UMTRAP GEN

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

FEDERAL EXPRESS

Mr. Paul H. Lohaus
Director, Division of Low-Level Waste
Management & Decommissioning
U.S. Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, MD 20852

JAN 1989 RECEIVED

DOCKETED USNRC JAN 10 MAIL SECTION DOCKET CLERK

Dear Paul,

The Ad Hoc Cell Design Working Group held a meeting with NRC personnel in Washington, DC, on October 20, 1988. As a result of this meeting, the enclosed report was prepared by G.R. Thiers, MK-E, and presents summary conclusions to be implemented by DOE on a site-by-site basis for the UMTRA Project in areas concerning rock erosion protection material particle size limits and procedures for absorption and sodium soundness field tests. These field tests will support DOE site certification for remedial actions through specification development and compliance; development of site specific Remedial Action Inspection Plans (RAIP); and follow-on Field Quality Control and Quality Assurance requirements.

Your responsive review and comment is requested. Your coordinated response with URFO would be appreciated.

For your information, Mr. T. Johnson, who was present at the October 20, 1988, meeting was given an advance copy of the enclosed information for his use. If you have any further questions please call me at (505) 844-3941.

Sincerely,

John R. D'Antonio
Special Assistant to Project Manager
Uranium Mill Tailings Project Office

Enclosure

cc w/enclosure:
T. Brazley, NE-22, HQ
G. Turi, NE-22, HQ
E. Hawkins, URFO, FEDERAL EXPRESS

cc w/o enclosure:
R. Rager, JEG
J. Caldwell, JEG
J. Williams, MK-F
G. Thiers, MKE
D. Gillen, NRC, FEDERAL EXPRESS
C. Cormier, UMTRA
F. Bosiljevac, UMTRA
R. Richey, UMTRA

89-0276

8901070153

PARTICLE SIZE LIMITS AND PROCEDURES FOR ABSORPTION AND SODIUM SOUNDNESS TESTS

PROBLEM 1 - PARTICLE SIZE LIMITS

As shown on attached Tables 1 and 2, and Ref. 1, Page 47, the absorption and sodium sulfate soundness loss values for the coarse (plus No. 4) fraction of a given crushed rock generally differ from the corresponding values measured on the fine fraction. The difference is especially important for bedding on the UMTRA project, where the ratio of fine fraction to coarse fraction can be as large as 60/40.

In many cases the differences in absorption and soundness will result in significant differences in rock quality scores, sometimes determining whether a material can be used in frequently saturated areas, and often affecting the oversizing percentage. Absorption is sometimes higher for the fine fraction (Table 1), and soundness loss may be higher (Table 2, Sheets 1 and 2) or lower (Table 2, Sheet 3 and Ref. 1, Page 47).

For UMTRA designs submitted to date the larger of the two values measured for a given sample, (generally the value for the fine fraction), has been used in computing the rock quality score for that sample. This contrasts with the approach used by the USBR in the tests on which the scoring system is based (Ref. 2, Tables 1 and 7), in that those tests were run on the following particle sizes (Ref. 3):

- o Absorption Tests: 3-inch cubes.
- o Soundness Tests : No. 4 to 1.5-inch material.

Thus minus No. 4 material was not used in the tests on which the scoring system is based, so that the results of tests on minus No. 4 material are not comparable to the results used in developing the rating system.

PROBLEM 2 - TEST PROCEDURES

Sodium Soundness: A comparison of Refs. 4, 5 and 6 indicates the following differences between ASTM and USBR procedures for sodium soun[illegible] tests on plus No. 4 material:

	ASTM C 88	USBR
Sample Weight (gm)		
No. 4 to 3/8"	300 ± 5	100 ± 2.5
3/8" to 3/4"	1000 ± 10	500 ± 17.5
3/4" to 1-1/2"	1500 ± 50	2000 ± 50
Sieve Used to Determine Loss		
No. 4 to 3/8" aggregate	No. 5	No. 4
3/8" to 3/4" aggregate	5/16"	3/8"
3/4" to 1-1/2" aggregate	5/8"	3/4"
Weighting to Determine Weighted Average Loss		
No. 4 to 3/8"	Use grading	20%
3/8" to 3/4"	of sample	30%
3/4" to 1-1/2"	as received	50%

These are the only significant differences between the test procedures.

Specific Gravity, Absorption, and L.A. Abrasion: For specific gravity, absorption and LA abrasion tests the USBR uses ASTM procedures (Ref. 4).

SOLUTION

In cases where the fine portion of a given material is derived from the same parent rock as the coarse portion, the absorption and soundness results from the coarse fraction can be used in deve.or'ng rock quality scores for the material. This is generally the case for material obtain by blasting and crushing rock from a relatively homogeneous strata, and may be true for some alluvial deposits. The pretrographic analysis should delineate the relative homogeneity of a given alluvial deposit.

