concluded that the HP aspects of the remedial action program were organized and performed according to written procedures and documented requirements. Findings and observations that were followed up in subsequent audits and surveillances verified that all issues were resolved to the satisfaction of the DOE UMTRA Project.

3.0 QUALITY ASSURANCE IN-PROCESS SURVEILLANCES

The DOE/TAC performed six QA in-process surveillances during remedial construction activities to ensure that approved construction plans and specifications were properly implemented by the RAC and its subcontractors. These surveillances were independent of the contractor performing the work and did not relieve the RAC and its subcontractors from their own QC requirements. The QA in-process surveillances were performed by a team consisting of a TAC lead auditor and the DOE QA manager. The Falls City remedial action activity requirements were verified using the Falls City remedial action inspection plan, the Falls City RAP, and approved plans and design specifications.

DOE/TAC QA in-process surveillance reports include observations and recommendations. Observations are comments documenting topics of concern to the DOE UMTRA Project and noting improvements in techniques or procedures in noncritical areas. Comments on proficiency, favorable comparisons, or developmental activities may be included as observations. Recommendations are made for observations that do not meet UMTRA Project requirements or where a best management practice would improve work processes.

3.1 SURVEILLANCE OBJECTIVES

The QA in-process surveillances had three objectives. The first was to verify RAC compliance with the approved RAP for the Falls City site. The surveillance team accomplished this objective by reviewing the RAP and making a checklist of the key construction activities and methods used to perform them.

The second objective was to verify RAC compliance with approved plans and specifications. The surveillance team accomplished this objective by reviewing documentation, observing construction activities, and using established checklists.

The third objective was to verify that the remedial action inspection plan for the Falls City site was implemented. The surveillance team accomplished this objective by evaluating testing and inspection activities performed by the RAC QC staff in the field.

3.2 SURVEILLANCE RESULTS

A summary of activities and results for the six in-process surveillances performed at the Falls City site follows.

The first DOE/TAC QA in-process surveillance was performed from 22-24 July 1992 (DOE, 1992a). The purpose of this surveillance was to verify that contaminated materials were placed and tested and activities documented in accordance with approved methods and requirements. The surveillance team examined documentation, observed remedial action construction activities, and conducted interviews with MK-F QC personnel at the Falls City site.

This surveillance resulted in 10 observations. The surveillance observations did not contain any recommendations and required no response from the RAC. The surveillance was closed on 13 August 1992.

The second DOE/TAC QA in-process surveillance was performed from 23-25 November 1992 (DOE, 1992d). The purpose and results of this surveillance were the same as for the first QA surveillance. This surveillance was closed on 29 December 1992.

The third DOE/TAC QA in-process surveillance was performed from 17-19 May 1993 (DOE, 1993b). The purpose of this surveillance was to evaluate the degree of compliance with UMTRA Project requirements of remedial action activities conducted to date. The surveillance team reviewed documentation and conducted interviews with MK-F QC personnel at the Falls City site. They also visited the commercial quarry in Marble Falls, Texas, where erosion protection materials were produced, to observe the preparations for erosion protection material production, scheduled to begin during the last week of May 1993.

This surveillance resulted in 13 observations with three recommendations, two of which required a response. One observation noted that radon barrier plasticity index (PI) tests were performed for Atterberg limits testing. These test results were sent to Morrison Knudson Environmental Services (MKES) design engineers for acceptance or rejection. However, there were no written criteria for acceptance or rejection. The surveillance report required MK-F to provide an explanation for acceptance/rejection criteria.

MK-F responded to this observation by noting that they were performing the PI tests to address NRC concerns that settlement may cause radon barrier cracking. PI tests were not required in the final RAP. MK-F decided that the best place to describe PI requirements was in a revision of the remedial action inspection plan. Since the PI tests were still ongoing at the time of the surveillance, and a total settlement value had not yet been determined, there were no PI requirements described in the revision of the remedial action inspection plan used for this surveillance.

