DRAFT STAFF TECHNICAL POSITION
ON
TESTING AND INSPECTION PLANS
DURING
CONSTRUCTION OF DOE'S REMEDIAL ACTION
AT
INACTIVE URANIUM MILL TAILING SITES

WM-8XXX
LOW-LEVEL WASTE AND URANIUM RECOVERY PROJECTS BRANCH
U.S. NUCLEAR REGULATORY COMMISSION
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1. INTRODUCTION

Title I of the Uranium Mill Tailings Radiation Control Act of 1978, as amended (UMTRCA) requires Nuclear Regulatory Commission (NRC) concurrence in DOE's selection and performance of remedial actions at inactive uranium mill tailings sites. The NRC provides reviews, concurrences, and licensing actions during the remedial process. Among the specific technical aspects of the remedial action performance is field control, including testing and inspection.

This staff technical position describes the engineering practices, testing, inspection, record keeping, nonconformance corrective action and "stop work order" controls considered satisfactory for the implementation of remedial action programs. These criteria reflect the approaches and state-of-the-art methods that are considered to be adequate to protect public health and safety, and as such acceptable to the NRC staff. If alternate methods are proposed, they will be considered on a case-by-case basis.

2. DISCUSSION

DOE is responsible for planning and conducting remedial actions for stabilization of inactive uranium mill tailings in accordance with EPA standards. The options presently being considered and implemented by the DOE for stabilization of the inactive tailings consist of (i) stabilization of tailings in place, (ii) stabilization on site, and (iii) relocation and stabilization of tailings at another location. The detailed design and construction procedure for each remedial action depends upon the site-specific plan selected by the DOE.

The objective of NRC's review and concurrence with DOE's remedial action plans is the verification of compliance with the requirements of the EPA standards issued pursuant to the UMTRCA. To meet this objective, the DOE's remedial action plan and construction must assure adequacy of (i) geotechnical stability, (ii) erosion protection, (iii) radon attenuation, and (iv) protection against existing and future groundwater contamination. Acceptance testing and adequate inspection during construction are essential to assure

compliance with specification requirements and to provide confidence that the intended design criteria are implemented during construction.

In its review of the Remedial Action Inspection Plans (RAIP's), the NRC staff must assure that acceptable criteria are used for the inspection and testing performed during construction of each remedial action. To facilitate this action, the staff has developed this position paper. It identifies remedial action inspection plan features related to geotechnical engineering that may be necessary to control, verify, and document the DOE's remedial action activities. It does not cover the general quality assurance requirements for an acceptable inspection and testing plan.

Since conditions are likely to vary from site to site and the various RAP's may differ in scope and extent, only relevant portions of the staff position on testing and inspection requirements need be applied at a given site.

3. STAFF POSITION

The establishment of the adequacy of construction is usually accomplished by visual examination, measurements, and testing. The extent of inspection and testing should be sufficient to provide adequate quality control, to satisfy requirements of plans and specifications, and to furnish the necessary permanent record. Also, it is essential that the personnel performing the inspection and testing have the required training and experience to perform a professional job.

It is impracticable to test completely all the work performed. An acceptable procedure would be to select samples of the work or materials for testing which are representative of some unit of work or material. Conditions which produce test results below the requirements should be remedied. For each failing test, representative sampling and testing should be accomplished before the material is accepted. If there is an appreciable number of borderline test results, immediate steps should be taken to ascertain the cause and to correct it.

Section 3.1 describes the NRC staff position on an acceptable testing and inspection plan for various geotechnical aspects of the design. Acceptable procedures and frequency of testing and inspection to implement this plan are given in Section 3.2 of the staff position.

3.1 Testing and Inspection Plan

3.1.1 Foundation and Subgrade

Prior to placing the first layer of material on the foundation, a final inspection of the subgrade should be made to assure that it has been proof rolled and has no sign of deterioration due to frost action, erosion due to rainwater, rutting, areas of subsidence, or drying out of the surface. The inspection should verify that the foundation surface has been moistened, but there is no standing water on the surface. In addition, the inspection should also verify that the foundation surface of cohesive soils has been scarified or penetrated by tamping rollers to insure proper bonding of material. Any unacceptable surface material should be either removed or excavated and recompacted to design specifications.

3.1.2 Capillary Break (non-cohesive)

Capillary break materials should be inspected and tested to verify that the gradation requirements of the materials have been met. Testing of in-place capillary break materials should be accomplished to assure that the in-place density of the materials is in conformance with the specified maximum relative density.