When the fine and coarse materials are derived from different parent rock sources the ideal approach will be to test samples of the parent rock in the same size range as used by the USBR. This will seldom be possible. Alternatively if separate criteria for fine material (differing from he criteria for coarse material based on the USBR tests) were available, such criteria could be applied. ASTM Standard C-233, "Standard Specification for Concrete Aggregates", does contain an upper limit of 10% for sodium sulfate soundness loss for fine aggregate; but this is essentially the same as applying the present scor.ng system, under which a 10% soundness loss gives a test score of 50%, the same as the minimum acceptable overall score. Other explicit criteria for fine aggregate have not been found. Therefore in the absence of separate criteria or representative larger samples it will be necessary to test samples of the largest-sized available representative material.

To correspond to the tests on which the scoring system is based the USBR procedure for sodium soundness tests (Ref. 5) should be used.

SUMMARY

1. In cases where the fine portion of a given material is derived from the same parent rock as the coarse fraction, test representative material in the following particle size ranges:

- Absorption Tests: 2-inch to 4-inch.
- Soundness Tests : No. 4 to 1.5-inch.

2. Where the fine and coarse fractions are derived from different parent rock sources, test representative samples in the following particle size ranges:

- Coarse material: as given above.
- Fine fraction:
  - If the parent rock is available in suitable sizes, test this rock in the size ranges given above.
  - In other cases test the fine fraction in the largest size range av-'lable.

This approach is more directly supported by past experience and will result in more real' 'c designs.

3. Use USBR procedures for sodium soundness test. (Ref. 5).

REFERENCES

1. Fookes, P. G., C. S. Gourley, and C. Ohikere (1988), "Rock Weathering in Engineering Time", Quarterly Journal of Engineering Geology, London, Vol. 21, pp. 33-57.

2. DePuy, G. W. (1965), "Petrographic Investigations of Rock Durability and Comparison of Various Test Procedures", Engineering Geology, Bulletin of the Association of Engineering Geologists, Vol. 2, No. 2, pp. 31-46.

3. DePuy, G. W. (1988), Phone Conversation with G. R. Thiers, Morrison-Knudsen Engineers, Inc., San Francisco, California, 20 January.

4. ASTM (1988), "Standard Test Method for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate", Designation C88-83, American Society for Testing and Materials, Volume 04.02.

5. USBR (1981), Concrete Manual, 8th Edition, U.S. Department of the Interior, Water and Power Resources Service.

6. Hess, Robert (1988), USBR, Denver, Phone Conversation with G. R. Thiers, Morrison-Knudsen Engineers, Inc., San Francisco, California, 28 November.

7. Hess, Robert (1988), USBR, Denver, Phone Conversation with G. R. Thiers, Morrison-Knudsen Engineers, Inc., San Francisco, California, 29 November.

TABLE 1
(Sheet 1 of 2)
COMPARISON OF ABSORPTION VALUES
FOR VARIOUS ROCK SIZES

SOURCE OF ROCK: PEPPERLING QUARRY, LAKEVIEW, OREGON

Sample No.	Large Riprap	Small Riprap	Bedding
1987			
Riprap D1A, B, C	0.64		
Riprap C1A, B	0.31		
Riprap B-1		0.48	
Riprap B-2		0.15	
Riprap B-3		0.25	
Riprap B-4		0.39	
Riprap A-1		0.64	
Riprap A-2		0.77	
Riprap A-3		0.76	
1988			
Bedding B-1 (1)			1.24
Bedding B-1 (2)			1.00
Bedding B-1 (2')			2.98
Bedding B-1 (3)			1.43
Bedding B-2 (1)			2.53
Bedding B-2 (2)			1.37
Bedding B-2 (3)			1.48
Riprap B (1)		1.04	
Riprap B (2)		1.10	
Riprap B (3)	___	2.13	___
Average (All Samples)	0.43	0.77	1.72
Average (1988 Only)		1.42	1.72

TABLE 1
(Sheet 2 of 2)
COMPARISON OF ABSORPTION VALUES
FOR VARIOUS ROCK SIZES

SOURCE OF ROCK: SHEER'S PIT, LAKEVIEW, OREGON

Sample No.	Large Riprap	Small Riprap	Bedding
2		0.26	
T-B-001	0.27		
M-B-001	0.26		
B-1-A			0.86
B-1-B			0.94
B-2-A			0.65
B-2-B			0.59
Average	0.26	0.26	0.76

