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DEC 20 1996

Mr. Joseph J. Holonich
U. S. Nuclear Regulatory Commission
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
Mail Stop T7J-9
Washington, D.C. 20555

SUBJECT: Lakeview Site Erosion Protection Monitoring

Dear Mr. Holonich:

The annual site inspection of the Lakeview, Oregon, Title I Site was conducted on June 3 and 4, 1996. During this inspection, particular attention was given to the erosion protection material in place at the site.

Mr. Ted Johnson of the NRC has expressed concern over the durability of riprap at the Lakeview Site. The condition of the riprap was evaluated, and observations are discussed in the enclosed report. The enclosed report also describes the methods the DOE proposes to use, within the coming year, to establish current or baseline conditions upon which to base future observations of rock quality. Once these baseline conditions are known, the DOE will develop procedures for on-going observations to record changes in rock quality. These procedures will also attempt to identify action levels based on rock mean diameter. Once these procedures are identified, NRC will be advised; if necessary, page changes to the Long-Term Surveillance Plan will be submitted. An outline for a draft rock quality monitoring procedure is included for your information.

Additionally, as agreed to during the August 7, 1996 DOE/NRC conference call on the subject of Lakeview rock quality, DOE understands that this response is no longer considered to be under the 60-day response time constraint required under Criterion 12 of Appendix A to 10 CFR 40 when unusual damage or disruption is evident at a site.

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If the NRC has comments or suggestions for the DOE's plans to establish baseline conditions and then to implement procedures for subsequent measurements of changes in erosion protection materials, please le' us know. You may contact Mark Plessinger at (970) 248-6571, or call me at (970) 248-6006.

Sincerely,

Joseph E. Virgona

Joseph E. Virgona
Project Manager

Enclosure

cc w/enclosure:
S. Hamp, DOE-AL/ERD-UMTRA
C. Jacobson, MACTEC-ERS
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Observations and Recommendations for Developing an Erosion Protection Monitoring Program for the Lakeview, Oregon, Title I Disposal Site

Introduction

The annual site inspection of the Lakeview, Oregon, Title I Site was conducted on June 3 and 4, 1996. During this inspection, particular attention was given to the erosion protection material placed on the side slopes, top slope, and in the drainage channel. Observations are noted and discussed below, followed by recommendations for developing a statistically valid and technically defensible riprap quality monitoring technique. Please note that the recommended field data-gathering included in this report is intended to provide the statistical information necessary to develop a technically defensible monitoring approach. The field work described in this recommendation should not be confused with what would ultimately become part of a site riprap monitoring procedure that would be defined in the Lakeview Long-Term Surveillance Plan.

Observations

The top slope is protected by a soil-rock mulch that was reseeded with a grass mixture following construction. No sign of significant rill or gully formation on the top slope was observed, even though establishment of vegetation has not been completely successful. During the inspection, two shallow trenches were excavated in the top slope to assess the condition of the rock in the soil-rock mulch. Stones were small, 1 to 1½ inches in diameter, and all appeared to be in good condition.

The side slopes are protected from wind and water erosion with 3- to 5-inch diameter Type B riprap. The majority of the riprap consists of a fine-grained olivine basalt. Some secondary alteration was observed in individual rocks. A majority of the fractures were filled, not open. Very thin fractures were observed in some samples. Samples were brittle and could normally be broken while holding the sample by hand, with two blows from a standard geologist's hammer. The breaks usually occurred along fractures. Examples of disintegrating (crumbling) riprap were also observed.

The drainage channel is protected by rock riprap of three general sizes. Within the upper reach, small, Type B riprap is used; in the mid-section Type C riprap (12- to 18-inch mean diameter) is used; and at the lower end of the channel, in an energy dissipation area (EDA), large Type D (30- to 36-inch mean diameter) riprap was placed.

Along upper reaches of the drainage channel, crumbling Type B riprap was observed, occurring at approximately the same frequency as on the side slope. The moderate sized riprap in the mid-section was in good condition, with no crumbling observed.

Sporadic crumbling was observed in the rock riprap used in the EDA. Grasses are typically present in areas where crumbling has occurred.

Discussion

Results of rock durability tests, provided in the Lakeview Completion Report, indicate that rock from the Pepperling (MK-F 1991b) and Shear (MK-F 1991c) quarries possessed "good" durability as originally tested, and oversizing was not required. The initial durability testing program did not include freeze-thaw tests. However, during construction of the disposal cell's side slopes, crumbling riprap was noted during stockpiling operations at the quarry site by geologists from Morrison-Knudson Environmental Services (UMTRA 1995). The stockpile was sampled at several representative locations and the quality of individual rock was judged as "good" or "bad." Approximately five percent of the rocks were judged to be bad. This is consistent with results from the original petrographic analysis on samples obtained from the quarry. Use of this small percentage of bad rock was justified, considering the fact that the rock had passed the NRC durability criteria for use in frequently saturated areas. Because of the small percentage of bad rock, the thickness of the riprap layer was increased to 12 inches, twice the thickness required by erosion calculations.

