

28 October 2010

Project No. 073-81694.0022

Mr. Robert R. Monok  
Project Manager  
Energy Fuels Resource Corporation  
44 Union Boulevard, Suite 600  
Lakewood, Colorado 80228

**RE: REVISED SPECIFICATIONS FOR CLOSURE AND RECLAMATION OF MILL FACILITIES  
PIÑON RIDGE PROJECT, MONTROSE COUNTY, COLORADO**

Dear Bob:

Golder Associates Inc. (Golder) revised the “*Specifications for Closure and Reclamation of Mill Facilities*” document (Golder, 2009) for consistency with other project components and has prepared this letter to transmit the revised document. The document was largely revised for consistency with the revised tailings cell closure cover design, which was recently completed by Kleinfelder West Inc. (Kleinfelder, 2010) in response to comments from the Colorado Department of Public Health and Environment (CDPHE) as part of Request for Information (RFI) #2.

For ease of review by the Division, a redline version of the modified Closure Specifications document is provided in Attachment A. An updated/clean version of the entire Closure Specifications document is included in Attachment B.

Notable modifications to the Closure Specifications include the following:

- Changes to the material specifications for construction of the tailings cell closure cover, including incorporation of a Geosynthetic Liner, elimination of the Filter Layer, an increase in thickness for the Erosion Barrier/Vegetative Cover and a corresponding reduction in thickness for the Radon Barrier (per Kleinfelder, 2010);
- Decommissioning of the settlement points prior to construction of the Geosynthetic Liner layer (which is in the upper 0.9 to 1.0 ft of the Radon Barrier layer), with re-installation after placement of the Radon Barrier layer;
- Revision to the revegetation specifications (Section 13.0) for consistency with the recent seed mix designs developed for the project, which include a shallow-rooted seed mix for the tailings cells closure cover area, and a deep-rooted seed mix for other reclaimed areas;
- Revision to the fencing specifications (Section 14.0) for consistency with the revised Technical Specifications issued by Golder (2010) in response to RFI #3 from CDPHE; and
- Incorporation of quality assurance measures for geosynthetic liner installation (Section 15.0).



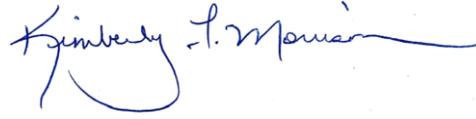
We appreciate the opportunity to provide continued engineering services for the Piñon Ridge Project. If you have questions or comments regarding these responses, please contact the undersigned via phone at 303-980-0540, or via e-mail at [kmorrison@golder.com](mailto:kmorrison@golder.com).

Sincerely,

**GOLDER ASSOCIATES INC.**



Gordon Gjerapic, Ph.D., P.E.  
Senior Project Engineer



Kimberly Finke Morrison, P.E., R.G.  
Associate - Senior Project Manager

Attachments: A – Revised Specifications for Closure and Reclamation of Mill Facilities  
(Redline Version)  
B – Revised Specifications for Closure and Reclamation of Mill Facilities

GG/KFM/rjg

**REFERENCES**

Golder Associates Inc. (Golder). 2009. "*Specifications for Closure and Reclamation of Mill Facilities, Montrose County, Colorado*," Prepared for Energy Fuels Resources Corporation. October 2009.

Golder Associates Inc. (Golder). 2010. "*Technical Specifications and Construction Quality Assurance (CQA)/Construction Quality Control (CQC) Plan*," Prepared for Energy Fuels Resources Corporation. Revision B – Issued for Permitting. October 2010.

Kleinfelder West Inc. (Kleinfelder). 2010. "*Tailings Cell Closure Design Report*," Energy Fuels Corporation, Piñon Ridge Project, Montrose County, Colorado. 10 September 2010.

**ATTACHMENT A**  
**REVISED SPECIFICATIONS FOR CLOSURE AND**  
**RECLAMATION OF MILL FACILITIES**  
**(REDLINE VERSION)**



OCTOBER **2009-2010**

SPECIFICATIONS

## PIÑON RIDGE PROJECT, MONTROSE COUNTY, COLORADO

### Specifications for Closure and Reclamation of Mill Facilities

**Submitted to:**  
Energy Fuels Resources Corporation  
44 Union Blvd., Suite 600  
Lakewood, CO 80228



Project Number: 073-81694.00470022

Revision Number: A-B-~~Revised~~, Issued for Permitting

  
A world of  
capabilities  
delivered locally





## Table of Contents

- 1.0 GENERAL PROJECT REQUIREMENTS..... 1
  - 1.1 General Description of Work ..... 1
  - 1.2 Reclamation Work Items..... 1
  - 1.3 Sanitary Facilities..... 2
  - 1.4 Drawings ..... 2
  - 1.5 As-Built Drawings ..... 2
  - 1.6 Communications ..... 2
  - 1.7 Federal, State, and Local Laws and Permits..... 3
  - 1.8 Project Completion ..... 3
  - 1.9 Codes and Standards ..... 3
  - 1.10 Submittals ..... 4
    - 1.10.1 Permits ..... 4
    - 1.10.2 Manufactured Products ..... 5
    - 1.10.3 Fabrication/Construction Details ..... 5
  - 1.11 Testing of Soil and Rock Materials ..... 5
  - 1.12 Definitions ..... 5
    - 1.12.1 General Terminology..... 5
    - 1.12.2 Description of Parties ..... 6
      - 1.12.2.1 Owner ..... 6
      - 1.12.2.2 Decommissioning Project Manager (DPM) ..... 6
      - 1.12.2.3 Task Manager (TM) ..... 6
      - 1.12.2.4 Contracting Officer (CO)..... 6
      - 1.12.2.5 Radiation Safety Officer (RSO) ..... 7
      - 1.12.2.6 Quality Assurance Coordinator (QAC) ..... 7
      - 1.12.2.7 Contractor ..... 7
    - 1.12.3 Materials..... 8
      - 1.12.3.1 Soil..... 8
      - 1.12.3.2 Topsoil ..... 8
      - 1.12.3.3 Rock..... 8
      - 1.12.3.4 Tailings ..... 8
      - 1.12.3.5 Windblown Tailings..... 9
      - 1.12.3.6 Affected Soil..... 9
      - 1.12.3.7 Ore ..... 9
      - 1.12.3.8 By-Product ..... 9
      - 1.12.3.9 Interim Cover ..... 9
      - 1.12.3.10 Tailings Cell Closure Cover Materials ..... 10