3.1.3 Geotextile Separators

In some Remedial Action Plans, a geotextile separator may be specified for placement between two different construction materials. This separator should be inspected to verify that the specified fabric is being used and that the fabric has no tears and has sufficient overlap of material between adjoining pieces when emplaced.

3.1.4 Seepage Barrier/Liner (Cohesive)

Inspection and testing of seepage barrier/liner materials should include verification that gradation, classification, plasticity index, soil moisture, and density conform with the specifications.

3.1.5 Tailings/Contaminated Material

Inspection and testing of tailings/contaminated material should be accomplished to assure that the quantity and maximum size of foreign material placed in the encapsulation cell is in conformance with the applicable specifications. Compaction of tailings around the relatively large sized foreign material should meet the specified requirements. Inspection should also verify that organic materials are uniformly distributed throughout the emplaced tailings. Compaction testing should be accomplished to assure that the in-place density and moisture content of the emplaced tailings are in compliance with applicable specifications.

3.1.6 Radon Barrier/Soil Covers

Materials for the radon barrier/soil cover should be inspected and tested to ensure verification of gradation, plasticity index, classification, optimum moisture, and maximum density to conform with the specifications. Testing of in-place density should also be accomplished to ensure compliance with appropriate compaction specifications.

3.1.7 Filter Bed

Inspection of filter bed materials emplacement should be accomplished to assure that they are being properly placed. Testing of emplaced materials should be accomplished to assure that the gradation is in conformance with applicable specifications. Care should be taken to assure that the gradation of filter materials are not altered by segregation at the time of emplacement or by physical breakdown of grains by compaction equipment.

3.1.8 Riprap

The placement of the riprap materials should receive continuous inspection to assure that proper placement techniques are employed to prevent degradation of the material due to improper handling, to assure that the distribution is uniform and that voids are kept as small as possible, and to assure proper gradation. The inspection should also verify that the size and classification of riprap rock, the lift thickness, and elevations comply with applicable specifications and drawings. Inspection of riprap quality may be provided at the material source if required to assure compliance to the specification requirements. The testing should include durability tests including tests such as specific gravity, soundness, abrasion, and absorption. Inspection of riprap at placement should include visual inspection of size and shape of riprap materials to ensure that riprap is nonsegregated (free of pockets of small stones or of clusters of large stones), that the grade tolerance is met and that the riprap is not emplaced in layers.

3.1.9 Top Soil

If top soil is used over the riprap, the inspection should assure that the loose thickness of the top soil conforms with the specifications. The inspection and testing should also verify that the lower layers of top soil are adequately compacted. The inspection should further verify that the upper layers of the top soil are seeded as per specifications.

3.2 Testing and Inspection Procedure

3.2.1 Materials Certification

Materials which are supplied for installation or which require certification should be verified by the RAC's project quality department as having met the specified requirements. Appropriate tests should be run whenever there is a visible change in engineering characteristics of the material. The inspector should sign or initial the transmittal indicating acceptance or describing the reason(s) for non-acceptance.

3.2.2 Instrument Certification

Instrumentation which is received should be inspected by the person responsible for using and maintaining the instrument. The instrument should be inspected for damage, for correct operation, and for proper calibration records. Equipment which does not meet the applicable requirements should not be used.

The calibration records should be included in the RAC's instruments calibration system. The system should identify the required frequency of calibration checks and methods of calibration for various instruments.

3.2.3 Compaction Evaluation Procedure

Inspections and testing should assure that specified materials are emplaced and compacted as designated on drawings. The loose thickness of the lifts of material and elevations should be verified frequently to ensure compliance to the specification requirements for the particular type of material emplaced. Inspection should also verify that the compaction equipment (or equivalent), as per specifications, is being used for compacting the material and the number of roller passes meets the specification requirements.

In-place field density tests and sufficient laboratory moisture-density tests should be performed to further evaluate compaction. However, the testing procedure should not jeopardize the integrity of the emplaced materials. The field density and moisture testing should be in accordance with ASTM D-698, ASTM D-1557, ASTM D-2049, ASTM D-1556 or ASTM D-2922, as applicable. The moisture content may also be determined by AASHTO T217 procedure, using the speedy moisture meter. However, when the speedy moisture tests are used, a correlation with oven drying method should be developed for each tenth test. If it is necessary to calibrate the moisture meter after every tenth test, then more frequent correlations should be obtained.