The second observation requiring a response noted that health physics checklist D, section C (entitled "OCS Systems") required revision because the checklist in question was based on a superseded standard operating procedure (SOP RAC-001, superseded by SOP RAC-IN-001). The surveillance report required that the checklist be updated and that MK-F provide a schedule describing revision and implementation of the new checklist at all UMTRA Project sites.

MK-F responded to this observation by revising their weekly surveillance forms (checklists) and issuing these revised forms to all UMTRA QC supervisors. The MK-F response included an attached memo from the RAC QA manager dated

2 June 1993 indicating that weekly surveillance forms were revised and issued. The surveillance was closed on 9 August 1993.

The fourth DOE/TAC QA in-process surveillance was performed from 16-18 August 1993 (DOE, 1993c). The purpose of this surveillance was to determine the degree of compliance with UMTRA Project specifications and requirements. QC tests and inspection records detailing QC activities associated with the remediation process were reviewed. Field observations were conducted at the disposal site. The QC field laboratory and the contractor's construction activities were observed. The Marble Falls, Texas, quarry was visited to observe the production of bedding material and Types B and C erosion protection materials.

This surveillance resulted in 11 observations. One observation resulted in a recommendation requiring a response. This observation noted that 8,000 cubic yards of Type B riprap were delivered and stockpiled at the disposal cell. Gradation tests indicated this stockpiled material did not meet specifications. The stockpile was marked with red flags. The surveillance report required that MK-F provide corrective actions, a schedule, and preventive measures to ensure that Type B material which did not meet specifications would not be delivered to the site in the future.

MK-F issued a response dated 15 October 1993. The response stated that MK-F issued quality deficiency report (QDR) number FCT-93-003, dated 30 July 1993, to Gilbert Texas Construction Corporation (GTCC). This QDR addressed the problem of out-of-specification erosion protection material delivery to the site. MK-F issued a stop-work order to GTCC on 5 August 1993 to discontinue any further delivery of material not meeting specifications to the site. MK-F issued this order primarily because GTCC was nonresponsive to QDR FCT-93-003. The result of the stop-work order was that GTCC committed to enact corrective action by 13 December 1993. The surveillance was closed on 6 December 1993.

The fifth DOE/TAC QA in-process surveillance was performed from 13-15 October 1993 (DOE, 1993d). The purpose of this surveillance was to evaluate the degree of compliance with UMTRA Project requirements of remedial action activities conducted to date. The surveillance team reviewed documentation and conducted interviews with MK-F QC personnel at the Falls City site.

This surveillance resulted in 13 observations. One observation required a response. This observation addresses segregation of Type B riprap material. The surveillance team observed that Type B material appeared to be segregated, with fine material accumulating at the top third of the cell and coarser material accumulating at the bottom third of the cell. The DOE QA manager requested that a gradation test be performed on the bottom third of the cell. This test was performed on 18 October 1993. The results from this test confirmed that the area did comply with site specifications.

The surveillance team recommended that MK-F site QC staff perform gradation tests on Type B material in areas that are visibly questionable. The team requested that these tests be performed at the normal specified frequency. They also asked MK-F to provide the DOE UMTRA Project Office with the gradation test results from the 18 October 1993 test.

MK-F issued a response to this observation on 14 December 1993 including the test results from 18 October 1993. MK-F also stated that they would continue to inspect erosion protection material for segregation and test those areas that appear suspect. The surveillance was closed on 11 February 1994.

The sixth DOE/TAC QA in-process surveillance was performed on 2-4 February 1994 (DOE, 1994a). Again, the purpose of this surveillance was to determine the degree of compliance with UMTRA Project specifications and requirements. The surveillance team reviewed QC test and inspection records. These records detailed QC activities associated with the remediation process. They also observed QC field and laboratory activities and the contractor's construction activities. This surveillance resulted in 14 observations. The surveillance observations did not contain any recommendations and required no response from the RAC. The surveillance was closed on 3 March 1994.

