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August 28, 2007
03G324

US Nuclear Regulatory Commission
Atten: Document Control Desk
Mail Stop O-3 H8
11555 Rockville Pike
Rockville, Maryland 20852-2738

Subject: Revised Rock Placement Procedures
Reading Slag Pile Site

Dear Mr. Smith,

GeoSystems Consultants, Inc. on behalf of Cabot Corporation is pleased to submit the revised rock placement procedures to construct the proposed rip-rap cover at the Reading Slag Pile Site. Changes have been made according to address NRC comments made during the conference call on August 27, 2007. The revised procedures are presented in specification format and are included as Attachment 1.

If you have any questions concerning these placement procedures, please do not hesitate to contact us.

Very truly yours,

GEOSYSTEMS CONSULTANTS, INC.

A handwritten signature in black ink, appearing to read 'David Harmanos', written over a horizontal line.

David Harmanos, P.E.
Senior Project Engineer

Attachments

ATTACHMENT 1

3.1 General

This Specification Section describes the requirements for placing rock riprap and granular aggregate materials for the construction of erosion protection cover, bedding layer, and perimeter aprons for the Reading Slag Pile Site cover. The process and performance criteria for selection of the type and source of material was provided in the Addendum 1 to Reading Slag Pile Site Decommissioning Plan (revision 4), dated August 2006.

3.2 Products

3.2.1 General

- A. Material Sources: Erosion protection materials shall be obtained from the Dyer Quarry in Birdsboro, PA.
- B. Approval of the Dyer Quarry as the source does not mean that all materials excavated will meet the requirements of this Specification. Processing will be utilized to meet the gradation and quality requirements of this Section.
- C. The diabase has been shown to be below the background radioactive level and free from other contamination.
- D. Material shall be dense, sound, resistant to abrasion, and shall be free from cracks, seams, and other defects as shown in the petrographic examination and during field inspection.
- E. Quality and Gradation Tests: For record purposes, the following tests will be performed:

Table F-1. Quality and gradation tests.

Test	Designation
Gradation	ASTM C117, ASTM C136
Specific Gravity (Saturated Surface Dry Basis)	ASTM C127
Absorption	ASTM C127
Sodium Sulfate Soundness	ASTM C88 (5 cycles)
Abrasion	ASTM C131 (100 revolutions)
Petrographic Examination	ASTM C295

The frequency of tests shall be in accordance with Article 3.4.1.C for the total amount produced at the quarry for this project regardless of number of sizes of materials produced.

3.2.2 Quality Requirements

A. All riprap and bedding materials used shall meet the following requirements as tested by the ENGINEER:

1. The tests specified in Table F-1 shall be taken at the frequency specified in 3.4.1.C for each material type. The score for each test is determined by multiplying the appropriate weighing factor by the score (0 to 10) based on the specific test results. The final score for each sample is the ratio of the sum of the individual test scores (four tests) to the maximum possible score, expressed as a percentage. To be acceptable, the final score must be no less than 80 percent for riprap and bedding material as presented in Table F-2.
2. Only igneous, diabase rock will be accepted.

Table F-2. Scoring criteria for determining rock quality.

Laboratory Test	Weighting Factor	Score										
	Igneous	10	9	8	7	6	5	4	3	2	1	0
Sp. Gravity	9	2.75	2.70	2.65	2.60	2.55	2.50	2.45	2.40	2.35	2.40	2.25
Absorption %	2	0.10	0.30	0.50	0.67	0.83	1.0	1.5	2.0	2.5	3.0	3.5
Sodium Sulfate %	11	1	3	5	6.7	8.3	10	12.5	15	20	25	30
LA Abrasion (100 revs). %	1	1	3	5	6.7	8.3	10	12.5	15	20	25	30
<p>1. Scores were derived from Tables 6.2, 6.5, and 6.7 of NUREG/CR-2642 - "Long-Term Survivability of Riprap for Armoring Uranium Mill Tailings and Covers: A Literature Review," 1982.</p> <p>2. Weighting Factors are derived from Table 7 of "Petrographic Investigations of Rock Durability and Comparisons of Various Test Procedures," by G. W. DuPuy, <u>Engineering Geology</u>, July 1965. Weighing factors are based on inverse of ranking of test methods for each rock type.</p>												

3.2.3 SUBCONTRACTOR-Proposed Sources

Not Applicable

3.2.4 Gradation Requirements

A. Materials shall be reasonably well-graded within the following limits:

1. Riprap:

- a. Gradation: Riprap materials shall be reasonably well-graded within the limits presented in Table F-3. The sizes are specified in terms of square openings of U.S. Standard Sieves or by the Nominal Sizes of the Materials.
- b. Maximum Size: No individual piece shall be greater than 90 percent of the riprap layer thickness.

