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MEMORANDUM FOR: Myron Fliegel, Section Leader
Operations Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

FROM: Michael Tokar, Section Leader
Technical Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

SUBJECT: GEOTECHNICAL REVIEW DOCUMENTATION OF THE REMEDIAL
ACTION COMPLETION REPORT FOR THE SHIPROCK, NEW MEXICO
UMTRAP SITE, FINAL, AUGUST 1987.

At your request, the geotechnical engineering aspects of the Final Completion Report for the Shiprock, New Mexico, UMTRAP site were reviewed to verify that all remedial action activities were performed in accordance with the NRC approved Remedial Action Plan and Remedial Action Inspection Plan. The documentation of this review is prepared in the format required by the project manager and is attached to this memo.

This review was performed by Dr. Banad Jagannath; please contact him should you have any questions.

Original Signed By

Michael Tokar, Section Leader
Technical Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

Enclosure: As stated

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GEOTECHNICAL ENGINEERING REVIEW SUMMARY OF
"THE REMEDIAL ACTION COMPLETION REPORT FOR THE
SHIPROCK, NEW MEXICO, UMTRAP SITE"

Documents Reviewed: "Shiprock, N.M., Uranium Mill Tailings Site Remedial Action Completion Report, Volumes 1, 2A, 2B, 3A, and 3B,"
Final, August, 1987; prepared for DOE by MK-Ferguson.

The Geotechnical engineering aspects of the Final Completion Report on the Remedial Actions for the Uranium Mill Tailings at the Shiprock, N.M. site were reviewed to determine if the remedial actions at the site were performed in accordance with the NRC concurred Remedial Action Plan (RAP) along with the approved modifications, final design and construction specifications, and whether the work was sufficient to ensure that the EPA standards and other site specific requirements have been met. Items of review included as-built drawings, compliance of construction operations and testing with the provisions of specifications and Remedial Action Inspection Plan (RAIP), reports of staff observations and review of records during site visit, and DOE Quality Assurance Audits. The review of the above items was performed using the documentation provided by the DOE in the Final Completion Report.

Based on its review the staff concludes the following:

1. Appropriate tests (gradation) and inspections were performed to assure that the proper type of material was placed for each item of construction. The loose material was inspected before compaction to ensure that the organic content was less than five percent by volume. The loose thickness of the lifts was verified periodically to ensure compliance with the specifications for that material. Placement and compaction operations were routinely inspected and tested to assure that the moisture and density requirements were met and that the soil moisture was uniform throughout the compacted lifts.

2. Laboratory and field testing were conducted in accordance with the acceptable test procedures and by trained and qualified persons.
3. The Completion Report shows that the frequency of materials testing and inspection comply with the frequencies specified in the RAIP.
4. As-built drawings adequately document that the remedial action was completed consistent with the approved design.
5. Final slope, elevation, and placement of the remediated embankment cover were adequately inspected to ensure that the final conditions were consistent with those stated in the RAP and final design.

The results of the staff review, which provides the basis for the above conclusions, are presented in the attached table. Based on the above conclusions and on the results of on site inspections performed by the NRC staff during construction, the NRC staff concludes that the geotechnical engineering aspects of the construction were performed in accordance with the design and specifications identified in the Remedial Action Plan (RAP) and Remedial Action Inspection Plan (RAIP). In addition, the NRC staff concurs with the DOE that the remedial actions reasonably assure compliance with the EPA's standards in Subpart A of 40 CFR Part 192 with respect to the geotechnical engineering aspects of the design and construction of the remediated tailings pile at the Shiprock site.