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

2.0	CLEARING AND GRUBBING .....	12
2.1	General .....	12
2.1.1	Scope of Work.....	12
2.1.2	Related Work.....	12
2.2	Products.....	12
2.3	Execution .....	12
3.0	UTILITY PROTECTION AND RELOCATION.....	14
3.1	General .....	14
3.1.1	Scope of Work.....	14
3.1.2	Related Work.....	14
3.2	Products.....	14
3.3	Execution .....	14
4.0	DECONTAMINATION.....	16
4.1	General .....	16
4.1.1	Scope of Work.....	16
4.1.2	Related Work.....	16
4.1.3	Definitions.....	16
4.1.4	Submittals.....	16
4.2	Products.....	16
4.3	Execution .....	17
5.0	BUILDING DEMOLITION AND DEBRIS DISPOSAL .....	18
5.1	General .....	18
5.1.1	Scope of Work.....	18
5.1.2	Related Work.....	18
5.2	Products.....	18
5.3	Execution .....	18
5.3.1	General.....	18
5.3.2	Disposal Method .....	18
5.3.2.1	Demolition Debris Disposal .....	19
5.3.2.2	Compaction Requirements .....	19
5.3.3	Disposal Locations .....	20
5.3.4	Backfilling .....	20
6.0	AFFECTED SOIL EXCAVATION AND PLACEMENT .....	21
6.1	General .....	21
6.1.1	Scope of Work.....	21
6.1.2	Related Work.....	21
6.1.3	Definitions.....	21
6.1.4	Submittals.....	22



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

6.2	Products.....	22
6.3	Execution .....	22
6.3.1	Radiological Survey .....	22
6.3.1.1	Initial Soil Survey .....	22
6.3.1.2	Verification Survey.....	23
6.3.2	Erosion Control.....	23
6.3.3	Access Roads and Dust Suppression.....	23
6.3.4	Excavation of Affected Soils.....	23
6.3.5	Regrading of Excavated Areas .....	24
6.3.6	Placement of the Affected Soil .....	24
7.0	MILL DECOMMISSIONING.....	25
7.1	General .....	25
7.1.1	Scope of Work.....	25
7.1.2	Regulatory and Guidance Requirements .....	25
7.1.3	Related Work.....	25
7.2	Products.....	25
7.3	Execution .....	26
7.3.1	Systems and Equipment Decommissioning.....	26
7.3.1.1	Uncontaminated Systems and Equipment .....	26
7.3.1.2	Contaminated Systems and Equipment .....	26
7.3.2	Buildings, Structures and Soils Decommissioning.....	26
8.0	ORE PAD RECLAMATION.....	27
8.1	General .....	27
8.1.1	Scope of Work.....	27
8.1.2	Related Work.....	27
8.2	Products.....	27
8.3	Execution .....	28
9.0	EVAPORATION PONDS RECLAMATION.....	29
9.1	General .....	29
9.1.1	Scope of Work.....	29
9.1.2	Related Work.....	29
9.2	Products.....	29
9.3	Execution .....	30
9.3.1	Reclamation Sequence .....	30
9.3.2	Removal of Contaminated Materials.....	30
9.3.2.1	Evaporation Pond Solids .....	30
9.3.2.2	Synthetic Liners .....	30



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

10.0	TAILINGS REGRADING AND INTERIM COVER PLACEMENT .....	31
10.1	General .....	31
10.1.1	Scope of Work.....	31
10.1.2	Related Work.....	31
10.1.3	Definitions.....	31
10.1.4	Submittals.....	32
10.2	Products.....	32
10.3	Execution .....	32
10.3.1	General.....	32
10.3.2	Access Roads and Dust Suppression.....	33
10.3.3	Dewatering (Underdrain) System Abandonment .....	33
10.3.4	Surface Water and Erosion Control .....	33
10.3.5	Regrading.....	33
10.3.6	Placement of Interim Cover.....	34
10.3.7	Settlement Monitoring Points .....	34
10.3.7.1	Survey Frequency.....	35
10.3.7.2	Settlement Monitoring Point Decommissioning.....	36
10.3.8	Radon Flux Measurements .....	36
11.0	TAILINGS CELL CLOSURE COVER .....	37
11.1	General .....	37
11.1.1	Scope of Work.....	37
11.1.2	Related Work.....	37
11.1.3	Definitions.....	38
11.1.4	Submittals.....	38
11.2	Products.....	38
11.3	Execution .....	38
11.3.1	Closure Cover Construction .....	38
11.3.1.1	General .....	39
11.3.1.2	Materials .....	39
11.3.1.3	Radon Barrier Placement .....	39
11.3.1.4	Geosynthetic Liner Placement.....	40
11.3.1.5	Bio-Intrusion Barrier Placement.....	41
11.3.1.6	Capillary Break Placement .....	41
11.3.1.7	Erosion Barrier Placement.....	41
11.3.2	Settlement Monitoring Points .....	42
11.3.3	Radon Flux Measurements .....	42



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

12.0	EROSION PROTECTION PLACEMENT .....	43
12.1	General .....	43
12.1.1	Scope of Work.....	43
12.1.2	Related Work.....	43
12.2	Materials .....	43
12.2.1	Riprap.....	44
12.2.2	Rock Blanket .....	44
12.2.3	Toe Protection.....	44
12.2.4	CDOT Type I Bedding and CDOT Type II Bedding .....	44
12.3	Execution .....	45
12.4	Placement.....	46
12.4.1	Riprap.....	46
12.4.2	Rock Blanket .....	46
12.4.3	Toe Protection.....	46
12.4.4	CDOT Type I Bedding and CDOT Type II Bedding .....	47
13.0	VEGETATION.....	48
13.1	General .....	48
13.1.1	Scope of Work.....	48
13.1.2	Related Work.....	48
13.2	Products.....	48
13.2.1	Seed Mixture Specifications and Planting Locations .....	48
13.2.2	Mulch.....	49
13.3	Execution .....	52
13.3.1	General.....	52
13.3.2	Soil Preparation.....	52
13.3.3	Seeding .....	52
13.3.4	Mulching.....	52
13.3.5	Restoration.....	52
14.0	FENCING.....	53
14.1	General .....	53
14.1.1	Scope of Work.....	53
14.1.2	Related Work.....	53
14.2	Products.....	53
14.2.1	Chain Link Fence .....	53
14.2.1.1	Chain Link Fence Fabric.....	54
14.2.1.2	Line Posts .....	54
14.2.1.3	End, Pull and Corner Posts .....	54
14.2.1.4	Top Rails.....	54