TABLE 2
(Sheet 1 of 3)
COMPARISON OF SODIUM SULFATE SOUNDNESS VALUES
FOR COARSE AND FINE FRACTIONS

SOURCE OF ROCK: PEPPERLING QUARRY, LAKEVIEW, OREGON

Sample No.	Coarse Fraction: Large Riprap	Coarse Fraction: Small Riprap	Coarse Fraction: Bedding	Fine Fraction
1987				
Riprap D1A, B, C	0.51			
Riprap C1A, B	0.75			
Riprap B-1		0.56		
Riprap B-2		0.13		
Riprap B-3		2.11		
Riprap B-4		0.89		
Riprap A-1		3.07		
Riprap A-2		1.36		
Riprap A-3		0.54		
1988				
Bedding B-1 (1)			1.2	7.2
Bedding B-1 (2)			3.9	11.9
Bedding B-1 (2')			1.9	17.3
Bedding B-1 (3)			6.9	9.4
Bedding B-2 (1)			5.4	6.7
Bedding B-2 (2)			3.7	7.0
Bedding B-2 (3)			5.7	8.5
Riprap B (1)		1.4		6.4
Riprap B (2)		1.9		11.1
Riprap B (3)		2.6		9.8
Average (All Samples)	0.63	1.46	4.1	9.5
Average (1988 Only)		1.97	4.1	9.5

TABLE 2
(Sheet 2 of 3)
COMPARISON OF SODIUM SULFATE SOUNDNESS VALUES
FOR COARSE AND FINE FRACTIONS

SOURCE OF ROCK: SHEER'S PIT, LAKEVIEW, OREGON

Sample No.	Coarse Fraction Large Riprap	Coarse Fraction Small Riprap	Coarse Fraction Bedding	Fine Fraction
1988				
2		4.8		8.1
T-B-001	0.7			-
M-B-001	0.2			-
B-1-A			0.9	4.2
B-1-B			1.4	4.8
B-2-A			1.0	2.2
B-2-B			0.8	4.0
Average	0.45	4.8	1.0	4.7

SOURCE OF ROCK: CHOATE'S QUARRY, LAKEVIEW, OREGON

Sample No.	Coarse Fraction Large Riprap	Coarse Fraction Small Riprap	Coarse Fraction Bedding	Fine Fraction
B-1			0.4	7.0
B-2			0.7	5.5
B-1-N			0.6	4.3
B-2-N			0.4	4.5
B-1-S			0.3	1.2
B-2-S			0.2	2.9
Average			0.5	4.2

TABLE 2
(Sheet 3 of 3)
COMPARISON OF SODIUM SULFATE SOUNDNESS VALUES
FOR COARSE AND FINE FRACTIONS

ADDITIONAL ROCK SOURCES

Source	Coarse Fraction	Fine Fraction
West Pawelekille Quarry, Texas	0.2	4.0
Redland Worth, San Pedro, Texas	0.06	0.02
Tordilla Hill Quarry (East), Texas	5.8	0.8
Tordilla Hill Quarry (West), Texas	0.4	0.6
Tordilla Hill Quarry (N. East), Texas	2.0	0.08
Tordilla Hill Quarry (North), Texas	0.3	0.6
Knippa Quarry, Texas	3.3	1.2

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

FEDERAL EXPRESS

Mr. Paul H. Lohaus
Director, Division of Low-Level Waste
Management & Decommissioning
U.S. Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, MD 20852

Dear Paul,

The Ad Hoc Cell Design Working Group held a meeting with NRC personnel in Washington, DC, on October 20, 1988. As a result of this meeting, the enclosed report was prepared by G.R. Thiers, MK-E, and presents summary conclusions to be implemented by DOE on a site-by-site basis for the UMTRA Project in areas concerning rock erosion protection material particle size limits and procedures for absorption and sodium soundness field tests. These field tests will support DOE site certification for remedial actions through specification development and compliance; development of site specific Remedial Action Inspection Plans (RAIP); and follow-on Field Quality Control and Quality Assurance requirements.

Your responsive review and comment is requested. Your coordinated response with URFO would be appreciated.

For your information, Mr. T. Johnson, who was present at the October 20, 1988, meeting was given an advance copy of the enclosed information for his use. If you have any further questions please call me at (505) 844-3941.

Sincerely,

John R. D'Antonio
Special Assistant to Project Manager
Uranium Mill Tailings Project Office

Enclosure

cc w/enclosure:
T. Brazley, NE-22, HQ
G. Turi, NE-22, HQ
E. Hawkins, URFO, FEDERAL EXPRESS

cc w/o enclosure:
R. Rager, JEG
J. Caldwell, JEG
J. Williams, MK-F
G. Thiers, MKE
D. Gillen, NRC, FEDERAL EXPRESS
C. Cormier, UMTRA
F. Bosiljevac, UMTRA
R. Eichey, UMTRA