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June 22, 1999

Via Federal Express Overnight Mail

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Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
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Re: White Mesa Mill, Reclamation Plan, Revision 2.0 – Attachment A
SUA-1358
Docket No. 40-8681

Dear Mr. Rom:

Enclosed please find the modifications along with additional information to sections in Attachment A as discussed.

If you or any of your staff have any questions, please feel free to call.

Very truly yours,

Harold R. Roberts
Executive Vice President

HRR:pl

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Drawing in File

ATTACHMENT A

PLANS AND SPECIFICATIONS

FOR

RECLAMATION

OF

WHITE MESA FACILITIES

BLANDING, UTAH

PREPARED BY

INTERNATIONAL URANIUM (USA) CORP.

INDEPENDENCE PLAZA

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TABLE OF CONTENTS

	Page No.
1.0 GENERAL	A-1
2.0 CELL 1-I RECLAMATION	A-1
2.1 Scope	A-1
2.2 Removal of Contaminated Materials	A-1
2.2.1 Raffinate Crystals	A-1
2.2.2 Synthetic Liner	A-2
2.2.3 Contaminated Soils	A-2
2.2.4 Sedimentation Basin	A-3
3.0 MILL DECOMMISSIONING	A-5
3.1 Mill	A-5
3.2 Mill Site	A-7
3.3 Windblown Contamination	A-7
3.3.1 Guidance	A-9
3.3.2 General Methodology	A-9
3.3.3 Scoping Survey	A-10
3.3.4 Characterization and Remediation Control Surveys	A-12
3.3.5 Final Survey	A-13
3.3.6 Employee Health and Safety	A-13
3.3.7 Environment Monitoring	A-14
3.3.8 Quality Assurance	A-14
4.0 PLACEMENT METHODS	A-16
4.1 Scrap and Debris	A-16
4.2 Contaminated Soils and Raffinate Crystals	A-17
4.3 Compaction Requirements	A-17

TABLE OF CONTENTS (continued)

	Page No.
5.0 CELLS 2, AND 3	A-18
5.1 Earth Cover	A-18
5.2 Materials	A-18
5.2.1 Physical Properties	A-18
5.2.2 Borrow Sources	A-20
5.3 Cover Construction	A-20
5.3.1 General	A-20
5.3.2 Placement and Compaction	A-20
5.3.2.1 Methods	A-20
5.3.2.2 Moisture and Density Control	A-22
5.4 Monitoring Cover Settlement	A-23
5.4.1 Temporary Settlement Plates	A-23
5.4.1.1 General	A-23
5.4.1.2 Installation	A-23
5.4.1.3 Monitoring Settlement Plates	A-23
6.0 ROCK PROTECTION	A-25
6.1 General	A-25
6.2 Materials	A-26
6.3 Placement	A-27

TABLE OF CONTENTS (continued)

	Page No.
7.0 QUALITY CONTROL/QUALITY ASSURANCE.....	A-27
7.1 Quality Plan	A-27
7.2 Implementation	A-28
7.3 Quality Control Procedures	A-28
7.4 Frequency of Quality Control Tests	A-28

1.0 GENERAL

The specifications presented in this section cover the reclamation of the White Mesa Mill facilities.

2.0 CELL 1-I RECLAMATION

2.1 Scope

The reclamation of Cell 1-I consists of evaporating the cell to dryness, removing raffinate crystals, synthetic liner and any contaminated soils. A sedimentation basin will then be constructed and a drainage channel provided.

2.2 Removal of Contaminated Materials

2.2.1 Raffinate Crystals

Raffinate crystals will be removed from Cell 1-I and transported to the tailings cells. It is anticipated that the crystals will have a consistency similar to a granular material when brought to the cells, with large crystal masses being broken down for transport. Placement of the crystals will be performed as a granular fill, with care being taken to avoid nesting of large sized material. Voids around large material will be filled with finer material or the crystal mass broken down by the placing equipment. Actual placement procedures will be evaluated by the QC officer during construction as crystal materials are brought and placed in the cells.