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

14.2.1.5	Compression Braces and Tension Rods .....	54
14.2.1.6	Post Tops (Post Caps).....	54
14.2.1.7	Stretcher Bars .....	55
14.2.2	Barbed Wire Fence .....	56
14.2.3	Chain Link Gates.....	56
14.2.3.1	Gate Frame.....	56
14.2.3.2	Gate Posts .....	56
14.2.3.3	Gate Hinges.....	56
14.2.3.4	Drop Rod, Latches, Padlocks and Catches.....	56
14.2.4	Hardware Wire Cloth (Wire Cloth).....	57
14.2.5	Concrete Foundations.....	57
14.3	Execution .....	57
14.3.1	Fence Installation .....	57
14.3.2	Chain Link Fence Installation .....	58
14.3.3	Barbed Wire Fence Installation .....	59
15.0	CONSTRUCTION QUALITY ASSURANCE.....	60
15.1	General .....	60
15.1.1	Environmental Submittals .....	60
15.1.2	Cleanup Verification Plan.....	61
15.1.3	In-Place Radiological Testing of Surface Tailings.....	61
15.1.4	Settlement Monitoring Report .....	61
15.1.5	Radon Barrier Prequalification .....	61
15.1.6	Tailings Cell Closure Cover Quality Control Report.....	61
15.1.7	Radon Flux Measurements .....	61
15.2	Products.....	61
15.3	Execution .....	62
15.3.1	Verification of Demolition Activities .....	62
15.3.2	Settlement Monitoring .....	62
15.3.3	Testing of In-Place Tailings and Interim Cover .....	63
15.3.4	Radon Barrier Placement, Compaction and Testing.....	63
15.3.4.1	Material Prequalification .....	64
15.3.4.2	Radon Barrier General Classification Testing .....	65
15.3.4.3	Radon Barrier Compaction Testing .....	65
15.3.4.4	Radon Flux Measurement .....	65
15.3.5	Earthworks and Geosynthetic Liner Quality Assurance.....	65
15.3.5.1	Construction Testing.....	65
15.3.5.2	Construction Monitoring.....	69



# PIÑÓN RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

15.3.6	Tailings Cell Construction Documentation .....	70
15.3.6.1	Daily Record Keeping .....	70
15.3.6.2	Soils Observation and Testing Forms .....	70
15.3.6.3	Geosynthetic Liner Placement Observation and Testing Forms .....	70
15.3.6.4	Photo Documentation .....	71
15.3.6.5	Design and Specification Changes.....	71
15.3.6.6	Weekly Progress Reports .....	71
15.3.6.7	CQA Report .....	71
16.0	HEALTH AND SAFETY .....	73
16.1	General .....	73
16.1.1	Scope of Work.....	73
16.1.2	Related Work.....	73
16.2	Safety Equipment .....	74
16.2.1	Personal Protective Equipment.....	74
16.2.2	Exposure Monitoring .....	74
16.3	Execution .....	74
16.3.1	Responsible Personnel .....	74
16.3.2	Hazard Analysis .....	74
16.3.3	Radiological Safety .....	75
16.3.4	Exposure Monitoring .....	76
16.3.4.1	Radiation Exposure .....	76
16.3.4.2	Radiological Contamination Survey Program.....	76
16.3.5	Emergency Procedures.....	77
16.3.6	Site Control and Decontamination .....	77
16.3.7	General Site Health and Safety and Work Rules.....	77
16.3.8	Health and Safety Training.....	77
17.0	REFERENCES .....	79

## List of Tables

Table 4-1: Acceptable Surface Contamination Levels.....	17
Table <del>12-12</del> : Erosion Protection Components .....	45
Table <del>13-13</del> : Proposed Seed Mixture 1 – Shallow Rooted .....	50
Table <del>13-24</del> : Proposed Seed Mixture 2 – Deep Rooted.....	51
Table 5: Hardware Wire Cloth Wire Gage.....	57
Table <del>15-16</del> : Soil Construction Minimum Testing Frequencies.....	67
Table 7: Geosynthetic Liner Minimum Testing Frequencies .....	68



## **1.0 GENERAL PROJECT REQUIREMENTS**

### **1.1 General Description of Work**

The work covered by these Technical Specifications (Specifications) consists of decommissioning and reclamation construction activities for the uranium mill, ore pad, tailings cells, and evaporation pond areas at Energy Fuels Resources Corporation’s (EFRC) Piñon Ridge Project located in the Paradox Valley of western Montrose County, Colorado. All work performed shall be in accordance with these Specifications and the Construction Drawings (Drawings). In the event of discrepancies, or if any aspect of the work is questionable, it shall be solely the responsibility of the Contractor to request clarification from the Owner. Work shall be performed in basic accordance with the schedule provided by the Owner. The work will be considered completed upon inspection and written approval by the Owner.

Unless otherwise specified by the Owner, the Contractor shall furnish all materials, products, equipment, supplies, utilities, skill, and labor required and all other items necessary for the work hereinafter described for decommissioning and reclamation of the tailings cells, mill areas, ore pad and evaporation ponds. Work by the Contractor shall be performed in compliance with the Health and Safety procedures identified herein.

The materials and products used shall be as specified herein for the services intended and shall be subject to review and written approval by the Owner. Such review and acceptance shall not be construed as relieving the Contractor of any responsibility or warranty stipulated in the Contract. Products or materials may be substituted only with the written consent of the Owner. The methods used by the Contractor shall produce satisfactory work for the services intended and shall be in accordance with standard construction industry practices.

### **1.2 Reclamation Work Items**

Reclamation shall be performed to stabilize the mill, tailings cells, ore pad and evaporation pond areas, and to prevent migration of tailings by either wind or surface water runoff. Primary activities to be performed during reclamation are as follows:

<b>Activity</b>	<b>Specifications Section</b>
Clearing and Grubbing	2.0
Utility Protection and Relocation	3.0
Decontamination	4.0
Building Demolition and Debris Disposal	5.0
Affected Soil Excavation and Placement	6.0
Mill Decommissioning	7.0
Ore Pad Reclamation	8.0
Evaporation Ponds Reclamation	9.0
Tailings Regrading and Interim Cover Placement	10.0
Tailings Cell Closure Cover	11.0
Erosion Protection Placement	12.0



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Vegetation	13.0
Fencing	14.0
Construction Quality Assurance	15.0
Health and Safety	16.0
References	17.0

## 1.3 Sanitary Facilities

The Contractor shall provide and maintain a potable water supply, suitable sanitary facilities and shower facilities on the construction site at all times. These facilities shall be subject to approval of the county and state health departments.

## 1.4 Drawings

Drawings (Kleinfelder 2009a) accompany and form a part of the Specifications and Contract Documents. The location, extent, and general character of the work are shown on the Drawings and/or are described within these Specifications. Drawings (Kleinfelder 2009a) accompanying these Specifications are intended for preliminary design (not for construction). The Owner will furnish additional Construction Drawings prior to construction. The work shall be executed in accordance with these Drawings, Construction Drawings (with information on Construction Drawings superseding information on Drawings), and additional or supplemental Drawings or schedule as may be furnished from time to time by the Owner.

