MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

UMTRA PROJECT
NATURITA, COLORADO

REMEDIAL ACTION
INSPECTION PLAN

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RAIP-1 Testing and Inspection REV. 1

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APPROVED: Robert E Cooney 5/23/94
REMEDIAL ACTION CONTRACTOR UMTRA PROJECT DIRECTOR

APPROVED: Steven D. Mathis 05/23/94
REMEDIAL ACTION CONTRACTOR UMTRA PROJECT QUALITY MANAGER

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RAIP-1 Testing and Inspection REV. 1 REVIEW B

STATEMENT OF POLICY

This Remedial Action Inspection Plan identifies the means by which the remedial action activities at Naturita, Colorado are controlled, verified, and documented. This plan was developed within the scope of the MK-Ferguson Quality Assurance Program Plan and it complies with the applicable portions of ASME NQA-1-1989 and DOE Order 5700.6C.

The procedures defining Organization, Qualification and Certification of Inspection and Test Personnel, Quality Assurance Records Control, Control of Measuring and Test Equipment, and Nonconformance and Corrective Action shall be in accordance with the applicable sections of the MK-F Quality Assurance Program Plan, as follows: Organization - QAPP-1; Qualification and Certification of Inspection and Test Personnel, Lead Auditors, and Auditors - QAPP-2; Nonconformance and Corrective Action - QAPP-3; Quality Assurance Records Control - QAPP-4; and Control of Measuring and Test Equipment - QAPP-5.

This Remedial Action Inspection Plan and the Quality Assurance Program Plan describe the means by which the MK-Ferguson Company will assure that the Environmental Protection Agency's requirements, and Nuclear Regulatory Commission's guidelines for Testing and Inspection Plans During Construction of DOE's Remedial Action at Inactive Uranium Mill Tailings Sites are satisfied.

It is the intent that this plan be applied to all permanent installations and work. Temporary facilities, installations, or work is to be tested and inspected, as required by the design specifications. Where testing and inspection is not stated in the design specifications for temporary work, (e.g., access roads, temporary ditches, etc.) the work is to be tested and inspected to the degree necessary to ensure it's integrity for the anticipated period of usage.

PROCEDURE TITLE:

TESTING AND INSPECTION

1.0 Purpose

To describe the methods by which the construction activities will be tested and inspected to verify compliance with the Design Specification requirements.

2.0 Scope

This procedure defines the testing and inspection of remedial action construction activities at Naturita, Colorado. Types of tests, test frequencies and acceptability, and documentation and reporting requirements are contained in this procedure. Procedures for performing individual tests are per applicable ASTM Standards or other referenced methods.

3.0 Definitions

None.

4.0 Attachments

None.

5.0 REFERENCES

5.1 ASME NQA-1 1989

5.2 Contract DE-AC04-83AL18796

5.3 ASTM Standards

5.4 AASHTO Standards

5.5 MK-F/CWMFES Health Physics Monitoring Plans and Procedures

5.6 DOE 5700.6C

5.7 DOE AL5700.6B

5.8 UMTRA Quality Assurance Plan

5.9 MK-Ferguson Quality Assurance Program Plan

5.10 Naturita, CO Design Specifications and Drawings

5.11 Nuclear Regulatory Commission (NRC) Staff Technical Position on Testing and Inspection Plans during Construction of DOE's Remedial Action at Inactive Uranium Mill Tailings Sites, dated January, 1989.

6.0 PROCEDURES

6.1 Field Density Control

6.1.1 Soil density and moisture testing shall be performed in accordance with ASTM D-698, ASTM D-1556, ASTM D-1557, ASTM D-2167, ASTM D-2216, ASTM D-4643, ASTM D-2922, or ASTM D-3017, as applicable.

6.1.2 When the microwave oven or nuclear density gauge is used in the determination of the moisture content, a correlation sample will be oven-dried a minimum of once every tenth moisture test performed. Moisture correlation test results shall be within plus or minus one percent. If the difference in results is greater than plus or minus one percent, all test results obtained since the previous correlation test shall be re-evaluated. Test results which may be indicated as failures as a result of a re-evaluation shall be retested in the area represented by the failing test result. Oven-dry moisture content test results will be used to determine the acceptability of the moisture test where moisture correlation test results are greater than plus or minus one percent.