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UMTRAP COMPLETION REPORT

RESULTS OF GEOTECHNICAL ENGINEERING REVIEW

UMTRAP Completion Report Review

Site: Shiprock

Reviewer(s): B. Jagannath

RAP Feature: 4. Tailings/Contaminated Material
(pg. 1 of 2)

Date: 10/10/87

RAP Requirements		Verification
a. Configuration:	a. Configuration:	
(1) Areal Extent	(1) Verified in As-built Drawing No. SHP-PS-10-0018	
° At least 300' from the San Juan River escarpment	"Tailings embankment set back approximately 300 feet away from the edge of the escarpment."	
° Figures 5.1 and E.2.2 Drawings SHP-PS-10-0012 SHP-PS-10-0018	RAPMod 1	
(2) Slopes	(2) Verified in As-Built Drawing No. SHP-PS-10-0043	
° 5H:1V max side slopes	"Tailings Embankment has a side slope of 5H:1V (Maximum) and top slope of approximately 2.8 percent (Required 2 to 4 percent)."	
° 2-4 percent top slopes		
b. Placement:	b. Placement:	
(1) Lift Thickness - 12" loose (Spec. pg. 02200-6)	(1) "Continuously monitored to ensure that the lifts did not exceed 12" loose depth" (p. E-4)	

UMTRAP Completion Report Review

Site: Shiprock
RAP Feature: 4.

Tailings/Contaminated Material
(pg. 2 of 2)

Reviewer(s): B. Jagannath
Date: 10/10/87

RAP Requirements	Verification
(2) Compaction-90% ± maximum density by ASTM D698 test, moisture (-5) opt to (+1) opt. (Spec. pg. 02200-8)	(2) "Average % compaction obtained was 93.8%" (p. E-4) Density data looks ok. Moisture tests verified that the material was placed at (-5) to (+1) of optimum moisture (p. E-3)
(3) Organics in lower lifts; <5% by volume in any lift (spec. pg. 02200-7)	(3) "Organics were well distributed and did not exceed 5%" (p. E-4)
c. Test Frequency	c. Test Frequency
Moisture/density 1 per 1,000 yd ³ (RAIP)	$\frac{1096 \text{ tests}}{1,078,996 \text{ Yd}^3} = 1 \text{ test: } 984 \text{ yd}^3 \text{ (p. E-4)}$

UMTRAP Completion Report Review

Site: Shiprock
RAP Feature: 5. Radon Barrier (pg. 1 of 2)

Reviewer(s): B. Jagannath
Date: 10/10/87

RAP Requirements		Verification
a. Configuration:	a. Configuration:	
(1) Areal Extent Drawing SHP-PS-10-0018 (RAPMod I - 3A)	(1) Verified in As-built Drawing No. SHP-PS-10-0018	
(2) Thickness - 7' sides 6.4' top	(2) Verified in As-built Drawing No. SHP-PS-10-0018	
b. Material:	b. Material:	
Sandy Silt, % passing No. 200 sieve ≥ 50 (Spec. pg. 02200-3)	Average of 80% passing No. 200 sieve, with a high of 95.7% and a low of 50.2%. Obtained from 150 tests, (p. E-84)	
c. Placement:	c. Placement:	
(1) Lift thickness 12" loose (Spec. pg. 02200-6)	(1) "Continuously monitored to ensure that the lifts did not exceed 12 inches loose depth." (p. E-84)	
(2) Moisture/Density: 95% of maximum by ASTM D698 test, wet side of OPT (Spec. pg. 02200-8)	(2) "The average percent compaction obtained was 96.8% (p. E-84) "Moisture content of the radon material remained on the wet side of optimum moisture content." (p. E-83)	

UMTRAP Completion Report Review

Site: Shiprock
RAP Feature: 5. Radon Barrier (pg. 2 of 2)

Reviewer(s): B. Jagannath
Date: 10/10/87

RAP Requirements		Verification
d. Test Frequency:	d. Test Frequency:	
(1) Moisture/Density 1 per 500 yd ³ (RAIP)	(1)	$\frac{1934 \text{ tests performed}}{765,378 \text{ yd}^3 \text{ placed}} = 1 \text{ per } 396 \text{ yd}^3 \text{ (p. E-84)}$
(2) Gradation 1 per day of fill placement (RAIP)	(2)	Gradation tests were performed a minimum of once daily for each day of placement. (p. E-84)

UMTRAP Completion Report Review

Site: Shiprock

RAP Feature: 6. Bedding Layer (pg. 1 of 2)