2.2.2 Synthetic Liner

The PVC liner will be cut up, folded (when necessary), removed from Cell 1-I, and transported to the tailings cells. The liner material will be spread as flat as practical over the designated area. After placement, the liner will be covered as soon as possible with at least one foot of soil, crystals or other materials for protection against wind, as approved by the QC officer.

2.2.3 Contaminated Soils

The extent of contamination of the mill site will be determined by a scintillometer survey. If necessary, a correlation between scintillometer readings and U-nat/Radium-226 concentrations will be developed. Scintillometer readings can then be used to define cleanup areas and to monitor the cleanup. Soil sampling will be conducted to confirm that the cleanup results in a concentration of Radium-226 averaged over any area of 100 square meters that does not exceed the background level by more than:

- 5 pCi/g averaged over the first 15 cm of soils below the surface, and
- 15 pCi/g averaged over a 15 cm thick layer of soils more than 15 cm below the surface

Where surveys indicate the above criteria have not been achieved, the soil will be removed to meet the criteria. Soil removed from Cell 1-I will be excavated and transported to the tailings cells. Placement and compaction will be in accordance with Section 4.0 of these Plans and Specifications.

2.2.4 Sedimentation Basin

Cell 1-I will then be breached and constructed as a sedimentation basin. All runoff from the mill area and immediately north of the cell will be routed into the sedimentation basin and will discharge onto the natural ground via the channel located at the southwest corner of the basin. The channel is designed to accommodate the PMF flood.

A sedimentation basin will be constructed in Cell 1-I as shown in Figure A2.2.4-1. Grading will be performed to promote drainage and proper functioning of the basin. The drainage channel out of the sedimentation basin will be constructed to the lines and grades as shown.

INSERT FIGURE A-2.2.4-1
SEDIMENTATION BASIN DETAILS

3.0 MILL DECOMMISSIONING

The following subsections detail decommissioning plans for the mill buildings and equipment; the mill site; and windblown contamination.

3.1 Mill

The uranium and vanadium processing areas of the mill, including all equipment, structures and support facilities, will be decommissioned and disposed of in tailings or buried on site as appropriate. All equipment, including tankage and piping, agitation equipment, process control instrumentation and switchgear, and contaminated structures will be cut up, removed and buried in tailings prior to final cover placement. Concrete structures and foundations will be demolished and removed or covered with soil as appropriate. These decommissioned areas would include, but not be limited to the following:

- Coarse ore bin and associated equipment, conveyors and structures.
- Grind circuit including semi-autogeneous grind (SAG) mill, screens, pumps and cyclones.
- The three preleach tanks to the east of the mill building, including all tankage, agitation equipment, pumps and piping.
- The seven leach tanks inside the main mill building, including all agitation equipment, pumps and piping.
- The counter-current decantation (CCD) circuit including all thickeners and equipment, pumps and piping.
- Uranium precipitation circuit, including all thickeners, pumps and piping.

- The two yellow cake dryers and all mechanical and electrical support equipment, including uranium packaging equipment.
- The clarifiers to the west of the mill building including the preleach thickener (PLT) and claricone.
- The boiler and all ancillary equipment and buildings.
- The entire vanadium precipitation, drying and fusion circuit.
- All external tankage not included in the previous list including reagent tanks for the storage of acid, ammonia, kerosene, water, dry chemicals, etc. and the vanadium oxidation circuit.
- The uranium and vanadium solvent extraction (SX) circuit including all SX and reagent tankage, mixers and settlers, pumps and piping.
- The SX building.
- The mill building.
- The office building.
- The shop and warehouse building.
- The sample plant building.

The sequence of demolition would proceed so as to allow the maximum use of support areas of the facility such as the office and shop areas. It is anticipated that all major structures and large equipment will be demolished with the use of hydraulic shears. These will speed the process, provide proper sizing of the materials to be placed in tailings, and reduce exposure to radiation and other safety hazards during the demolition. Any uncontaminated or decontaminated equipment to be considered for salvage will be released in accordance with the terms of Source Material License Condition 9.10. As with the equipment for disposal, any contaminated soils from the mill area will be disposed of in the tailings facilities in accordance with Section 4.0 of the Specifications.

