MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

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MAYBELL, COLORADO

REMEDIAL ACTION INSPECTION PLAN

APPROVAL

APPROVED: _____ 10-30-95
REMEDIAL ACTION CONTRACTOR UMTRA PROJECT DIRECTOR

APPROVED: _____ for SDM 10/30/95
REMEDIAL ACTION CONTRACTOR UMTRA PROJECT QUALITY MANAGER

CONCURRENCE: _____ 10/30/95
U.S. DEPARTMENT OF ENERGY

STATEMENT OF POLICY

This Remedial Action Inspection Plan identifies the means by which the remedial action activities at Maybell, Colorado are controlled, verified, and documented. This plan was developed in adherence to the scope of the MK-Ferguson Quality Assurance Program Plan and complies with the applicable parts of ASME NQA-1-1989.

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 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 ensures 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, and work are to be tested and inspected as required by the Design Specifications. Where testing and inspection are not specified 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 its 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 Maybell, Colorado. Types of tests, test frequencies and acceptability, 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 Maybell, 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

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 moisture content by dry weight for each test, for each soil type.

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

d. When two consecutive moisture correlation test results performed in accordance with Section 6.1.2 above exceed plus or minus one percent moisture content by dry weight 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 there are density requirements in 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 uncontaminated materials placed.

c. One test per each 5,000 square yards of the subgrade surface area.

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

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

f. 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 of material. In-place density tests are taken for each lift of material, although it may not appear so to the reviewer. This situation occurs when the reviewer assumes that the lifts of material were constructed on a level plane. In practice, the lifts of material are usually placed on an incline to facilitate drainage.

The locations of the in-place density tests are recorded with x, y and z coordinates (northing, easting, and elevation). The slope of the lift plane is not recorded. Therefore, when field data is reviewed by elevation, several density tests may appear to be within a one foot horizontal cross section, while several other cross sections may not show density tests.

~~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.~~

g. One test per each 30,000 square feet of previously placed and accepted materials after a seasonal shutdown or period of prolonged exposure, and prior to placing additional materials.

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 Moisture conditioning of radon barrier materials prior to, during, and following mixing with bentonite shall be at a suitable level or levels to achieve a thorough composite mixture, and shall permit uniform and effective addition of any required additional moisture. 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 minus one (-1%) percent of the optimum moisture content. 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 At the time of compaction, contaminated material moisture content shall be at optimum to six percent dry of optimum as determined by ASTM D698.~~

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 or 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 periodically

checked for conformance in accordance with the prescribed requirements of ASTM D-1556.

6.1.9 Materials overlying the radon barrier shall be track-walked or rolled to a firm condition to prevent damage to the radon barrier and facilitate compaction of overlying materials, as delineated in the Site Subcontract Documents.

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

6.2 Gradation Testing of Fill Materials

6.2.1 Gradation testing for radon barrier material shall be performed prior to adding bentonite material. Tests shall be taken at a minimum frequency of one test for each 1,000 cubic yards and a minimum of two (2) gradation tests for each day of material placement.

6.2.2 Gradation testing of engineered backfill material, when required by the Design Specifications, shall be performed a minimum of once for each 2,000 cubic yards of material placed.

6.2.3 Gradation testing shall be in accordance with ASTM D-422 and D-1140 (with agitation in dispersion cup according to Note 2 of ASTM D-422), as applicable. 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 ISRM Method
(Modified-loading rate shall cause failure in 1 to 3 minutes)

The results shall be submitted to M-K 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. The Schmidt Rebound and Splitting Tensile Strength Tests are not required for bedding material and riprap Types A and B. ~~and C.~~ The materials shall be tested as prescribed in Section 6.3.1 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 where the total quantity is greater than 30,000 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 Bedding and 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 6.3.1 above) in the scoring process.~~

6.3.4 At least one petrographic examination shall be made per each rock type 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 disposal 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. OP-003-7 ~~RAC-018~~. Monitoring activities performed by Quality Control shall be documented on CWMFES Surveillance Forms or Daily Inspection Report Forms, as applicable.

6.4.4 Radon Barrier

Frequent inspections of the placement of the radon barrier shall be performed to verify lift thickness, elevation and 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. Compaction operations shall be monitored to assure the area tested for required density is representative of the compacted area.

Radon barrier material shall be thoroughly mixed, using the equipment specified in the Subcontract Documents, with a minimum of ten percent by weight of the specified bentonite. The dry weight of radon barrier material without bentonite is to be multiplied by 0.10 to determine the minimum dry weight of bentonite to be added to the radon barrier material.

Clod size in radon barrier materials shall be one-inch or smaller immediately after mixing with bentonite.

6.4.5 Frost Protection

Compaction of the frost protection material shall be accomplished by the use of a tamping-foot roller, approved by the Contractor. The top surface of the frost protection layer shall be bladed and compacted by the use of a flat drum roller while moisture content is within the required limits. ~~still above optimum.~~

During the compaction of the frost protection layer, moisture content shall be maintained within ~~minus~~ three (3%) to plus three (3%) percent of optimum, as determined by ASTM D698.

6.4.6 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 metasedimentary rock, resistant to abrasion, and free from cemented cracks, seams, and other defects, as shown in the petrographic examination.

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 to produce an essentially solid, densely placed face of rock with all stone firmly wedged in place. Any stones which are not firmly wedged shall be adjusted and additional selected stones inserted or existing stones replaced to achieve a solid interlock.

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. If properly constructed on the tailings embankment, the section can become part of the completed erosion protection.

6.4.7 Surveillance

The MK-F Site Quality Control Department shall perform a 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. ~~Surveillances shall be conducted in accordance with the MK-F QA/QC Work Procedure No. 2.~~

6.4.8 Receiving

6.4.8.1 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.

6.4.8.2 Materials supplied for permanent installation or which, by the Design Specifications require certifications, will be verified by the quality department as having met the specified requirements. The inspector shall sign or initial the transmittal in the appropriate space, indicating acceptance or describing the reason(s) for nonacceptance.

6.4.9 Seasonal Shutdowns

When work is interrupted for seasonal shutdowns (more than six weeks), the exposed surfaces of contaminated and uncontaminated materials will be stabilized in a manner to prevent off-site spread of contamination and 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.