Table F-3. Riprap gradation.

Sieve	Total Percent Passing								
	30"	24"	18"	15"	12"	9"	6"	4"	3"
Material									
R-7	100		15-50		0-15				
R-6		100			15-50		0-15		
R-4					100		15-50		0-15

2. Bedding Material:

- a. Bedding material shall be obtained from borrow areas approved by the ENGINEER. The QUARRY shall process the materials, as required, to meet the gradation requirements specified below.
- b. Gradation: Bedding material shall be reasonably well-graded within the following limits:

Table F-4. Bedding gradation.

Seive	Total Percent Passing															
	6.5"	4"	3.5"	2.5"	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#8	#16	#30	#100	#200
Material																
FS-3 or PennDOT-4	100			50											0	
		100	90-100	25-60		0-15		0-5								
FS-2 or PennDOT-2A					100						50				0	
					100			52-100		36-70	24-50	16-38	10-30			0-10

3.2.5 Source Quality Control

- A. The materials shall be inspected and tested by the ENGINEER to ensure that they meet all requirements of this Specification. Gradation requirements will be tested by the ENGINEER at the quarry and placement location.
- B. The ENGINEER shall provide a qualified engineering geologist or soils technician to monitor materials acquisition and production to ensure that only materials acceptable under Article 3.2.1 as confirmed by the ENGINEER are processed. During excavation or blasting of materials, the ENGINEER will inspect the site to ensure that stripping and material selection procedures are adequate to prevent inclusion of deleterious materials in processed materials. The ENGINEER reserves the right to inspect and test the materials.
- C. The ENGINEER will perform gradation tests for select bedding material and for each type of riprap. The tests will be performed in accordance with the requirements of ASTM C136. There will be at least four tests performed with an initial test and one test for every third (by volume) of the total material produced.

3.3 Execution

3.3.1 Placement and Compaction

- A. Erosion protection materials shall be handled, loaded, transported, stockpiled, and placed in a manner that avoids nonconformance with specifications due to segregation and degradation, including materials moved to and from stockpiles.
- B. Subgrade preparation shall include:
 - 1. Removing of trees and vegetation.
 - 2. Grind stumps to a minimum of 6 inches below the subgrade. On slopes where grinding can not be performed due to safety or the limitations of the grinder, a chainsaw will be used to cut the stump below grade. Subgrade should be pushed to facilitate grinding or use of a chainsaw but may not be removed.
 - 3. Slope shall be lightly graded by filling to remove gullies and local slope irregularities to achieve a relatively uniform surface. PennDOT Course Aggregate 2A produced from the Dyer Quarry diabase may be used as fill to facilitate grading. The maximum slope of the subgrade may not exceed 1.5 horizontal to 1 vertical at any point.
 - 4. A topographic survey of the completed subgrade will be made to verify slope, for thickness verification of subsequent layers and as a basis for contractor payment.
- C. Where the required bedding material thickness is six inches or less, the bedding material shall be spread and compacted in one layer.

- D. Placing of material by methods that will tend to segregate particle sizes within the layer will not be permitted.
- E. Riprap material, up to a maximum nominal size of 12 inches, may be placed by end-dumping and may be spread by bulldozers or other suitable equipment.
- F. Dumped riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the bedding material. The larger stones shall be well-distributed throughout the mass. The finished riprap shall be free from pockets of small stones and clusters of larger stones. Placing stone by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement that will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand may be required to the extent necessary to obtain a well-keyed and reasonably well-graded distribution of stone sizes as specified above. Larger pieces of riprap may require individual placement by equipment. Hand arrangement will be required only to the extent necessary to secure acceptable results. Stones shall be selected and positioned so as to produce an essentially solid, densely placed face of rock with all stones firmly wedged in place. Any stones that are not firmly wedged shall be adjusted and additional selected stones inserted or existing stones replaced, so as to achieve a solid interlock.
- G. For riprap placed by clam-shell or similar equipment, hand arrangement will be required only to the extent necessary to secure the results specified herein. Stones shall be selected individually and positioned manually under experienced supervision so as to produce an essentially solid layer with all stones firmly wedged in place. Any stones that are not firmly wedged, in the opinion of the ENGINEER, shall be adjusted by crow-bars or similar tools and additional selected stones inserted, or existing stones replaced, so as to achieve solid interlock.
- H. Bedding layers shall be track-walked by two passes of a Caterpillar D5 bulldozer or equal unless otherwise approved by the ENGINEER. Riprap shall be spread in a manner that will achieve full coverage and a uniformly distributed well-keyed, densely-placed layer.
- I. Construction equipment other than spreading and compaction equipment shall not be allowed to move over the placed riprap material and bedding material layers except at equipment crossovers as designated by the ENGINEER. Fill materials shall be placed temporarily at equipment crossovers to prevent degradation of placed riprap materials. Each crossover shall be cleaned of all contaminating materials and approved by the ENGINEER before additional materials are placed in these areas. Other construction equipment may move over placed riprap and bedding layers. The ENGINEER may restrict such traffic to minimize damage to completed layers. Areas of riprap and bedding layers damaged by construction equipment shall be restored to meet the requirements of the Specifications.