3.2 Mill Site

Contaminated areas on the mill site will be primarily superficial and include the ore storage area and surface contamination of some roads. All ore will have been previously removed from the ore stockpile area. All contaminated materials will be excavated and be disposed in one of the tailings cells in accordance with Section 4.0 of these Plans and Specifications. The depth of excavation will vary depending on the extent of contamination and will be based on the criteria in Section 2.2.3 of these Plans and Specifications.

All ancillary contaminated materials including pipelines will be removed and will be disposed of by disposal in the tailing cells in accordance with Section 4.0 of these Plans and Specifications.

Disturbed areas will be covered, graded and vegetated as required. The proposed grading plan for the mill site and ancillary areas is shown on Figure 3.2-1.

3.3 Windblown Contamination

Windblown contamination is defined as mill derived contaminants dispersed by the wind to surrounding areas. The potential areas affected by windblown contamination will be surveyed using scintillometers taking into account historical operational data from the Semi-annual Effluent Reports and other guidance such as prevailing wind direction and historical background data. Areas covered by the existing Mill facilities and ore storage pad, the tailings cells and adjacent stockpile of random fill, clay and topsoil, will be excluded from the survey. Materials from these areas will be removed in conjunction with final reclamation and decommissioning of the Mill and tailings cells.

INSERT FIGURE A3.2-1

MILL SITE AND ORE PAD FINAL GRADING PLAN

3.3.1 Guidance

The necessity for remedial actions will be based upon an evaluation prepared by IUC, and approved by the NRC, of the potential health hazard presented by any windblown materials identified. The assessment will be based upon analysis of all pertinent radiometric and past land use information and will consider the feasibility, cost-effectiveness, and environmental impact of the proposed remedial activities and final land use. All methods utilized will be consistent with the guidance contained in NUREG-5849: "Manual for Conducting Radiological Surveys in Support of License Termination."

3.3.2 General Methodology

The facility currently monitors soils for the presence of Ra-226, Th-230 and natural uranium, such results being presented in the second semi-annual effluent report for each year. Guideline values for these materials will be determined and will form the basis for the cleanup of the White Mesa Mill site and surrounding areas. For purposes of determining possible windblown contamination, areas used for processing of uranium ores as well as the tailings and evaporative facilities will be excluded from the initial scoping survey, due to their proximity to the uranium recovery operations. Those areas include:

- The mill building, including CCD, Pre-Leach Thickener area, uranium drying and packaging, clarifying, and preleach.
- The SX building, including reagent storage immediately to the east of the SX building.
- The ore pad and ore feed areas.
- Tailings Cells No. 2, 3, and 4A.
- Evaporative cell No. 1-I.

The remaining areas of the mill will be divided up into two areas for purposes of windblown determinations:

- The restricted area, less the above areas; and,
- A halo around the restricted area.

Areas within the restricted area, as shown on Figure A3.2-1 will be initially surveyed on a 30 x 30 meter grid as described below in Section 3.3.3. The halo around the suspected area of contamination will also be initially surveyed on a 50 x 50 meter grid using methodologies described below in Section 3.3.3. Any areas which are found to have elevated activity levels will be further evaluated as described in Sections 3.3.4 and 3.3.5. Initial surveys of the areas surrounding the Mill and tailings area have indicated potential windblown contamination only to the north and east of the Mill ore storage area, and to the southwest of Cell 3, as indicated on Figure A3.2-1.

3.3.3 Scoping Survey

Areas contaminated through process activities or windblown contamination from the tailings areas will be remediated to meet applicable cleanup criteria for Ra-226, Th-230 and natural uranium. Contaminated areas will be remediated such that the residual radionuclides remaining on the site, that are distinguishable from background, will not result in a dose that is greater than that which would result from the radium soil standard (5 pCi/gram above background).

Soil cleanup verification will be accomplished by use of several calibrated beta/gamma instruments. Multiple instruments will be maintained and calibrated to ensure availability during remediation efforts.