3.3 SUMMARY AND CONCLUSIONS

Six QA in-process surveillances were performed at the Falls City, Texas, UMTRA Project site during remedial action surface cleanup. These surveillances resulted in 71 observations. Five of the observations included recommendations from the surveillance team. Follow-up on observations and recommended activities confirmed that all required actions were performed by the RAC, and that all recommendations were resolved to the satisfaction of the TAC and the DOE UMTRA Project Office. All six of the QA in-process surveillances were closed out.

4.0 REMEDIAL ACTION CLOSE-OUT INSPECTION

To ensure that the Falls City, Texas, remedial action site was constructed in accordance with approved construction plans and specifications, the DOE/TAC team conducted a remedial action close-out 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 close-out inspection was conducted in three parts. The first part of this process was performed from 9-10 June 1994 (DOE, 1994b) and involved an inspection and thorough review of the 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, composed of the DOE technical support group leader, DOE QA manager, and TAC senior QA specialist, visited the Falls City site and conducted an in-depth site walk-through and inspection from 9-10 June 1994 (DOE, 1994b).

The final part of the remedial action close-out inspection consisted of an additional close-out inspection that was performed on 26 July 1994 (DOE, 1994c), and involved a final walkover and verification of completed outstanding site issues.

The final close-out inspection was closed out on 26 January 1995.

4.1 REMEDIAL ACTION CLOSE-OUT INSPECTION OBJECTIVES

Remedial action close-out inspections have two distinct objectives. The first objective is to verify that the site was constructed in accordance with approved RAP, construction plan, and specifications 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 UMTRA Project files.

4.2 REMEDIAL ACTION CLOSEOUT INSPECTION RESULTS

Remedial action close-out 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. Test and inspection documentation was reviewed at the RAC office in Poth, Texas. The initial close-out inspection performed from 9-10 June 1994 resulted in 22 observations, of which 21 required a response. The following items from the June close-out inspection are open:

- Installation and survey of three survey monuments, SM-1, SM-2, and SM-3.
- Installation and survey of two boundary monuments, BM-1 and BM-2.

- Installation of 60 perimeter signs.
- Installation of one entrance sign and verification that posts are embedded to the minimum depth of 3 feet 2 inches into concrete.
- Completion of aerial photography and mapping.
- Removal of subcontractor maintenance vans and equipment.
- Closure of open nonconformance report No. 94-01.
- Inspection and verification of all remaining erosion protection materials.
- Completion of final grading/placement of Type B and C materials (survey).
- Completion of bedding placement on southwest and northwest bench area.
- Completion of bedding depth checks in bedding placement areas.
- Removal of excess stockpile areas north of the disposal cell and completion of grading of the area.
- Completion of permanent fencing in Parcel A around disposal cell and Parcel B.
- Installation of plugs in the disposal cell apron (grouted dams).
- Installation of pipe drains (in finger trench).
- Installation of the apron out-fall in the southeast collection ditch of the disposal cell.
- Removal of all survey lath on the site and other materials/trash.
- Removal of equipment and miscellaneous subcontractor items (e.g., mailbox, portable toilets, and signs) north of the embankment in temporary stockpile area.
- Initiation and completion of survey of Type B erosion protection layer.
- Completion of survey for site drainage.
- Seeding and mulching north of embankment in temporary stockpile area.
- Verification of vegetative growth within 180 days of completion.

The final close-out inspection, performed on 26 July 1994, resulted in 34 observations, of which 8 required a response. Open items for the July close-out inspection are the following:

- Transmittal to the UMTRA Project of the actual 28-day compressive strength tests on the concrete poured for the survey/boundary monuments.
- Explanation of why the boundary monuments were not set in concrete, and why boundary marker BM-2 was not stamped to indicate its designation or surveyed corner marking.
- Completion date for aerial photography and mapping.
- Completion date for the survey for Type B and C erosion protection material.
- Bedding depth checks for the last month, with performance dates.
- Explanation of why the survey station was located at coordinates West 1, N60397.91 - E63513.637, elevation 461.48 feet.
- Performance date for the final grading survey.
- Inspection and verification of vegetative growth on the top of the disposal cell and areas of tailings cleanup. The inspection was to occur in late December 1994 or early January 1995.