6.1.2.1 When determining the moisture content of soil by the microwave oven method, an initial control shall be performed and evaluated, as prescribed below, prior to recording test results as record test results.

a. A minimum of ten consecutive moisture correlation tests between the conventional oven-dry and microwave oven-dry methods shall be performed for each type of testable soil.

b. A minimum of ten consecutive moisture correlation results shall each be within plus or minus one percent for each test, for each soil type.

c. Once the ten consecutive moisture correlation results are within plus or minus one percent, moisture correlations shall be performed in accordance with Section 6.1.2 above.

d. When two consecutive moisture correlation tests above exceed plus or minus one percent for a specific soil type, the procedure prescribed in Section 6.1.2.1 shall again be performed.

6.1.3 When the nuclear density gauge is used for density determinations, a correlation sand-cone density test shall be performed a minimum of once for every ten nuclear density tests performed. If there is a difference in results obtained which exceeds two percent, the sand-cone test results shall be used. All test results which were recorded using the nuclear density gauge since the last correlation shall be re-evaluated. Re-testing shall be performed when re-evaluations of correlation results yield failure. The nuclear density gauge shall be used in materials with a nominal maximum particle size of 3/4 inches or less. The nuclear density gauge shall not be used in radioactively contaminated materials, or in areas where the gauge may be affected by background radiation or the chemical composition of the soil (e.g., the first lift of radon barrier material).

6.1.4 When density requirements are specified by the Design Specifications, in-place field density and moisture tests for compacted materials shall be tested at the following minimum frequency:

a. One test per each 500 cubic yards of radon barrier material placed.

b. One test per each 1,000 cubic yards of contaminated and frost barrier materials placed.

c. One test per each 1,000 cubic yards of general fill material for retention basin dikes and contaminated material embankment area.

d. One test per each 3,000 cubic yards of general fill materials.

e. At least two tests for each day of material placement in excess of 150 cubic yards for each material.

f. There shall be a minimum of one test for each full shift of compaction operations.

g. A test may be performed at any time the inspector or Site Manager determines the need to verify the compaction effort. There shall be a minimum of one in-place field density and moisture test per lift.

With the various design slopes associated with each cell embankment and with staggered lift placements, it is feasible to test each lift and, thereby, have certain horizontal elevations which are void of in-place field density and moisture tests. Even fill placements on relatively flat surfaces are constructed to slope in order to facilitate drainage of moisture.

h. In-place density testing shall be performed on surface material of previously placed material, after a seasonal shutdown or period of prolonged exposure, prior to placing additional materials, as specified in the Design Specifications.

6.1.5 Each layer of embankment, backfill, and subgrade shall be compacted to the minimum percentage of maximum dry density as determined by ASTM D-698 or by the number of roller passes, in accordance with the percentages and equipment prescribed by the Design Specifications.

6.1.5.1 During compaction, the moisture content of fill material shall be maintained to achieve the minimum specified density, and moisture shall be uniformly distributed throughout each lift.

6.1.5.2 Radon barrier materials shall be moisture conditioned a minimum of two hours prior to compaction.

During compaction of the radon barrier material layer, the moisture content shall be maintained at optimum moisture to plus three percent of optimum moisture, as determined by ASTM D-698. Once minimum specified density is achieved, additional compaction shall not be performed.

The moisture content of the preceding in-place radon barrier lift, with the exception of the top two inches, shall be maintained at not less than the optimum moisture content minus one percent. The specified moisture content shall be verified from samples taken two to four inches beneath the top surface of the compacted radon barrier lift.

The top surface of the underlying compacted radon barrier shall be indented or scarified to a depth of one to two inches just prior to placement of the overlying loose lift.

6.1.5.3 Moisture shall not be added to contaminated materials in the contaminated materials embankment area, except when it is determined to be absolutely necessary for environmental dust control.

6.1.6 Maximum density determinations shall be performed prior to the start of embankment or backfill placement when possible. The inspector or technician shall be alert for changes in material such as color, size distribution, etc. When different material types are encountered, a complete maximum density determination test shall be performed. Supplementary maximum density determination tests shall be performed at an approximate frequency of one test for every 10 of 15 in-place field density tests performed, depending on the variability of materials.

6.1.7 In order to verify that the correct maximum dry density is being used to determine the relative compaction, a one-point proctor test shall be performed. The material shall be as close to optimum moisture as possible and shall be compacted in accordance with the requirements of ASTM D-698. There shall be a minimum of one, one-point check for each five in-place field density tests performed for each type of material.