Initial soil samples will be chemically analyzed to determine on-site correlation between the gamma readings and the concentration of radium, thorium and uranium, in the samples. Samples will be taken from areas known to be contaminated with only processed uranium materials (i.e. tailings sand and windblown contamination) and areas in which it is suspected that unprocessed uranium materials (i.e. ore pad and windblown areas downwind of the ore pad) are present. The actual number of samples used will depend on the correlation of the results between gamma readings and the Ra-226 concentration. A minimum of 35 samples of windblown tailings material, and 15 samples of unprocessed ore materials is proposed. Adequate samples will be taken to ensure that graphs can be developed to adequately project the linear regression lines and the calculated upper and lower 95 percent confidence levels for each of the instruments. The 95 percent confidence limit will be used for the guideline value for correlation between gamma readings and radium concentration. Because the unprocessed materials are expected to have proportionally higher values of uranium in relation to the radium and thorium content, the correlation to the beta/gamma readings are expected to be different than readings from areas known to be contaminated with only processed materials. Areas expected to have contamination from both processed and unprocessed materials will be evaluated on the more conservative correlation, or will be cleaned to the radium standard which should ensure that the uranium is removed.

Radium concentration in the samples should range from 25% of the guideline value (5 pCi/gram above background) for the area of interest, through the anticipated upper range of radium contamination. Background radium concentrations have been gathered over a 16 year period at sample station BHV-3 located upwind and 5 miles west of the White Mesa mill. The radium background concentration from this sampling is 0.93 pCi/gram. This value will be used as an interim value for the background concentration. Prior to initiating cleanup of windblown contamination, a systematic soil sampling program will be conducted in an area within 3 miles of the site, in geologically similar areas with soil types and soil chemistry similar to the areas to be

cleaned, to determine the average background radium concentration, or concentrations, to be ultimately used for the cleanup.

An initial scoping survey for windblown contamination will be conducted based on analysis of all pertinent radiometric and past land use information. The survey will be conducted using calibrated beta/gamma instruments on a 30 meter by 30 meter grid. Additional surveys will be conducted in a halo, or buffer zone, around the projected impact area. The survey in the buffer area will be conducted on a 50 meter by 50 meter grid. Grids where no readings exceed 75% of the guideline value (5 pCi/gram above background) will be classified as unaffected, and will not require remediation.

The survey will be conducted by walking a path within the grid as shown in Figure A-3 3-1. These paths will be designed so that a minimum of 10% of the area within the grid sidelines will be scanned, using an average coverage area for the instrument of one (1) meter wide. The instrument will be swung from side to side at an elevation of six (6) inches above ground level, with the rate of coverage maintained within the recommended duration specified by the specific instrument manufacturer. In no case will the scanning rate be greater than the rate of 0.5 meters per second (m/sec) specified in NUREG/CR-5849 (NRC, 1992).

3.3.4 Characterization and Remediation Control Surveys

After the entire subarea has been classified as affected or unaffected, the affected areas will be further scanned to identify areas of elevated activity requiring cleanup. Such areas will be flagged and sufficient soils removed to, at a minimum, meet activity criteria. Following such remediation, the area will be scanned again to ensure compliance with activity criteria. A calibrated beta/gamma

instrument capable of detecting activity levels of less than or equal to 25 percent of the guideline values will be used to scan all the areas of interest.

3.3.5 Final Survey

After removal of contamination, final surveys will be taken over remediated areas. Final surveys will be calculated and documented within specific 10 meter by 10 meter grids with sample point locations as shown in Figure A-3.3.2. Soil samples from 10% of the surveyed grids will be chemically analyzed to confirm the initial correlation factors utilized and confirm the success of cleanup effort for radium, thorium and uranium. Ten (10) percent of the samples chemically analyzed will be split, with a duplicate sent to an off site laboratory. Spikes and blanks, equal in number to 10 percent of the samples that are chemically analyzed, will be processed with the samples.

3.3.6 Employee Health and Safety

Programs currently in place for monitoring of exposures to employees will remain in effect throughout the time period during which tailings cell reclamation, mill decommissioning and clean up of windblown contamination are conducted. This will include personal monitoring (film badges/TLD's) and the ongoing bioassay program. Access control will be maintained at the Restricted Area boundary to ensure employees and equipment are released from the site in accordance with the current License conditions. In general, no changes to the existing programs are expected and reclamation activities are not expected to increase exposure potential beyond the current levels.