## 1.5 As-Built Drawings

The Contractor shall be responsible for preparing and providing the Owner with "as-built" Drawings by properly recording all dimensions that are necessary for construction but are not indicated on the plans. The Contractor shall also provide the Owner with measurements and data used to develop the "as-built" Drawings, including survey of decommissioned and reclaimed areas (post-closure), final site grading, and thickness of tailings cover layers on an appropriate survey grid with additional survey points at slope breaks.

## 1.6 Communications

All notices, demands, requests, instructions, approvals, proposals, and claims must be in writing. Any notice to, or demand upon, the Contractor shall be sufficiently given if delivered at the office of the Contractor, stated on the signature page of the agreement (or at such other offices as the Contractor may from time to time designate in writing to the Owner), or if deposited in the United States mail, in a sealed, postage-paid envelope, and sent certified mail, or delivered with charges prepaid by courier express, in each case addressed to such office. All correspondence required to be delivered to the Owner, unless otherwise specified in writing to the Contractor, shall be delivered to the Owner at the following address:

Energy Fuels Resources Corporation  
44 Union Blvd., Suite 600  
Lakewood, CO 80228.



## 1.7 Federal, State, and Local Laws and Permits

It shall be the responsibility of the Contractor to acquaint himself with all federal, state, and local laws and regulations governing the work to be completed and to conduct his obligations under the Contract in compliance with said laws and regulations. Permit acquisition for performance of any aspect of the work, including Radiation Work Permits (RWPs), shall be the responsibility of the Contractor unless otherwise identified by the Owner.

## 1.8 Project Completion

The project shall commence within 30 days after the date of an Owner-issued Notice to Proceed. Within this period, the Contractor shall estimate the required time period for completion of the project and provide the Owner with a detailed bar chart schedule of construction activities. The schedule shall be updated at regular intervals and provided to the Owner with special notation of any significant schedule changes proposed. The Owner shall approve any schedule changes that significantly affect completion of the work before such changes become part of the Contract Documents.

## 1.9 Codes and Standards

Work described herein shall be conducted in accordance with industry Standards including, but not limited to, the most current designation of the codes and standards designated herein. Wherever the following abbreviations are used in these Specifications or on the plans, they shall be construed the same as the respective expressions represented:

1. ASTM, "American Society for Testing and Materials."
2. USCS, "Unified Soil Classification System."
3. ASTM A 121, "Specifications for Zinc-Coated (Galvanized) Steel Barbed Wire."
4. ASTM A 123, "Specification for Zinc (Hot-dip Galvanized) Coatings on Iron/Steel Products (Made from Rolled Pressed and Forged Shapes/Castings/Plates/Bars/Strips)."
5. ASTM A 153, "Specifications for Zinc Coating (Hot-dip) on Iron/Steel Hardware."
6. ASTM A 392, "Specifications for Zinc-Coated Steel Chain-Link Fence Fabric."
7. ASTM A 491, "Specifications for Aluminum-Coated Steel Chain-Link Fence Fabric."
8. ASTM C 33, "Standard Specification for Concrete Aggregate."
9. ASTM C 88, "Test Methods for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate."
10. ASTM C 97, "Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone."
11. ASTM C 127, "Test Methods for Specific Gravity and Absorption of Coarse Aggregate."



12. ASTM C 131, "Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion Impact in the Los Angeles Machine."
13. ASTM C 136, "Methods for Sieve Analysis of Fine and Coarse Aggregates."
14. ASTM C 150, "Standard Specification for Portland Cement."
15. ASTM C 295, "Petrographic Analysis of Aggregates."
16. ASTM C 535, "Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion Impact in the Los Angeles Machine."
17. ASTM D 422, "Standard Test Method for Particle Size Analysis of Soils."
18. ASTM D 423, "Liquid Limit of Soils."
19. ASTM D 424, "Plastic Limit and Plasticity Index of Soils."
20. ASTM D 698, "Test Method for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb. (2.49-kg) Hammer and 12-in (305-mm) Drop."
21. ASTM D 854, "Test Method for Specific Gravity of Soils."
22. ASTM D 1556, "Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method."
23. ASTM D 2216, "Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil-Aggregate Mixtures (Oven-drying Method)."
24. ASTM D 2922, "Test Methods for Density of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth)."
25. ASTM D 3017, "Test Methods for Water Content of Soil and Rock In-Place by Nuclear Methods (Shallow Depth)."
26. ASTM D 3441, "Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil."
27. ASTM D 4643 "Determination of Water (Moisture) Content by the Microwave Oven Method for Expedited Test Results (Microwave Method)."

## 1.10 Submittals

### 1.10.1 Permits

If required by federal, state, or local ordinances, the Contractor shall furnish copies of all permits to the Owner prior to the commencement of the permitted activity including, but not limited to, the following:

- Fugitive dust;
- Water control;
- Burning;



- Road use;
- Radiation Work Permits (RWPs);
- General construction; and
- Off-site materials disposal.

## 1.10.2 *Manufactured Products*

Prior to use, the Contractor shall submit to the Owner manufacturer's certification and/or test data for all products utilized in construction, stating and supplying supporting data that the products meet or exceed the specification requirements given for each product. The products requiring submittals prior to use include, but are not limited to:

- Seed mixture;
- Fertilizer;
- Mulch; and
- Fence.

## 1.10.3 *Fabrication/Construction Details*

The Contractor shall submit to the Owner details of the relocation of each utility prior to initiation of relocation construction activities. The Owner and the utility company must approve the relocation in writing prior to the Contractor initiating relocation work.

## 1.11 **Testing of Soil and Rock Materials**

The Contractor shall provide the Owner access for sampling and testing of all soil and rock materials to be used in construction activities. These materials shall not be used without prior approval of the Owner. Materials requiring sampling and testing include, but are not limited to:

- Soil;
- Tailings Cell Closure Cover Materials;
- Riprap; and
- Filter Material.

## 1.12 **Definitions**

### 1.12.1 *General Terminology*

As used in these Specifications, the following terms are defined as follows:

Tailings Cell - The entire tailings cell structure which consists of the lined excavation, upstream embankment berms and hydraulically placed tailings.



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Tailings Cell Top - The top of the tailings surface beginning at the upstream embankment berm of the cell.

Berms - The Tailings Cell embankments constructed of fill which form the outer perimeter of the Tailings Cell.

Tailings Cell Drainage Channels – Surface water channels that collect surface water runoff from the reclaimed Tailings Cell area as indicated in the Drawings.