4.3 SUMMARY AND CONCLUSIONS

Follow-up activities for the issues identified during the site remedial action close-out 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. The Falls City final close-out inspections were closed out on 26 January 1995.

5.0 OTHER AUDITS AND CONSTRUCTION REVIEWS

DOE/TAC QA audit reports and NRC on-site construction reviews include observations and recommendations. Observations are comments documenting topics of concern to the DOE UMTRA Project and noting improvements in techniques or procedures in noncritical areas. Comments on proficiency, favorable comparisons, or developmental activities may be included as observations. Recommendations are made for observations that do not meet UMTRA Project requirements or where a best management practice would improve the work process.

5.1 QUALITY ASSURANCE AUDITS

During the performance of remedial action activities at the Falls City, Texas site, the DOE/TAC performed QA audits on programmatic issues on MK-F and MKES. Two audits were conducted on the MKES design activities in San Francisco, California. These audits were performed on 28-30 September 1992 and 25-27 October 1993. The MK-F Project Office, located in Albuquerque, New Mexico, was audited on 14-15 December 1992. All audits were performed by the TAC QA department with support from the DOE UMTRA Project Office. The purpose of the audits was to determine the degree of compliance with the MK-F quality assurance project plan (QAPP). The audits verified that MKES was generally in compliance with MK-Ferguson's QAPP. Results of the audits are maintained in the UMTRA Project Office Project Document Control Center.

5.2 ON-SITE CONSTRUCTION REVIEWS OBJECTIVES

The NRC conducted three OSCR at the Falls City UMTRA Project site. The objectives of the construction reviews were to verify that construction activities followed the design and guidance in the RAP, the remedial action inspection plan, and design project specifications. A summary of the OSCRs and their results follow.

5.3 ON-SITE CONSTRUCTION REVIEWS RESULTS

The first NRC OSCR was performed by D. Rom and M. Layton on 9 December 1992. The OSCR consisted of a walkover tour of the site and a review of the field and laboratory records pertaining to soil placement. The OSCR team examined piles 1, 2, 3, 7, and 5, naturally-occurring radioactive soils, the wastewater retention basin, and the road crossing the right-of-way to pile 3. The construction review resulted in the following four observations that required responses from the DOE.

- The NRC asked DOE to examine the impacts on slope stability resulting from the placement of a geotextile liner and overlying bridge lift of tailings on the stabilized embankment slopes where seeps were occurring. The special construction techniques used in these areas were not described in the RAP. The NRC noted that if a potential shear plane was being incorporated, then

slope stability factors of safety may be less than those presented in the RAP. They were also concerned about the long-term effects of seepage. If a seepage situation similar to that of the Durango site was expected to occur, the NRC wanted the DOE to provide a plan for post-construction control.

- The NRC was concerned that actual recorded embankment settlements possibly were not indicative of the worst case despite what was assumed in selecting the test area described in the RAP. The NRC wanted the DOE to address the consolidation of slimes to determine whether the measured settlement within the cell represented what was likely to occur within the saturated slimes at the edges of the cell. The settlement as of the date of the construction review was less than the projected amount.

- The NRC observed that the earthwork project specification section 02200 used during their site visit was revision 4. They noted that the most recent revision submitted to the NRC office was revision 2. They wanted the DOE to verify that the changes incurred from revision 2 to revision 4 were "not changes of significance which have yet to be reviewed and concurred by NRC in accordance with the NRC/DOE memorandum of understanding."

- The NRC observed in-place sand-cone density testing on the northeast edge of the stabilized embankment. They observed that the plate was nearly parallel to the sideslope. The NRC noted that the baseplate residing on a sloping surface can result in the sand not properly filling the test hole. The NRC requested that MK-F personnel review the appropriate paragraphs of the American Society for Testing and Materials D-1556 testing procedure for details for sand-cone density testing on a sloping surface.