3.3.2 Tolerances

- A. The material layers shall be placed generally to the limits and thicknesses shown on the Subcontract Drawings within the following tolerances:
1. The top of the bedding subgrade shall not have a slope steeper than 1.5 horizontal to 1 vertical (1.5:1). No visible gullies, ditches or other features which would allow for surface water flow concentrations will be accepted
 2. Top of bedding material shall be between 0.25 feet above and 0.1 feet below the design elevations as determined from the subgrade survey.
 3. The in-place thickness of riprap material shall be between 90 percent and 125 percent of the thickness specified.
 4. Local irregularities not exceeding the thickness limits above will be permitted provided that such irregularities do not form noticeable mounds, ridges, swales or depressions that in the opinion of the ENGINEER could cause concentrations of surface runoff or form ponds or gullies.
 5. The material placed meets the gradation requirements specified.

Riprap layer thickness will be directly measured on a specified grid to determine that minimum thickness requirements are met using rebar grade stakes pre-painted with the appropriate layer thickness.

- B. Materials segregated or not placed according to the above requirements shall be regraded or adjusted, or removed and replaced using appropriate equipment, to conform with the tolerances and limits given above.
- C. Materials not meeting the requirements of this Section shall be removed and replaced with specified materials. Rejected materials shall be disposed of at designated disposal sites. Materials not meeting the grading requirements shall be reprocessed or discarded. The ENGINEER may require modification of the processing and grading operations to ensure that the specified grading requirements are met.
- D. During placement of riprap material and bedding material, the ENGINEER will perform a minimum of four gradation tests in accordance with Article 3.2.4 above. An initial sample shall be obtained and tested during the early stages of placement activities. Additional samples shall be obtained and tested when approximately one-third and two-thirds of the total volume of material has been placed, and a final sample shall be obtained and tested near completion of placement activities.

3.4 Materials Testing

3.4.1 Erosion Protection Materials Testing

- A. The bedding material and riprap shall be tested by a commercial testing laboratory during production in accordance with the following:

Specific Gravity (SSD) ASTM C-127

Absorption ASTM C-127

Soundness (5 cycles) ASTM C-88

Abrasion (100 revolutions) ASTM C-131

The results shall be submitted for analysis and subsequent acceptance or rejection of the material represented by the test results, based on engineering calculations.

- B. Each type of riprap and bedding material shall be tested for gradation in accordance with ASTM C-117 and ASTM C-136, as applicable. Test results shall be in accordance with the Design Specifications.
- C. Bedding and riprap material shall be tested a minimum of four times. The materials shall be tested initially prior to the delivery of any materials to the site and at the beginning of placement. Thereafter, the test frequency shall be three total tests for all materials when approximately one-third and two-thirds of the total volume of material has been produced or placed. A final set of durability tests shall be performed near completion of production of the materials. A final gradation test shall be performed near completion of placement for each type of material. When representative bedding and riprap materials are considered under-sized for tests, sufficiently large parent material shall be obtained for testing, or these tests will not be utilized in the scoring process.
- D. At least one petrographic examination shall be made for each rock type used for erosion protection materials. Testing shall be performed in accordance with ASTM C- 295-90. 3.4.2 Inspections.
- E. Daily visual inspections shall be performed to verify that quality-related activities are performed in accordance with requirements. Daily visual inspections performed by qualified and certified inspection personnel shall be accomplished during execution of the various work activities to verify compliance to the above-listed criteria.

3.4.3 Erosion Protection

The excavation, production, stockpiling, transportation, placement, and compaction of the erosion protection materials shall receive adequate inspection to verify the following:

- 1) proper techniques are employed to prevent degradation of the material due to improper handling;
- 2) distribution is uniform;
- 3) voids are kept as minimal as possible; and
- 4) proper gradation and lift thickness are maintained.

Inspections will be performed at the material source, as required, to verify compliance with the specification requirements. Riprap material shall be visually inspected to verify that the material is dense, sound rock, resistant to abrasion, and free from cemented cracks, seams, and other defects, as shown in the petrographic examination.

For placement control purposes, a 25' x 25' or larger, test area shall be constructed for each type of riprap using material meeting gradation and thickness requirements, as specified. This section will be used to show what material meeting specifications looks like after placement, and to calibrate "eyes" of inspectors and other interested persons. If properly constructed on the embankment, the test section can become part of the completed erosion protection.

END OF SECTION