6.1.8 When the level of work activity is such that sand-cone density tests are being performed throughout the day, the sand used for determining the volume of the test hole shall be calibrated twice a day and for each new bag of sand. The calibration data shall be documented on the density test record. In addition, sand-cone density sand shall be tested for Coefficient of Uniformity, for each new shipment of density sand received in accordance with the ASTM D-1556.

6.1.9 Bedding materials overlying the radon barrier shall be track-walked as delineated in the Site Subcontract Documents.

6.1.10 Required equipment that is specified in the Subcontract Documents for compaction shall be verified and documented.

6.2 Gradation Testing of Fill Materials

6.2.1 Gradation testing for radon barrier material shall be performed at a minimum frequency of one test for each 1,000 cubic yards and a minimum of one (1) gradation test for each day of material placement.

6.2.2 Gradation testing for radon barrier shall be in accordance with ASTM D-422. Gradation test results shall be in accordance with the Subcontract Documents. For distribution of particle sizes smaller than the No. 200 sieve, the use of a hydrometer is not required.

6.3 Erosion Protection Materials Testing

6.3.1 The bedding material and each type of riprap shall be tested by a commercial testing laboratory during production in accordance with the following:

Riprap and Bedding Material

Specific Gravity (SSD)	ASTM C-127
Absorption	ASTM C-127
Soundness (5 cycles)	ASTM C-88
Abrasion (100 revolutions)	ASTM C-131
Schmidt Rebound Hardness	ISRM Method
Splitting Tensile Strength (Modified-loading rate shall cause failure in 1 to 3 minutes)	ISRM Method

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

6.3.2 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.

6.3.3 Bedding material and each type of riprap material shall be tested, as delineated in Sections 6.3.1 and 6.3.2 above, a minimum of four times. For bedding material, the Schmidt Rebound and splitting Tensile Strength tests shall be performed on the source material before any processing.

The materials shall be tested as prescribed in Section 6.3.1 (larger than No. 4 sieve only) initially prior to the delivery of any materials to the site and as prescribed in Section 6.3.2 at the beginning of placement. Thereafter, the testing shall be performed at a minimum frequency of one test for each 10,000 cubic yards, or fraction thereof produced/placed (durability tests for materials produced/gradation tests for materials placed).

When the total volume is less than 30,000 cubic yards, the test frequency shall be three tests for each type material when approximately one-third and two-thirds of the total volume of material has been produced/placed. A final set of durability tests shall be performed near completion of production for each type of material. A final gradation test shall be performed near completion of placement for each type of material. When representative riprap materials are considered under sized for Schmidt Rebound and Splitting Tensile Strength tests, sufficiently large source parent material shall be obtained for testing. If source parent material is found to be insufficiently sized, the Schmidt Rebound and Splitting Tensile Strength tests shall not be used with the other four tests (as listed in paragraph 6.3.1 above) in the scoring process.

6.3.4 At least one petrographic examination shall be made per each rock source used for erosion protection materials. Testing shall be performed in accordance with ASTM C-295-90. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type material shall be determined for scoring.

6.4 Inspections

Daily visual inspections shall be performed to verify that quality related activities are performed in accordance with the requirements of the Design Specifications, Remedial Action Inspection Plan, and the Quality Assurance Program Plan. 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, and as follows:

6.4.1 Excavation

Inspections shall be performed to verify that the correct lines and grades are reached, as required. Where contaminated material is excavated, an MK-F Quality Control Inspector and Health Physics Supervisor/Designee shall verify that the contaminated material has been removed, as required.

6.4.2 Foundation and Subgrade

Prior to placing the first layer of material on the foundation, a final inspection of the subgrade shall be made to verify that it 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 shall verify that the foundation surface is moist, with no standing water on the foundation surface. In addition, the inspection shall verify appropriate scarification of foundation surfaces and rolled surfaces of any lift of fill.

Scarification of foundation surfaces and lifts thereafter shall be appropriate to ensure proper bonding. Any unacceptable surface material shall be either removed or excavated and recompacted to Design Specifications.

6.4.3 Embankment Fill and Backfill

Inspections shall verify that the proper material is placed as designated on the Design Drawings. The loose thickness of the lifts of material shall be verified frequently to verify compliance to the Design Specifications for the particular type of material. The inspections shall verify that the applicable moisture requirements are maintained and that the moisture is uniform throughout each lift.