MK-F submitted their responses to the first three NRC issues to the DOE on 9 February 1993. They submitted their response to the last NRC issue on 12 February 1993. The DOE reviewed MK-F's responses, concurred with them, and replied to the NRC on 31 March 1993. The responses to the four issues are summarized as follows.

- The DOE responded that the seepage and minor sloughing observed by the NRC OSCR team would not have any bearing on the long-term stability of the disposal cell because improvement of soft subgrade as described in the Project Interface Document (PID)-20-S-10; long-term stability analyses were based on the assumptions of a high perched water table and all *in situ* materials were slime tailings, which have the weakest shear strength; the placement of geotextile in combination with dry soil actually enhances the long-term stability of the disposal embankment.

  The DOE also explained that seepage along the embankment slopes, similar to those at Durango, Colorado, would not occur at the Falls City site because no seepage zones were observed in the soil dikes retaining the

tailings deposits prior to construction. The absence of preconstruction seepage zones and the fluctuations of perched water recorded by piezometers indicated that rain water infiltrated through the pile surface and was either temporarily contained in the tailings pile or migrated directly into the underlying ground water table. The seeps observed along the excavated slopes were possibly due in part to porewater dissipation resulting from consolidation of slimes during embankment reshaping. Since the final design grade was nearly reached at the time of the NRC construction review, the resulting post-construction settlement would be very small and the residual dissipation of excess porewater from the slime tailings would not be substantial. The final construction of the disposal embankment would substantially reduce infiltration below preconstruction levels. The tailings would be overlain, in ascending order, by a 3-foot backfill blanket and 2-foot radon barrier. The permeabilities of these engineered cover fills were substantially lower than those of the original soil dikes.

- The DOE proposed to continue monitoring settlement at two test embankments located near the center of pile 7 and near the western edge of pile 1. The DOE had agreed with the NRC before the 9 December 1992 OSCR to monitor these two test areas for settlement. The DOE proposed to continue monitoring these two areas until primary consolidation of the material was nearly complete. The DOE felt that these two areas were sufficient for monitoring purposes and that there was no reason for settlement analysis in the seepage areas observed by the NRC.

- The DOE transmitted PIDs 7, 8, and 9, corresponding respectively to revisions 2, 3, and 4 of specification section 02200, to the NRC.

- The DOE transmitted the results of a study performed by MK-F that indicated a conservative value for sand-cone density volumes calculated on a slope. The study showed that testing on an inclined surface would consume a higher volume of density sand. The higher volume of density sand would result in a lower net density for the displaced material being tested. This would yield a more conservative figure of a lower percent compaction for the material being tested on a slope.

The NRC replied to the DOE responses on 27 May 1993. The stability of wet seepage areas was considered closed. This item was addressed in the 31 March 1993 DOE response and in PID-20-S-10. The NRC concurred with PID-20-S-10 in a letter dated 23 April 1993.

A settlement analysis enclosed with the DOE response was considered satisfactory by the NRC for verification of settlement in the wet slimes area. This item was also closed on 27 May 1993.

The item concerning the earthwork specification used at the site being revision 4 and that the revision number in the NRC's records was revision 2 was considered closed with the submittal of PIDs 20-S-7, 20-S-8, and 20-S-9 to specification 02200 with the DOE response. This item was closed on 27 May 1993 in the NRC reply.

The NRC considered the DOE response to the fourth item regarding sand-cone density testing on slopes satisfactory and closed it in the 27 May 1993 reply. However, the NRC wanted the DOE to inform them if future testing at the Falls City or other sites would follow ASTM D-1556 as written, or if the MK-F study submitted with the DOE response intended to justify future testing not in strict accordance with ASTM D-1556. MK-F responded in a 24 June 1993 memo to the DOE that the "study used to justify the occurrence observed by the NRC was not intended to allow this practice of performing sand-cones without a level baseplate." MK-F stated in this memo that the RAC does not intend to perform sand-cone testing on slopes without the baseplate being level (Martz, 1993).

