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JUN 7 - 1985

WM-39/DCG/85/6/4/0

MEMORANDUM FOR: Leo B. Higginbotham, Chief
Low-Level Waste and Uranium
Recovery Projects Branch
Division of Waste Management

FROM: John T. Greeves, Chief
Engineering Branch
Division of Waste Management

SUBJECT: DRAFT STAFF POSITION ON TESTING AND INSPECTION DURING CONSTRUCTION OF DOE's REMEDIAL ACTION AT URANIUM MILL TAILINGS SITES

As per your Technical Assistance Request (TAR-85033) dated May 13, 1985, my staff has prepared the enclosed draft technical position on testing and inspection requirements during construction of DOE's remedial action at uranium mill tailings sites. This draft 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. The position paper incorporates a minimum level of testing and inspection deemed necessary for an adequate construction control program.

The enclosed draft technical position is based on our previous review experience of Riverton and Shiprock remedial action plans, procedures outlined in NUREG/CR-3356, "Geotechnical Quality Control: Low-level Radioactive Waste and Uranium Mill Tailings Disposal Facilities", Navy Design Manuals NAVFAC DM 7.1 and NAVFAC DM 7.2, U. S. Department of Interior-Bureau of Reclamation-Earth Manual, and other sound engineering practices. If alternate methods are proposed by the DOE, we recommend that they be considered on a case-by-case basis.

Please note that the staff position described in the enclosed draft position paper discusses only geotechnical aspects of the testing and inspection requirements. It does not cover the quality assurance requirements for an acceptable inspection and testing plan.

We request that you provide us your comments on the enclosed draft position paper by COB June 21, 1985. After receiving your comments, we can proceed to finalize it.

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The position paper has been prepared by Dr. Dinesh Gupta. He can be reached at x74742 (Room 274-SS).

Original signed by

John T. Greeves, Chief
Engineering Branch
Division of Waste Management

Enclosure:
As stated

cc: D. Gillen
T. Johnson

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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
JUNE, 1985

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STAFF TECHNICAL POSITION
WM-8XXX
TESTING AND INSPECTION PLANS DURING
CONSTRUCTION OF DOE'S REMEDIAL ACTION AT
INACTIVE URANIUM MILL TAILING SITES

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 scheme 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 DOE's RAP, 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 NRC 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 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, at least three subsequent consecutive passing tests should be available, before the unit of work or 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. Additional tests should be run whenever there is a visible change in engineering characteristics of the material.

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 has been scarified or penetrated by tamping rollers to insure proper bonding of material.

3.1.2 Capillary Break (non-cohesive)

Capillary break materials should be inspected and tested for verifying the borrow materials, gradation requirements, and for assuring the relative compaction according to specified maximum relative density.

The DOE's project quality department should certify that the materials supplied for placement of capillary break meet the specified requirements. The inspector should document his acceptance of the material or describe the reason(s) for non-acceptance.

3.1.3 Geotextile Seperators

In some Remedial Action Plans, a geotextile seperator may be specified for placement between two different construction materials. This seperator 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.

3.1.4 Seepage Barrier/Liner (Cohesive)

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

3.1.5 Tailings/Contaminated Material

Inspection and testing during placement of tailings/contaminated material should include verification of maximum size of foreign material placed in the encapsulation cell. Compaction of tailings around the relatively large sized

foreign material should meet the specified requirements. Inspection should also verify that organics are uniformly distributed throughout the emplaced tailings. The testing should include verification of density and moisture content of the emplaced tailings to conform with the specifications.

3.1.6 Radon Barrier/Soil Covers

During the placement of the radon barrier/soil cover, inspection and testing should include verification of borrow material, gradation, plasticity index, classification, soil moisture, and density of the emplaced material to conform with the specifications.

3.1.7 Filter Bed

The filter bed materials should be inspected to assure that they are being properly placed. The inspection and testing should verify the gradation to conform with the specifications.

3.1.8 Riprap

The placement of the riprap materials should receive continuous inspection to assure that proper placing techniques are employed to prevent degradation of the material due to improper handling and 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 the size and classification of riprap rock, the lift thickness, and elevations. Inspection may be provided at the material source if required to assure compliance to the specification requirements. The testing should include durability tests including testing for specific gravity, ~~absorption,~~ soundness, abrasion, and absorption.

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 conform 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 permanent installation or which require certification should be verified by the DOE's project quality department as

having met the specified requirements. The inspector should sign or initial the transmittal in the appropriate space indicating acceptance or describing the reason(s) for non-acceptance.

3.2.2 Instruments 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 into the DOE'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 the proper material is placed for compaction, 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. 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.

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. 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. The foundation subgrade or the original ground should be tested for density and moisture content at a frequency of one test for each 1,000 square yards of subgrade. An additional test should be taken whenever there is a definite suspicion of the quality of moisture control or effectiveness of compaction.

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 five 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 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. The following example may be used for guidance:

For moisture control, if approximately two-thirds of all field values fall in the range of $\pm$ 1 percent of the specified moisture content, close moisture control would be evidenced. Similarily, if approximately two thirds of all field densities fall in the range of $\pm$ 3 percent about the percent maximum density required, suitable compaction would be evident. However, if two thirds of all moisture content values fall in the range of $\pm$ 3 percent about the specified moisture content or if two thirds of all the field densities fall in range of 5 percent below the specified maximum density, insufficient compaction control would be evident.

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. 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, if required to assure compliance to 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 plasticly. The tests should be run at least once each day of significant material placement. The samples should be randomly selected. The test results should be documented on the laboratory test reports.

3.2.6 Rock Durability Tests

For each gradation of riprap, specific gravity, absorption, soundness, and abrasion testing should be performed prior to beginning delivery of the material to the site. During construction activities, additional test series should be performed for each type of riprap when approximately one third and two third 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 organics in the tailings and/or contaminated materials are evenly distributed. Also, the inspection should assure that the maximum size of the organic material in the encapsulation cell 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

Before implementing the construction remedial action plan, the DOE should establish procedures to define, identify, and document non-conformances or deviations from plans, specification, or procedures. 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 DOE'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.

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3.4 Records

Daily inspection reports should be made of adequacy, progress, 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 volume of material placed between each test should be recorded with the the test results. The inspection and test status should be identified by charts, as-builts or by periodic status reports. 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, 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 the acceptability of the procedures and outcome can be independently reviewed.