6.4.3.1 Visual observation shall verify that placement of organics in the encapsulation cell is uniform and evenly distributed. Inspections shall verify that the percent by volume of organic material for all material does not exceed the Design Specifications. Results of visual inspections shall be documented on a Daily Inspection Report. Sampling and testing for site cell radiological characterization during construction shall be routinely monitored to ensure compliance with the prescribed requirements of Health Physics Procedure No. RAC-019. Monitoring activities performed by Quality Control shall be documented on the Surveillance Checklists.

6.4.4 Radon Barrier

Frequent inspections of the placement of the radon barrier shall be performed to verify lift thickness, elevations, moisture content and, as required, the number of roller passes. The moisture content will be determined as frequently as is required to verify the proper moisture content is maintained during the compaction effort.

Radon barrier materials shall not contain more than five (5) percent by volume of organic matter in accordance with the Walkley-Black method.

6.4.5 Erosion Protection

The excavation, production, stockpiling, transportation, placement, and compaction of the erosion protection materials shall receive adequate inspection to verify that (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 is maintained. The inspection shall also verify the lift thickness. Inspection 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, resistant to abrasion, and free from cemented cracks, space seams, and other defects, as shown in the petrographic examination. For placement control purposes, a 30' x 50' 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.

6.4.6 Surveillance

The MK-F Site Quality Control Department shall perform weekly surveillance of Health Physics (HP), Environment, Safety and Health (ESH), and Measure and Test Equipment (M&TE) used by site Quality Control. Surveillances shall verify compliance with applicable HP and ESH procedures, as specified by the MK-F Quality Assurance Program Plan.

6.4.7 Receiving

6.4.7.1 Equipment shall be inspected for damage, correct operations, and proper calibration records by the person responsible for using and maintaining it. The instrument shall be inspected for damage, correct operations, and proper calibration records.

The inclusion of calibration records in the calibration system shall be evidence of satisfactory inspection results. Equipment which does not meet the applicable requirements shall be returned to the vendor.

6.4.7.2 Materials supplied for permanent installation or which, by the Design Specifications require certifications, shall be verified by the quality department as having met the specified requirements.

6.4.8 Seasonal Shutdowns

When work is interrupted for seasonal shutdowns the exposed surfaces of contaminated and uncontaminated materials will be stabilized in a manner to prevent off-site spread of contamination to prevent erosion.

During this period, weekly surveillance shall be performed and documented routinely to verify that the integrity of the method of stabilization is maintained.

Prior to commencing work following a seasonal shutdown a radiological survey shall be performed on all areas which may have been subject to contamination as a result of the method of stabilization.

Following a seasonal shutdown or period of prolonged exposure, density and moisture tests will be taken on the last lift of materials placed and accepted. Density and moisture tests will be performed at frequencies commensurate with those specified in Sections 6.1.4 above. Materials failing to meet specified density and moisture requirements shall be removed or reworked to satisfy the minimum specified density and moisture requirements. If the last lift of radon barrier material requires reworking due to inadequate moisture content, underlying materials will be tested to determine the amount of material to be reworked.

7.0 RECORDS

7.1 Test and inspection records shall be reported the same day in which a test or inspection is performed. The inspection and test status shall be identified by charts, as-builts, or periodic status reports, and will be available at all times in order to prevent an inadvertent bypass of inspection or hold point.

7.2 Test and inspection records shall contain, at a minimum, the following:

7.2.1 Items tested or inspected.

7.2.2 Date of test or inspection.

7.2.3 Tester, inspector or data recorder.

7.2.4 Type of test or inspection.

7.2.5 Results and acceptability, including the test or inspection acceptance criteria.

7.2.6 Instrument number used in performing the test or inspection.

7.2.7 Action taken in connection with any deviations noted.

7.2.8 Person evaluating test results, if different from the person named in Section 7.2.3.

7.3 Test and inspection records shall be filed and maintained in accordance with MK-F QA/QC Work Procedure No. 7.

7.4 Daily Inspection Reports shall be generated and shall describe the adequacy, discrepancies, progress, disposition and details of each day's construction activities.

7.5 A Weekly Quality Control Report shall be generated and shall summarize the volume of emplaced materials and number of field and laboratory tests performed for each type of material. A copy of the Weekly QC Report shall be transmitted to the MK-F Project Quality Manager.

7.6 Permanent QA/QC records shall be periodically evaluated through internal and external surveillances and audits.