The second NRC OSCR was performed by E. Brummett on 12 May 1993. The reviewer examined excavated areas; discussed verification procedures in areas with naturally elevated radium-226 and thorium-230; observed gamma readings in verified, windblown, and borrow areas; and reviewed construction and verification progress to date.

In areas with naturally elevated radium-226 and thorium-230, the RAC first used visual cues to distinguish between tailings and natural material. Soil samples were then collected on a 150-foot grid and analyzed for radium-226. If a sample read more than 15 picocuries per gram (pCi/g) the uranium/radium ratio was then measured by the germanium system to decide if the elevated radium-226 was due to *in-situ* mineralization. The NRC reviewer suggested that a discussion of this verification procedure be included in the completion report. This discussion would include the TAC and state geologists' reports, details on the procedures, data characterizing background, and explanation of references to other UMTRA Project sites that used alternate grid sizes.

The RAC staff inquired if material should be removed from the thorium-230 plume area southeast of the embankment. The reviewer said the NRC staff would need to review the data and discuss the issue before making a recommendation.

The NRC noted there was a DOE concern about meeting required radon flux measurements with radon barrier borrow material that had naturally elevated background levels. The RAC committed to monitoring and sampling during excavation.

The reviewer said that the characterization data for the overburden material that would be backfilled into pit number three could be summarized in the completion report. Included with this data should be assurance that the overburden did not contain mine wastes (e.g., tires or barrels of fuel).

Follow-up discussions held on 13 and 14 May 1994 indicated the following:

- The NRC had no problem with the naturally elevated radium-226 in the radon barrier material but would discuss it with NRC legal staff. No record of the resolution of this issue was found in the UMTRA Project Document Control Center.

- The DOE decided that it would be best to remove some of the material in the plume with elevated thorium-230 levels. The NRC had indicated that the plume could remain if the elevated material was covered by enough fill so that the estimated radon progeny concentration did not exceed the EPA standard.

- The DOE said that the RAC would revise the draft submittal on the 150-foot verification grids used to take soil samples of *in-situ* material with naturally elevated radium-226 and/or thorium-230.

The NRC OSCR was closed on 14 May 1993.

The third and final NRC OSCR was performed by D. Rom and T. Johnson on 25 October 1993. The reviewers examined placed and stockpiled riprap and noted that the rock was satisfactory and that segregation did not appear to be a problem. They took record photographs of the cell and observed field laboratory operations. Various MK-F personnel were interviewed and QC records were examined. Information was gathered by the NRC to compare actual field conditions related to the radon barrier design with assumptions made in the RAP.

The NRC staff indicated during the close-out meeting that there were no open issues or discrepancies generated from the review. The NRC OSCR was closed at the exit meeting on 27 October 1993.

5.4 SUMMARY AND CONCLUSIONS

Three OSCRs were performed by the NRC at the Falls City, Texas, UMTRA Project site during remedial action surface cleanup. The OSCRs resulted in observations for seepage slope stabilization, settlement measurement, sand-cone density testing, verification of naturally occurring radioactive materials, and the presence of a thorium plume.

Follow-up on observations confirmed that all required actions were performed by the RAC and DOE and that all recommendations were resolved to the satisfaction of the NRC.

6.0 SUMMARY AND CONCLUSIONS

Four radiological audits, six QA in-process surveillances, two QA audits, and two final remedial action close-out inspections were conducted during remedial action construction at the Falls City UMTRA Project site. In addition, the NRC conducted three OSCRs at the Falls City site.

During TAC audit/surveillance activities a total of 158 observations were made. Of those, 55 required a response. NRC OSCR activities resulted in a total of seven observations of which four required a response. Follow-up activities of observations/recommendations confirmed that all required actions were taken by the RAC, and all observations/ recommendations were satisfactorily resolved.

Since all audit and surveillance observations 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 Falls City, Texas, remedial action site as being completed in conformance with applicable EPA standards and the agreed-upon deviations from those standards.

7.0 LIST OF CONTRIBUTORS

The following individuals contributed to the preparation of this report.

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