Tailings Cell Vault – Final Tailings Cell area designated for disposal of contaminated buildings, debris and affected soils.

### **1.12.2 Description of Parties**

The following sections provide descriptions of the parties, including their responsibilities and qualifications.

#### 1.12.2.1 Owner

The Owner refers specifically to Energy Fuels Resources Corporation (EFRC). EFRC is the Owner, and will be responsible for decommissioning and reclamation of the facility.

#### 1.12.2.2 Decommissioning Project Manager (DPM)

The Decommissioning Project Manager (DPM) will be appointed by, and report to, the Owner. The DPM will have training and experience in radiological facility operations and/or decommissioning that is acceptable to the Colorado Department of Public Health and Environment (CDPHE). The DPM will have the primary responsibility for preparing the detailed Decommissioning Plan and for managing the decommissioning activities.

The DPM will serve as the communications coordinator for the Project, initiating construction and resolution meetings. As communications coordinator, the DPM will serve as a liaison between all parties involved in the Project to ensure that ongoing communications are maintained.

#### 1.12.2.3 Task Manager (TM)

The decommissioning activities will be executed as tasks, each with a designated Task Manager (TM). A TM may have responsibility for more than one task. The TM will oversee the task, including work of Contractors performing the task. Each TM will have training and experience in the activity of their assigned task and will be responsible for the work plan associated with their assigned task. The TMs will report directly to the DPM.

#### 1.12.2.4 Contracting Officer (CO)

The Contracting Officer (CO) will be appointed by the Owner, and will report to the DPM. The CO will be responsible for procurement of subcontracted services, and of materials and equipment required for



decommissioning. The CO will issue bid documents and will receive and maintain records of measurement and payment for completed work.

### 1.12.2.5 Radiation Safety Officer (RSO)

The Radiation Safety Officer (RSO) will report to the Vice President of Regulatory Affairs, and will be responsible for the radiological health and safety training and procedures for all on-site workers. The RSO must have completed training in radiation protection in a program approved by the CDPHE. The RSO will approve Radiation Work Permits (RWP), and will monitor work to assess compliance with RWPs and procedures.

### 1.12.2.6 Quality Assurance Coordinator (QAC)

The Quality Assurance Coordinator (QAC) will report to the DPM and will be responsible for establishing and confirming compliance with the Quality Assurance Program. The QAC will maintain the Document Control Program, and will maintain control of the measuring and testing equipment. The QAC will alert the DPM and TMs when corrective actions are required, and will maintain records of compliance with the program requirements.

Specific responsibilities of the QAC include:

- Reviewing the Drawings, Specifications and related guidance document;
- Review all Contractor QC submittals and make appropriate recommendations regarding compliance with the Drawings and Specifications;
- Obtain construction samples and perform material evaluation testing as required;
- Monitor foundation preparation activities and material placement activities;
- Assure that testing equipment used and tests performed are conducted according to the Specifications and industry standards;
- Document and report test results to the DPM;
- Report any deficiencies to the DPM and TM that are not corrected to the satisfaction of the QAC, including Design or Specification changes;
- Prepare a Construction Quality Assurance (CQA) Report describing the decommissioning, closure and reclamation activities, and details of field and laboratory test data; and
- Maintain an on-site soils laboratory and perform regular calibration of equipment.

### 1.12.2.7 Contractor

The Contractor is responsible for reclamation construction activities. The Contractor may provide Subcontractors to fulfill portions of the reclamation construction activities, which may include demolition, radiological surveying, earthworks, and revegetation.



## 1.12.3 Materials

### 1.12.3.1 Soil

Soil consists of all earth materials capable of being excavated with conventional earthwork excavation equipment without the use of rippers, hammers, or blasting, as may be required for rock. Soil shall be free from ore and windblown tailings materials, affected soil, debris, roots, branches, stumps or other organic matter. Soils to be used in the Tailings Cell Closure Cover may be a mixture of soils from different borrow sources to achieve the required gradation. No more than 10 percent of the soil volume shall contain particles greater than 6 inches in diameter. Clean soil considered acceptable for use as final cover material shall meet the following criteria:

- Soil shall be classified as an ML, CL, SP, SP-SM, SC, or SM soil type as defined by the USCS; and
- Soil shall have a Ra-226 concentration of less than or equal to the background criterion approved by CDPHE. Soil exceeding this background criterion is defined as tailings, affected soil, or windblown tailings.

### 1.12.3.2 Topsoil

Topsoil is the upper A soil horizon containing organic matter. Affected topsoil shall be excavated and placed in the Tailings Cell Vault area. Non-affected topsoil excavated during the reclamation activities shall be stockpiled for later use during re-vegetation.

### 1.12.3.3 Rock

Rock shall consist of all earth materials harder than soil, which must be excavated by ripping with a D9 Caterpillar bulldozer or equivalent equipped with a single shank ripper, hammering, or blasting. Rock has a Ra-226 concentration less than or equal to the CDPHE-approved background criterion.

### 1.12.3.4 Tailings

Tailings consist of milled ore materials which are a by-product of the extraction of uranium. The tailings are wastes hydraulically discharged to the Tailings Cells as identified on the Drawings. The tailings, for the purposes of this work, are subdivided into the categories described below:

- Coarse Tailings - Coarse tailings consist of all tailings materials of which the predominant fraction (i.e., greater than 50 percent) is retained on the No. 200 sieve (i.e., sand size), using the procedures outlined in ASTM D 422.
- Fine Tailings - Fine tailings are fine-grained and consist of all tailings materials of which the predominant fraction (i.e., greater than 50 percent) passes the No. 200 sieve (i.e., silts and clays), using the procedures described in ASTM D 422.



### 1.12.3.5 Windblown Tailings

Windblown tailings are surface soils consisting of tailings transported by wind. Windblown tailings represent one type of affected soil and shall be defined and handled as an affected soil.

### 1.12.3.6 Affected Soil

Affected soil is any soil in the mill area or adjacent areas that contains an average Ra-226 concentration greater than:

- The background cleanup criterion approved by CDPHE for excavated soil.

Or

- Five (5) picoCuries per gram (pCi/g) above the mean background concentration for soil that will remain in the upper 15 centimeters (cm) of soil; and
- Fifteen (15) pCi/g above the mean background concentration averaged over any other 15-cm layers of soil that will remain below the surface after reclamation.

Affected soil shall be delineated by the Owner's radiological survey during the course of the work. Affected soil shall be placed within the Tailings Cell.