3.3.7 Environment Monitoring

Existing environmental monitoring programs will continue during the time period in which reclamation and decommissioning is conducted. This includes monitoring of surface and groundwater, airborne particulates, radon, soils and vegetation, according to the existing License conditions. In general, no changes to the existing programs are expected and reclamation activities are not expected to increase exposure potential beyond the current levels.

3.3.8 Quality Assurance

At least six (6) months prior to beginning of decommission activities, a detailed Quality Assurance Plan will be submitted for NRC approval. The Plan will be in accordance with Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs. In general, the Plan will detail the Company's organizational structure and responsibilities, qualifications of personnel, operating procedures and instructions, record keeping and document control, and quality control in the sampling procedure and outside laboratory. The Plan will adopt the existing quality assurance/quality control procedure utilized in compliance with the existing License.

Figure A3.3-1

Figure A3.3-2

4.0 PLACEMENT METHODS

4.1 Scrap and Debris

The scrap and debris will have a maximum dimension of 20 feet and a maximum volume of 30 cubic feet. Scrap exceeding these limits will be reduced to within the acceptable limits by breaking, cutting or other approved methods. Empty drums, tanks or other objects having a hollow volume greater than five cubic feet will be reduced in volume by at least 70 percent. If volume reduction is not feasible, openings will be made in the object to allow soils, tailings and/or other approved materials to enter the object at the time of covering on the tailings cells. The scrap, after having been reduced in dimension and volume, if required, will be placed on the tailings cells as directed by the QC officer.

Any scrap placed will be spread across the top of the tailings cells to avoid nesting and to reduce the volume of voids present in the disposed mass. Stockpiled soils, contaminated soils, tailings and/or other approved materials will be placed over and into the scrap in sufficient amount to fill the voids between the large pieces and the volume within the hollow pieces to form a coherent mass. It is recognized that some voids will remain because of the scrap volume reduction specified, and because of practical limitations of these procedures. Reasonable effort will be made to fill the voids. The approval of the Site Manager or a designated representative will be required for the use of materials other than stockpiled soils, contaminated soils or tailings for the purpose of filling voids.

4.2 Contaminated Soils and Raffinate Crystals

The various materials will not be concentrated in thick deposits on top of the tailings, but will be spread over the working surface as much as possible to provide relatively uniform settlement and consolidation characteristics of the cleanup materials.

4.3 Compaction Requirements

The scrap, contaminated soils and other materials for the first lift will be placed over the existing tailings surface to a depth of up to four feet thick in a bridging lift to allow access for placing and compacting equipment. The first lift will be compacted by the tracking of heavy equipment, such as a Caterpillar D6 Dozer (or equivalent), at least four times prior to the placement of a subsequent lift. Subsequent layers will not exceed two feet and will be compacted to the same requirements. During construction, the compaction requirements for the crystals will be reevaluated based on field conditions and modified by the Site Manager or a designated representative, with the agreement of the NRC Project Manager.

The contaminated soils and other cleanup materials after the bridging lift will be compacted to at least 80 percent of standard Proctor maximum density (ASTM D-698).

5.0 CELLS 2, AND 3

5.1 Earth Cover

A multi-layered earthen cover will be placed over tailings Cells 2, and 3. The general grading plan is shown on Drawing 5.1-1. Reclamation cover cross-sections are shown on Drawings 5.1-2 and 5.1-3.

5.2 Materials

5.2.1 Physical Properties

The physical properties of materials for use as cover soils will meet the following:

Random Fill (Platform Fill and Frost Barrier)

These materials will be mixtures of clayey sands and silts with random amounts of gravel and rock size material. In the initial bridging lift of the platform fill, rock sizes of up to 2/3 of the thickness of the lift will be allowed. On all other random fill lifts, rock sizes will be limited to 2/3 of the lift thickness, with at least 30 percent of the material finer than 40 sieve. For that portion passing the No. 40 sieve, these soils will classify as CL, SC, MC or SM materials under the Unified Soil Classification System. Oversized material will be controlled through selective excavation at the stockpiles and through the utilization of a grader, bulldozer or backhoe to cull oversize from the fill.

Clay Layer Materials

Clays will have at least 40 percent passing the No. 200 sieve. The minimum liquid limit of these soils will be 25 and the plasticity index will be 15 or greater. These soils will classify as CL, SC or CH materials under the Unified Soil Classification System.