Reviewer(s): B. Jagannath

Date: 10/10/87

RAP Requirements		Verification
a. Configuration:	a. Configuration:	
(1) Areal Extent - see drawings RAP Mod 2	(1) Areal extent verified in As-built drawing #SHP-PS-10-0018	
(2) Thickness - 6"	(2) Thickness verified in As-built drawing #SHP-PS-10-0018	
b. Material:	b. Material:	
(1) Gradation (Specs. pg. 02200-4)	(1) Gradation curves provided in Appendix E, select bedding material, attachment 1, indicate that all tested material meet the gradation requirements (p. E-201 revised)	
c. Placement:	c. Placement:	
(1) 6" lift compacted by 4 passes of bulldozer (Specs. pg. 02270-5)	(1) "Compaction control was accomplished by monitoring the number of passes (4) by a bulldozer" (p. E-201) "Thickness continuously monitored to ensure that the lifts did not exceed 6". " (p. E-201)	

UMTRAP Completion Report Review

Site: Shiprock
 RAP Feature: 6. Bedding Layer (pg. 2 of 2)

Reviewer(s): B. Jagannath
 Date: 10/10/87

RAP Requirements		Verification
d. Test Frequency:		d. Test Frequency:
(1) 1 Gradation test per 10,000 yd ³ (See revised RAIP) (Specs. pg. 02270-3)	(1) $\frac{7 \text{ tests}}{65,850 \text{ yd}^3 \text{ placed}} = 1 \text{ per } 9407 \text{ yd}^3$ (p. E-201)	
e. Material Tests:		e. Material Tests:
(1) Abrasion (ASTM C131) <40%/500 cycles	(1) Average 17.9% loss/500 cycles (Range 15.3-22.4%)	(p. E-200, revised)
(2) Soundness (ASTM C88) <10%/5 cycles	(2) Average 1.2% loss/5 cycles (Range: 0.2-2.2%)	
(3) Specific Gravity >2.60	(3) Average 2.65 (Range: 2.65-2.67)	

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 12. Site Specific Features
(pg. 1 of 2)

Reviewer(s): B. Jagannath
Date: 10/10/87

RAP Requirements		Verification
a.	Arroyo Fill - Pitrun Cravel	a. Arroyo Fill
(1)	Configuration - drawing SHP-PS-10-0021, RAP Mod-2	(1) Verified in As-built drawing SHP-PS-10-0021
(2)	Placement - 18" loose lift, compacted by a minimum of four passes of a vibratory roller (Specs. pg. 02200-10)	(2) Compaction monitored
b.	Drainage and Seepage Control	b. Drainage and Seepage Control
(1)	Top of escarpment grade - drawing SHP-PS-10-0019 RAP Mod 2	(1) Verified in As-built drawing SHP-PS-10-0019
(2)	Seepage Barrier	(2) Seepage Barrier
(a)	Location-escarpment top, ditch D5, D6, and D7	(a) Location verified in As-built drawing SHP-PS-10-0021 Ditches verified in As-built drawing SHP-PS-10-0016

UMTRAP Completion Report Review

Site: Canonsburg
 RAP Feature: 12. Site Specific Features
 (pg. 2 of 2)

Reviewer(s): B. Jagannath
 Date: 10/10/87

RAP Requirements	Verification
(b) Thickness 12" (Spec. pg. 02200-5)	(b) "Thickness was continuously monitored to ensure that the lifts did not exceed 12" loose depth" (p. E-198)
(c) Material - Mancos Shale - 2"+ material $\leq$ 15% (Spec. pg. 02200-3)	(c) Average percent greater than 2" is 1.9% (p. E-198) - Range 0% to 10.0%.
(d) Placement - Minimum 95% of maximum density as per ASTM D1557 test wet side optimum (Spec. pg. 02200-9)	(d) "Average % compaction obtained was 95.6%" (p. E-198) - Data on p. E-199 verifies this statement. "Moisture tests were performed in order to verify that the moisture content...remained on the wet side of optimum moisture content" (p. E-197)
(e) Test frequency (RAIP) - Moist/Density: 1 per 500 yd ³ - Gradation - 1 per day of placement	(e) • $\frac{75 \text{ density tests}}{29,976 \text{ yd}^3} = 1:400 \text{ yd}^3$ (p. E-198) • "Gradation tests were performed for each day of placement to verify" (p. E-198) (total of 15 gradation tests)

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