### 1.12.3.7 Ore

Ore is rock, soil or other material which has been transported to the mill for uranium and/or vanadium extraction. For purposes of these Specifications, "ore" is any imported material in the tailings disposal or mill area, or adjacent areas that contains an average uranium content of 0.05% or more and/or a Ra-226 concentration greater than or equal to the criterion for affected soil. Prior to reclamation of the final Tailing Cell, the remaining ore shall be placed within the Tailings Cell Vault.

### 1.12.3.8 By-Product

By-product material is tailings and wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Non-tailings by-product material encountered during the performance of reclamation activities shall be treated in the same manner as tailings material.

### 1.12.3.9 Interim Cover

Interim cover is a two-foot or greater layer of soil placed on top of the tailings. A portion of the interim cover over the fine tailings may contain a synthetic geogrid for added support. Interim cover placed over the tailings shall be left in place during construction of the radon barrier unless excavation is necessary to achieve specified grades.



## 1.12.3.10 Tailings Cell Closure Cover Materials

Materials for use as closure cover soils shall be free of organic and inorganic debris, organic soils, frozen material, and other deleterious materials, and shall be excavated and/or processed, as required. The physical properties of materials for use as cover soils are described in the following sections.

Interim Cover - Interim Cover will consist of on-site colluvium and alluvium materials. Interim Cover shall be derived from on-site stockpiles developed during project construction, consisting predominantly of material sourced from local excavations within the Tailings Cells, or other approved borrow sources.

Interim Cover shall consist of material having Unified Soil Classification (USCS) of SP, SW, SC, SM, ML, CL or CH. Interim Cover will have a maximum particle size of eight (8) inches or sixty-seven (67) percent of the approved lift height, whichever is smaller. Oversized material will be controlled through selective excavation at the stockpiles, and through the use of construction equipment to cull oversize from the fill, or break down the oversize materials.

~~Geosynthetic Liner – Geosynthetic Liner shall be placed over the Interim cover and shall consist of the laminated GCL, Bentomat<sup>®</sup> CL or Bentomat<sup>®</sup> CLT produced by CETCO Lining Technology (1350 West Shure Drive, Arlington Heights, Illinois 60004), or approved equivalent.~~

Radon Barrier - Radon Barrier materials will consist of on-site colluvium and alluvium materials. Radon Barrier shall be derived from on-site stockpiles developed during project construction, consisting predominantly of material sourced from local excavations within the Tailings Cells, or other approved borrow sources. Radon Barrier shall consist of material having USCS of SP, SW, SC, SM, ML, CH or CL. Radon Barrier will have a maximum particle size of five (5) inches or sixty-seven (67) percent of the approved lift height, whichever is smaller. Oversized material will be controlled through selective excavation at the stockpiles, and through the use of construction equipment to either cull oversize from the fill, or break down the oversize materials.

~~Geosynthetic Liner – Geosynthetic Liner shall be positioned in the upper portion of the Radon Barrier and shall consist of laminated GCL such as Bentomat<sup>®</sup> CL or Bentomat<sup>®</sup> CLT produced by CETCO Lining Technology (1350 West Shure Drive, Arlington Heights, Illinois 60004), or approved equivalent.~~

~~Capillary Break – The Capillary Break material shall consist of free-draining granular soil (sand and gravel) imported from off-site for use in the Capillary Break layer as shown in the design (refer to Kleinfelder 2009b). Specific soil gradation characteristics of the Capillary Break material shall be determined by the Task Manager for the Tailings Cell closure prior to Capillary Break construction.~~



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

~~Filter Layer – The Filter Layer shall consist of free-draining granular soil (sand) imported from off-site for use in the Filter Layer between the Capillary Break and Bio-Intrusion Barrier as shown in the design (refer to Kleinfelder 2009b). Specific soil gradation characteristics of the Filter Layer material shall be determined by the Task Manager for the Tailings Cell closure prior to Filter Layer construction.~~

Bio-Intrusion Barrier – The Bio-Intrusion Barrier shall be placed over the ~~Filter Layer~~Radon Barrier, as shown in the design (refer to Kleinfelder ~~2009b~~2010), to restrict burrowing by animals up to the size of prairie dogs. Bio-Intrusion Barrier shall consist of nominal three (3) inch rock (sound cobbles) in a native soil matrix.

Capillary Break - The Capillary Break material shall consist of free-draining granular soil (sand and gravel) imported from off-site for use in the Capillary Break layer as shown in the design (refer to Kleinfelder 2010). Specific soil gradation characteristics of the Capillary Break material shall be determined by the Task Manager for the Tailings Cell closure prior to Capillary Break construction.

Erosion Barrier – The Erosion Barrier (also referred to as the Vegetative Cover or Vegetative Cover Layer) shall be placed over the ~~Bio-Intrusion Barrier~~Capillary Break, as indicated in the design (refer to Kleinfelder ~~2009b~~2010), to resist erosion by wind and runoff as well as provide a growth medium for vegetative cover. The Erosion Barrier shall consist of native soil meeting the Interim Cover specifications, with rock mulch mixed in to the upper 0.5 feet of the Erosion Barrier. Rock mulch shall have a minimum  $D_{50}$  of 0.5 inches, and consist of durable rock (meeting the durability scoring criteria in Appendix D of NUREG-1623), and shall comprise approximately 20 percent of the upper 0.5 feet of the Erosion Barrier.



## 2.0 CLEARING AND GRUBBING

### 2.1 General

#### 2.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials, and required equipment and shall perform all operations in connection with clearing, grubbing, and topsoil removal in accordance with the Construction Drawings and these Specifications. This work shall also include the preservation from damage of vegetation and objects intended to remain.

#### 2.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 11.0 - Tailings Cell Closure Cover
- Section 13.0 - Vegetation
- Section 16.0 - Health and Safety

### 2.2 Products

Not applicable.

### 2.3 Execution

Clearing and grubbing shall be performed primarily within the approximate limits of the affected soil areas as shown on the Drawings. Clearing and grubbing within construction work areas to be disturbed as shown on the Drawings shall be considered incidental to other items of work specified herein. Clearing and grubbing shall also be performed to a minimum distance of 20 feet outside of the limits to be disturbed by construction activities. The work performed shall completely remove all brush and trees on the surface and major root systems near the surface. Vegetative debris shall be chipped and incorporated into a topsoil stockpile as designated by the Owner or shall be burned by the Contractor, if approved in writing by the Owner. Under no circumstances shall vegetated debris material be used in the Tailings Cell closure cover layers.