A5.1-1

5.2.2 Borrow Sources

The sources for soils for the cover materials are as follows:

1. Random Fill (Platform and Frost Barrier) - stockpiles from previous cell construction activities currently located to the east and west of the tailing facilities.
2. Clay - will be from suitable materials stockpiled on site during cell construction or will be imported from borrow areas located in Section 16, T38S, R22E, SLM.
3. Rock Armor - will be produced through screening of alluvial gravels located in deposits 1 mile north of Blanding, Utah, 7 miles north of the mill site.

5.3 Cover Construction

5.3.1 General

Placement of cover materials will be based on a schedule determined by analysis of settlement data, piezometer data and equipment mobility considerations. Settlement plates and piezometers will be installed and monitored in accordance with Section 5.4 of these Plans and Specifications.

5.3.2 Placement and Compaction

5.3.2.1 Methods

Platform Fill

An initial lift of 3 to 4 feet of random fill will be placed over the tailings surface to form a stable working platform for subsequent controlled fill placement. This initial lift will be placed by pushing random fill material or contaminated materials across the tailings in increments, slowly enough that

the underlying tailings are displaced as little as possible. Compaction of the initial lift will be limited to what the weight of the placement equipment provides. The maximum rock size, as far as practicable, in the initial lift is 2/3 of the lift thickness. Placement of fill will be monitored by a qualified individual with the authority to stop work and reject material being placed. The top surface (top 1.0 feet) of the platform fill will be compacted to 90% maximum dry density per ASTM D 698.

Frost Barrier Fill

Frost barrier fill will be placed above the clay cover in 12- inch lifts, with particle size limited to 2/3 of the lift thickness. Frost barrier material will come from the excavation of random fill stockpiles. If oversized material is observed during the excavation of fill material it will be removed as far as practicable before it is placed in the fill.

In all layers of the cover the distribution and gradation of the materials throughout each fill layer will be such that the fill will, as far as practicable, be free of lenses, pockets, streaks or layers of material differing substantially in texture, gradation or moisture content from the surrounding material. Nesting of oversized material will be controlled through selective excavation of stockpiled material, observation of placement by a qualified individual with authority to stop work and reject material being placed and by culling oversized material from the fill utilizing a grader. Successive loads of material will be placed on the fill so as to produce the best practical distribution of material.

If the compacted surface of any layer of fill is too dry or smooth to bond properly with the layer of material to be placed thereon, it will be moistened and/or reworked with a harrow, scarifier, or other suitable equipment to a sufficient depth to provide relatively uniform moisture content and a satisfactory bonding surface before the next succeeding layer of earthfill is placed. If the compacted surface of any layer of earthfill in-place is too wet, due to precipitation, for proper compaction of the earthfill material to be placed thereon, it will be reworked with harrow, scarifier or other suitable

equipment to reduce the moisture content to the required level shown in Table 5.3.2.1-1. It will then be recompacted to the earthfill requirements.

No material will be placed when either the materials, or the underlying material, is frozen or when ambient temperatures do not permit the placement or compaction of the materials to the specified density, without developing frost lenses in the fill.

5.3.2.2 Moisture and Density Control

As far as practicable, the materials will be brought to the proper moisture content before placement on tailings, or moisture will be added to the material by sprinkling on the earthfill. Each layer of the fill will be conditioned so that the moisture content is uniform throughout the layer prior to and during compaction. The moisture content of the compacted fill will be within the limits of standard optimum moisture content as shown in Table 5.3.2.1-1. Material that is too dry or too wet to permit bonding of layers during compaction will be rejected and will be reworked until the moisture content is within the specified limits. Reworking may include removal, re-harrowing, reconditioning, rerolling, or combinations of these procedures.

Density control of compacted soil will be such that the compacted material represented by samples having a dry density less than the values shown in Table 5.3.2.1-1 will be rejected. Such rejected material will be reworked as necessary and rerolled until a dry density equal to or greater than the percent of its standard Proctor maximum density shown in Table 5.3.2.1-1.