The field test frequency should be a minimum of one test per 1,000 cubic yards of contaminated material placed and one test per 500 cubic yards of other compacted materials including seepage barrier and/or radon barrier earth cover. There should be a minimum of two tests taken for each day that an appreciable amount of fill is placed (in excess of 150 cubic yards). There should be a

minimum of one test per lift and at least one test for every full shift of compaction operations.

Prior to the start of field compaction operations, appropriate laboratory compaction curves should be obtained for the range of emplaced materials. During construction, one point Proctor tests at a frequency of one test for every [illegible] field density tests on cohesive materials should be performed. Similar checks should be provided for varifying relative densities of non-cohesive materials. Supplementary laboratory compaction curves (based on complete Proctor tests) should be obtained, approximately one for every 10 or 15 field tests, depending on the variability of materials.

The field determination of moisture and density should be compared with the appropriate compaction curve to evaluate conformance with requirements. The Remedial Action Inspection Plan should include a criterion for evaluating the inspected field density and moisture data based on a continuous review of data.

3.2.4 Gradation and Classification Testing

The placement of materials should receive continuous visual inspection and frequent verification testing to assure that specification requirements with respect to gradation and classification are maintained. The inspection should assure that the maximum particle size in the emplaced material meets the specified requirements. At least one gradation and classification test should be run for each day of significant material placement (in excess of 150 cubic yards). The radon barrier and liner material should be tested more frequently to assure that these materials meet the specified requirements. Random samples obtained from material being placed should be used for these tests. Inspection may also be provided at the material source to assure compliance with the specification requirements. Documentation of the test results should be on appropriate laboratory test report sheets and results of visual inspection should be documented in the daily inspection report.

3.2.5 Atterberg Limits Tests

Inspections should assure that the proper material is placed as designated on the drawings. Verification testing should include determination of plasticity index, which determines the range of water content over which a cohesive soil behaves plastically. The tests should be run at least once for each day of significant material placement (in excess of 150 cubic yards). The samples should be randomly selected. The test results should be documented in the laboratory test reports.

3.2.6 Rock Durability Tests

For each gradation of riprap, rock durability tests such as specific gravity, absorption, sodium or magnesium sulfate soundness, and abrasion testing should be performed prior to delivery of any material to the site. The testing program may vary from site to site and is dependent on the type of rock selected and the expected environmental stresses that it will be subject to. During construction activities, additional test series should be performed for each type of riprap when approximately one-third and two-thirds of the total volume of each type of riprap have been delivered. For any type of riprap where the volume is greater than 30,000 cubic yards, a test series should be performed for each additional 10,000 cubic yards of riprap delivered. A final sample should be obtained for each riprap type following completion of delivery of the material.

3.2.7 Distribution of Organics

Continuous visual observation should be used to assure that placement of organics in the encapsulation cell is uniform and evenly distributed. Also, the inspection should assure that the maximum size of the emplaced organic material does not exceed the specified requirements. Results of visual inspection should be documented on the daily inspection report.

3.3 Non Conformances, Corrective Action and Stop Work Orders

In the Remedial Action Inspection Plan, the DOE should establish procedures to define, identify, and document non-conformances or deviations from plans, specification, or precedures. A mechanism to develop, control, approve and implement the necessary corrective action should also be established. Follow-up procedures to assure that proposed corrective actions have been implemented should be documented.

The RAC's plans should also address provisions for a "Stop Work Order". The situations when a "Stop Work Order" may become necessary should be described. Procedures and level of authority for issuing a "Stop Work Order" should be established and a mechanism for resolving the corresponding nonconformance(s) should be discussed.

3.4 Records

Daily inspection reports should be written that address the adequacy, progress, and details of construction activities, and decisions. The reports should include the results of visual inspection, measurements, and tests performed in the laboratory and in the field. The inspection and test status should be identified by charts, as-builts, or by periodic status reports. The inspector should summarize volume of emplaced materials and the number of field and

laboratory tests performed on each material on a weekly basis. The status should be available at all times and precautions should be taken to prevent inadvertently by-passing an inspection point. The inspection and test reports should become part of the permanent record of the implementation of the remedial action plan.

The records should include date, name of tester or inspector, items inspected or tested, type of inspection or test, identification of test method, results, acceptability and acceptance criteria, and name and initials of the reviewer. The records should also identify the testing equipment or instrument used in performing the test. For deviations, nonconformances, and stop work order situations, the report should provide sufficient details so that acceptability of the procedures and outcome can be independently reviewed.