Following removal of trees and shrubs, unaffected topsoil containing roots, grasses, and forbs shall be stripped to a minimum depth of six inches. This material shall be stockpiled in a loose condition for later use as seed bed material for the areas to be revegetated. The topsoil stockpile shall be broadcast seeded with the seed mixture and at the application rate specified in Section 13.0, if it is not used for revegetation during the immediate construction season. Affected topsoil shall be placed in layers of eight inches or less within



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

the Tailings Cell and shall be compacted. Affected topsoil shall be placed below the Interim Cover and shall not be used for construction of the Tailings Cell Closure Cover. Affected and unaffected topsoil shall be delineated by the Owner's radiological survey during the course of the work.



## 3.0 UTILITY PROTECTION AND RELOCATION

### 3.1 General

#### 3.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall be responsible for the location, protection and, where necessary, relocation of the utility lines in the Piñon Ridge restricted areas and other areas as specified by the Reclamation Plan and shown on the Drawings.

All necessary coordination between the respective utility company and the relocation survey shall be performed by the Contractor at no additional cost to the Owner. All utilities shall be adequately protected during construction and, where necessary, relocated so as to not interfere with the lines and grades of the Reclamation Plan as shown on the Drawings. Any relocation of the utility lines shall be consistent with the requirements of the respective utility company and shall be approved by the Owner prior to initiation. Relocation may include lowering, elevating, laterally moving, or removing a specific utility line. Additional buried utilities may exist within the project area. A complete utility check shall be performed by the Contractor prior to construction to locate all buried utilities.

#### 3.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 6.0 - Affected Soil Excavation and Placement
- Section 11.0 - Tailings Cell Closure Cover
- Section 14.0 - Fencing
- Section 16.0 - Health and Safety

### 3.2 Products

Not applicable.

### 3.3 Execution

All utilities shall be located, protected and, where necessary, relocated prior to construction activities being performed in areas where utilities exist. The utilities shall be relocated in a manner that shall not interfere with the grade lines shown on the Drawings. Relocated buried utilities shall be placed and backfilled in accordance with the requirements of the utility company or local codes or ordinances. Utility lines relocated within the Colorado State Highway easement shall be placed and buried according to Colorado State



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Highway specifications. Unless otherwise stated in these Specifications, utility line relocation shall be on the same side of all roadways as existing locations.

Marker tape shall be placed 12 inches above all relocated underground lines. Laths shall be placed every 100 feet directly above relocated underground lines. Ownership of line and depth to line shall be indicated on the lath and flagged with a blue ribbon. After reconfiguration and final regrading, permanent markers shall be installed in accordance with the specifications of the respective utility company.



## 4.0 DECONTAMINATION

### 4.1 General

#### 4.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform decontamination activities in accordance with these Specifications.

Work shall include, but not be limited to, the following:

- Radiological survey data interpretation as provided by the Owner's radiological survey;
- Demarcation and isolation of contaminated areas;
- Radiological survey of equipment and materials prior to decontamination;
- Decontamination of contaminated equipment and materials;
- Radiological survey of equipment, materials and reclamation areas after decontamination; and
- Disposal of wastes produced during the decontamination process.

The contractor shall perform all work in strict accordance with the Health and Safety requirements included as Section 16.0 of these Specifications and procedures outlined in the Owner's Health and Safety Plan (EFRC 2009). These requirements include worker physical examinations, worker protective equipment, medical surveillance, and radiation monitoring during, but not limited to, activities related to equipment and material decontamination and release to areas below acceptable radiation limits.

#### 4.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 5.0 - Building Demolition and Debris Disposal
- Section 11.0 - Tailings Cell Closure Cover
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

#### 4.1.3 *Definitions*

A complete list of definitions is provided in Section 1.12.

#### 4.1.4 *Submittals*

Provide copies of the Radiation Work Permits (RWP) and the Equipment/Material Release forms to RSO or its representative after specific decontamination task is completed.

## 4.2 Products

None.



### 4.3 Execution

Decontamination procedures shall be executed in accordance with the Owner’s Health and Safety Plan (EFRC 2009) using the following procedures:

- Wash the equipment or material to remove contamination;
- Survey appropriate area based on the equipment/material classification;
- Determine alpha and beta emissions;
- Compare alpha and beta with the acceptable contamination limits (Table 1); and
- Release equipment and material with emissions at or below the acceptable limits.

Equipment and material that does not meet release criteria in Table 1 upon completion of the decontamination process shall be deposited in the Tailings Cell Vault in accordance with Section 5.0 of these Specifications. Surfaces of materials, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits and deposited in Tailings Cell Vault in accordance with Section 5.0 of these Specifications.

**Table 1: Acceptable Surface Contamination Levels**

Nuclides <sup>a</sup>	Average <sup>b,c</sup> (dpm per 100 cm <sup>2</sup> )	Maximum <sup>d,e</sup> (dpm per 100 cm <sup>2</sup> )	Removable <sup>d,e,f</sup> (dpm per 100 cm <sup>2</sup> )
Alpha Emissions from U-nat, U-235, U-238 and associated decay products	5,000	15,000	1,000
Alpha emissions from Ra-226, Ra-228, Th-230, Th-228, Ac-227	100	300	20
Alpha Emissions from Th-nat, Th-232, Ra-223, Ra-224, U-232	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission, except others noted above)	5,000	15,000	1,000

Notes:

- <sup>a</sup> Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.
- <sup>b</sup> As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
- <sup>c</sup> Measurements of average containment should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- <sup>d</sup> The maximum contamination level applies to an area of not more than 100 cm<sup>2</sup>.
- <sup>e</sup> The amount of removable radioactive material per 100 cm<sup>2</sup> of surface area should be determined by wiping that area with dry filters or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
- <sup>f</sup> The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.



## 5.0 BUILDING DEMOLITION AND DEBRIS DISPOSAL

### 5.1 General

#### 5.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with demolition and on-site disposal of the mill buildings, concrete and other debris associated with mill decommissioning.

The contractor shall perform all work in strict accordance with the Health and Safety procedures included in Section 16.0 of these Specifications and the Owner's Health and Safety Plan (EFRC 2009). These requirements include worker's physical examinations, worker protective equipment, medical surveillance, and environmental monitoring during, but not limited to demolition, earth moving and regrading activities.

#### 5.1.2 *Related Work*

- Section 2.0 - Clearing and Grubbing
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 5.2 Products

Not applicable.

### 5.3 Execution

#### 5.3.1 *General*

The decommissioning of mill facilities includes demolishing and disposing of the mill structures, equipment, asphalt, concrete pads and foundations, boneyard material, and appurtenant facilities as specified in greater detail in Section 7.0 - Mill Decommissioning of these Specifications. Contaminated demolition materials shall be placed in the Tailings Cell Vault. The main office building and concrete, and other foundation debris not removed as part of mill decommissioning shall be excavated and placed in the designated disposal area(s) specified in the Drawings, or if necessary, in the Tailings Cell Vault. During demolition, uncontaminated structural steel and miscellaneous equipment and materials may be salvaged for reuse. Salvage of materials shall be performed in accordance with the Decommissioning Plan approved by the CDPHE.