To determine that the moisture content and dry density requirements of the compacted fill are being met, field and laboratory tests will be made at specified intervals taken from the compacted fills as specified in Section 7.4, "Frequency of Quality Control Tests."

5.4 Monitoring Cover Settlement

5.4.1 Temporary Settlement Plates

5.4.1.1 General

Temporary settlement plates will be installed in the tailings Cells. At the time of cell closure, a monitoring program will be proposed to the NRC. Data collected will be analyzed and the reclamation techniques and schedule adjusted accordingly.

5.4.1.2 Installation

At the time of cell closure or during the placement of interim cover temporary settlement plates will be installed. These temporary settlement plates will consist of a corrosion resistant steel plate 1/4 inch thick and two foot square to which a one inch diameter corrosion resistant monitor pipe has been welded. The one inch monitor pipe will be surrounded by a three inch diameter guard pipe which will not be attached to the base plate.

The installation will consist of leveling an area on the existing surface of the tailings, and placing the base plate directly on the tailings. A minimum three feet of initial soil or tailings cover will be placed on the base plate for a minimum radial distance of five feet from the pipe.

5.4.1.3 Monitoring Settlement Plates

Monitoring of settlement plates will be in accordance with the program submitted to and approved by the NRC. Settlement observations will be made in accordance with Quality Control Procedure QC-16-WM, "Monitoring of Temporary Settlement Plates."

INSERT TABLE 5.3.2.1-1

6.0 ROCK PROTECTION

6.1 General

The side slopes of the reclaimed cover will be protected by rock surfacing. Drawings 5.1-1, 5.1-2, and 5.1-3 show the location of rock protection with the size, thickness and gradation requirements for the various side slopes.

A riprap layer was designed for erosion protection of the tailings soil cover. According to NRC guidance, the design must be adequate to protect the soil/tailings against exposure and erosion for 200 to 1,000 years (NRC, 1990). Currently, there is no standard industry practice for stabilizing tailings for 1,000 years. However, by treating the embankment slopes as wide channels, the hydraulic design principles and practices associated with channel design were used to design stable slopes that will not erode. Thus, a conservative design based on NRC guidelines was developed. Engineering details and calculations are summarized in the Tailings Cover Design report (Appendix D).

Riprap cover specifications for the top and side slopes were determined separately as the side slopes are much steeper than the slope of the top of the cover. The size and thickness of the riprap on the top of the cover was calculated using the Safety Factor Method (NUREG/CR-4651, 1987), while the Stephenson Method (NUREG/CR-4651, 1987) was used for the side slopes. These methodologies were chosen based on NRC recommendations (1990).

By the Safety Factor Method, riprap dimensions for the top slope were calculated in order to achieve a slope "safety factor" of 1.1. For the top of the soil cover, with a slope of 0.2 percent, the Safety Factor Method indicated a median diameter (D_{50}) riprap of 0.28 inches is required to stabilize the top slope. However, this dimension must be modified based on the long-term durability of the specific rock type to be used in construction. The suitability of rock to be used as a protective cover has been

assessed by laboratory tests to determine the physical characteristics of the rocks. The gravels sourced from pits located north of Blanding require an oversizing factor of 9.35%. Therefore, riprap created from this source should have a D_{50} size of at least 0.306 inches and should have an overall layer thickness of at least three inches on the top of the cover. From a practical construction standpoint the minimum rock layer thickness may be up to six (6) inches.

Riprap dimensions for the side slopes were calculated using Stephenson Method equations. The side slopes of the cover are designed at 5H:1V. At this slope, Stephenson's Method indicated the unmodified riprap D_{50} of 3.24 inches is required. Again assuming that the gravel from north of Blanding will be used, the modified D_{50} size of the riprap should be at least 3.54 inches with an overall layer thickness of at least 8 inches.

6.2 Materials

Materials utilized for riprap applications will meet the following specifications:

Location	D_{50} Size	D_{100} Size	Layer Thickness
Top Surface	0.3"	0.6"	6"
Slope Surface	3.5"	7"	8"
Toe Apron	6.4"	12"	24"

Riprap will be supplied to the project from gravel sources located north of the project site. Riprap will be a screened product.