Subsequent durability tests by Terracon in 1996 included freeze-thaw tests. Forty percent of the required number of freeze-thaw cycles (Terracon 1996) specified in DOE's Technical Approach Document (DOE 1989) were performed. Results of the abbreviated testing were reviewed and reported by Thornton and Abt (1996), NRC's consultant at Colorado State University. This report predicts that all the rock will disintegrate within 300 years. Results reported by Thornton and Abt support independent research done at Oregon State University, indicating that original durability testing did not predict the accelerated weathering of rock that is now occurring. However, the projections of Thornton and Abt are based on an extremely small data set, and the long-term durability of the riprap may not be as dismal as they predict. The calculations also are based on a limited number of freeze-thaw tests and may not accurately predict the long-term durability of the rock.

Research supporting a Master's Thesis was performed by Mr. Tom Syzmoniak, Jacobs Engineering Group, on durability of olivine basalt riprap similar to the riprap used at the Lakeview disposal site. Results of his work indicated that although olivine basalt possesses good to excellent durability when first quarried, the olivine mineral quickly weathers into serpentine, a clay-like mineral, and the rock begins to crumble. Common durability tests designed to simulate chemical weathering, such as sodium and magnesium soundness tests, do not alter the olivine, and the rock appears durable. Other test procedures, e.g., dimethyl sulfoxide accelerated weathering testing, are proposed by Mr. Syzmoniak to determine if sufficient clay minerals have been produced from secondary alteration of the olivine mineral to cause decomposition.

Recommend Approach

This report outlines procedures that can be used to quantify the baseline size distribution and condition of riprap on the side slopes. Once the existing conditions are

quantified, the data can be used to develop a statistically representative monitoring program.

It is proposed that the riprap condition on the top slope be inferred from the condition of the riprap on the side slope. The side slope riprap condition should be a conservative indicator of top slope riprap condition because the side slope riprap is directly exposed to the elements, while the top slope riprap is protected by the soil matrix.

Physical disintegration of the riprap is considered to have occurred if the mean diameter, determined through particle-size analyses, is less than the mean diameter required by the design.

Design Requirements and Monitoring Procedures

Particle-size distributions of riprap from the side slope are required to determine adequate sample sizes for subsequent monitoring. Percent confidence levels desired and an acceptable error in the estimate can then be selected.

Side Slopes

Design Specifications:

A flow velocity of 3.35 fps and a unit discharge of 0.53 cfs/ft result from the PMP of 8.4 inches per hour. Riprap sizing is performed using the Stephenson Method, which results in a nominal mean diameter ranging between 2.7 to 3.9 inches (MK-F 1991a).

Monitoring Procedures:

Investigate the thickness of the riprap as placed on the side slopes during the next inspection to confirm that twice the required thickness was placed.

Collect data from10 randomly located 1-yd^2 quadrants on the side slope. Data will consist of the percentage passing a 3-inch screen from a 150-pound sample. The 3-inch screen size represents the design mean diameter of Type B riprap. The calculated mean diameter required to resist the design PMP event is 2.7 inches (MK-F 1991a). From the data collected, the mean and variance of percent passing from the 10 sampling locations can be determined. With this information, the number of randomly-located quadrants for subsequent monitoring for a statistically significant confidence limit can be computed, and a technically based riprap quality monitoring program can be developed.

In addition to collecting data for the side slope, the EDA near the bottom of the diversion channel will be examined with the intent of locating any submerged or partially submerged rocks that would be readily observable during subsequent inspections. If such conditions are located and observed, the positions will be marked and the

submerged rocks would be visually inspected each year for degradation that may be caused by freeze-thaw cycles.

Conclusion

Chemical weathering of olivine basalt used for stone riprap erosion protection on the UMTRA Lakeview disposal site is occurring. Although the stone initially passed all durability tests, exposure to the elements causes olivine to weather to serpentine and disintegration ensues (Mitchell 1976; Syzmoniak 1986).

Not all rocks are exhibiting disintegration, so the integrity of the disposal cell is not currently threatened. It is believed that the monitoring program, outlined herein, will provide sufficient advance notice of a failure to allow time to remedy the problem.

The final monitoring plan that is developed will account for the overthickened riprap layer according to the procedure discussed with Mr. Ted Johnson on November 14, 1996. When the riprap mean diameter is determined to be less than the design mean diameter, an appropriate plan will be identified and executed.

Draft Outline for Rock Quality Monitoring Procedure

1. Monitor a statistically representative number of quadrants on the side slope for rock size distribution (the number and size of the quadrants to be monitored are determined by the process outlined in the preceding document).

   The monitoring process proposed here will be as discussed with Mr. Ted Johnson on November 14, 1996, taking into account the overthickened riprap layer.

2. Check one quadrant on the top slope.

3. Visually inspect selected large riprap in the EDA for observable degradation. The selected riprap will be subject to submersion under accumulated water and therefore subject to frequent freeze-thaw cycles.

4. Perform steps 1 and 2 biannually, adjusting the monitoring frequency as appropriate, depending on the results of the observations.

5. Perform step 3 annually.

References

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