Riprap quality will be evaluated by methods presented in NUREG/1623 Design of Erosion Protection for Long-Term Stabilization. Size adjustment will be made in the riprap for materials not meeting the quality criteria.

6.3 Placement

Riprap material will be hauled to the reclaimed surfaces and placed on the surfaces using belly dump highway trucks and road graders. Riprap will be dumped by trucks in windrows and the grader will spread the riprap in a manner to minimize segregation of the material. Depth of placement will be controlled through the establishment of grade stakes placed on a 200 x 200 foot grid on the top of the cells and by a 100 x 100 foot grid on the cell slopes. Physical checks of riprap depth will be accomplished through the use of hand dug test pits at the center of each grid in addition to monitoring the depth indicated on the grade stakes. Placement of the riprap will avoid accumulation of riprap sizes less than the minimum D_{50} size and nesting of the larger sized rock. The riprap layer will be compacted by at least two passes by a D-7 Dozer (or equivalent) in order to key the rock for stability.

7.0 QUALITY CONTROL/QUALITY ASSURANCE

7.1 Quality Plan

A Quality Plan has been developed for construction activities for the White Mesa Project. The Quality Plan includes the following:

1. QC/QA Definitions, Methodology and Activities.
2. Organizational Structure.
3. Surveys, Inspections, Sampling and Testing.
4. Changes and Corrective Actions.

- 5. Documentation Requirements.
- 6. Quality Control Procedures.

7.2 Implementation

The Quality Plan will be implemented upon initiation of reclamation work.

7.3 Quality Control Procedures

Quality control procedures have been developed for reclamation and are presented in Attachment B of this Reclamation Plan. Procedures will be used for all testing, sampling and inspection functions.

7.4 Frequency of Quality Control Tests

The frequency of the quality control tests for earthwork will be as follows:

- 1. The frequency of the field density and moisture tests will be not less than one test per 1,000 cubic yards (CY) of compacted contaminated material placed and one test per 500 CY of compacted random fill, radon barrier or frost barrier. A minimum of two tests will be taken for each day that an applicable amount of fill is placed in excess of 150 CY. A minimum of one test per lift and at least one test for every full shift of compaction operations will be taken.

Field density/moisture tests will be performed utilizing a nuclear density gauge (ASTM D-2922 density and ASTM D-3017 moisture content). Correlation tests will be performed at a rate of one for every five nuclear gauge tests for compacted contaminated materials (one

per 2,500 CY placed) and one for every ten nuclear gauge tests for other compacted materials (one per 5,000 CY of material placed). Correlation tests will be sand cone tests (ASTM D-1556) for density determination and oven drying method (ASTM D-2216) for moisture determination.

2. Gradation and classification testing will be performed at a minimum of one test per 2,000 CY of upper platform fill and frost barrier placed. A minimum of one test will be performed for each 1,000 CY of radon barrier material placed. For all materials other than random fill and contaminated materials, at least one gradation test will be run for each day of significant material placement (in excess of 150 CY).
3. Atterberg limits will be determined on materials being placed as radon barrier. Radon barrier material will be tested at a rate of at least once each day of significant material placement (in excess of 150 CY). Samples should be randomly selected.
4. Prior to the start of field compaction operations, appropriate laboratory compaction curves will be obtained for the range of materials to be placed. During construction, one point Proctor tests will be performed at a frequency of one test per every five field density tests (one test per 2,500 CY placed). Laboratory compaction curves (based on complete Proctor tests) will be obtained at a frequency of approximately one for every 10 to 15 field density tests (one lab Proctor test per 5,000 CY to 7,500 CY placed), depending on the variability of materials being placed.
5. For riprap materials, each load of material will be visually checked against standard piles for gradation prior to transport to the tailings piles.

Prior to delivery of any riprap materials to the site rock durability tests will be performed for each gradation to be used. Test series for riprap durability will include specific gravity,

absorption, sodium soundness and LA abrasion. During construction additional test series and gradations will be performed for each type of riprap when approximately one-third ($1/3$) and two-thirds ($2/3$) of the total volume of each type have been produced or delivered. For any type of riprap where the volume is greater than 30,000 CY, a test series and gradations will be performed for each additional 10,000 CY of riprap produced or delivered.

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