#### 5.3.2 *Disposal Method*

All debris, regardless of dimensions, shall be placed in a disposal area in a manner that fills the voids with soil/cement slurry or soil to the extent practicable. Debris which has natural voids shall be broken down to



the extent possible (e.g., large tanks shall be cut into pieces to minimize voids). Debris shall be stacked in lifts of nominal 5-foot thickness, then flooded with soil/cement slurry designed to flow into and fill the residual voids in the debris prior to setting. The mix may include coarse tailings, affected soil, soil, stockpiled materials, cement, slag, fly ash and water, and will have low strength (less than 500 psi compressive strength). Soils and/or affected soils may be placed with the debris and above the debris to allow the debris to be driven over with equipment to further reduce voids and minimize long-term settlement.

### 5.3.2.1 Demolition Debris Disposal

Demolition debris will be reduced in size to maintain the 5-foot deposition lift limitation, and to reduce volume prior to Tailings Cell Vault disposal. Materials exceeding these limits will be reduced to within acceptable limits by breaking, cutting or other approved methods. Empty drums, tanks, or other objects having a hollow volume greater than 5 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 soil/cement slurry and/or other approved materials to enter the object at the time of covering in the Tailings Cell Vault. The demolition debris, after having been reduced in dimension and volume (if required), will be placed in the Tailings Cell Vault as directed by the ~~Quality Assurance Coordinator (QAC) (see Section 1.12.2). 1.12.2.6 — Quality Assurance Coordinator (QAC).~~

Any demolition debris allowed to be placed in a Tailings Cell Vault will be spread across the top of the tailings surface to avoid nesting, and to reduce the volume of voids present in the disposed mass. Soil/cement slurry and/or other approved materials will be placed into the demolition debris in sufficient quantity to fill the voids between the large pieces, and the volume within the hollow pieces. The debris will vary in composition, size and shape; therefore, debris will be selectively handled such that larger less compressible debris is mixed with smaller material to reduce residual voids in the deposited debris. Approval of the ~~Decommissioning Project Manager (DPM) (see Section 1.12.2) 1.12.2.2 — Decommissioning Project Manager (DPM)~~ or a designated representative will be required for use of materials other than those specified for the purpose of filling voids.

### 5.3.2.2 Compaction Requirements

The demolition debris, affected soils and other materials for the first lift will be placed over the existing tailings surface to a nominal depth of 5 feet in a bridging lift to allow access for construction equipment. The first lift will be compacted by tracking with a Caterpillar D6 dozer (or equivalent) at least four times prior to the placement of a subsequent lift. Subsequent layers will be placed in nominal 5-foot lifts, and will be compacted to the same requirements.

Affected soils placed after the initial bridging lift will be compacted to at least 80 percent of the standard Proctor maximum dry density (ASTM D698).



### **5.3.3 Disposal Locations**

The demolition debris shall be reduced to approximately 5 feet in length or less and placed in the Tailings Cell Vault except for the steel beams and columns with the maximum dimensions reduced to 12 inch x 8 inch x 20 feet prior to disposal in the Tailings Cell Vault (with long dimension placed horizontally). If the sequence of site-wide reclamation necessitates disposal elsewhere, the Tailings Cell Top areas (other than Tailings Cell Vault) may be used for disposal purposes upon approval by the Owner. If Tailings Cell areas other than the Tailings Cell Vault are used for disposal, the contaminated debris shall be placed in the lower portion of a fill section in accordance with the procedures described in Section 5.3.2 above.

### **5.3.4 Backfilling**

After debris disposal has been completed, the respective disposal area shall be backfilled to the subgrade contours shown on the Drawings using affected soils and/or soil. Placement and compaction of the backfill soils shall be performed in accordance with Section 6.0 of these Specifications.



## 6.0 AFFECTED SOIL EXCAVATION AND PLACEMENT

### 6.1 General

#### 6.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with affected soil excavation and placement in accordance with the Drawings and these Specifications.

Work shall include, but not be limited to, the following:

- Surface erosion control;
- Construction of access roads and dust suppression;
- Excavation of affected soils;
- Regrading of excavated areas;
- Placement of the affected soil; and
- Maintenance and monitoring of settlement monitoring points.

The Contractor shall be responsible for providing all surveying necessary to excavate affected soil to the lines and grades determined by the Owner's radiological survey and to place the affected soil to the lines and grades shown in the Drawings. The contractor shall perform all work in strict accordance with the Health and Safety requirements and procedures included as Section 16.0 of these Specifications. These requirements include worker physical examinations, worker protective equipment, medical surveillance, and environmental monitoring during, but not limited to, all earth moving and regrading activities.

#### 6.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 3.0 - Utility Protection and Relocation
- Section 5.0 - Building Demolition and Debris Disposal
- Section 11.0 - Tailings Cell Closure Cover
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

#### 6.1.3 *Definitions*

A complete list of definitions is provided in Section 1.12.



## 6.1.4 Submittals

Upon placement of the affected soil within the Tailings Cell, the Contractor shall provide the Owner with as-built drawings showing the elevations and grades of the Tailings Cell and the thickness of the affected soil cover.

## 6.2 Products

Materials to be used for erosion control such as silt fences, straw bales, and fast growing seed mixes shall require Owner approval prior to installation or application.

## 6.3 Execution

### 6.3.1 Radiological Survey

#### 6.3.1.1 Initial Soil Survey

An initial gamma (direct radiation) survey will be performed by the Owner to evaluate potential areas where soil contamination might exceed background radium levels, based on gamma-radium correlations established in the baseline radiological investigation (ERG 2009). Areas with potentially affected soils include, but are not limited to, evaporation ponds, mill and ore pad areas, Tailings Cell and windblown tailings areas and all other areas identified by the Owner's radiological survey. The initial gamma survey will be performed on grids with 100-foot (30-meter) spacing across the disturbance area. Closer survey intervals will be applied to delineate the extent of contamination, if detected within the 100-foot survey.

Soil sampling will be conducted on a 30-foot (10-meter) grid at locations that register gamma readings correlating with Ra-226 concentrations exceeding 5 pCi/g above background. Samples will be tested for Ra-226 concentrations at depth intervals of 0 to 15 cm, and over a 15 cm thick layer of soils more than 15 cm below the surface. The necessity of conducting Th-232/Ra-228 testing (refer to NUREG 1620 [Appendix H]) as part of the initial survey (or verification survey discussed below, ~~Section 0~~) will be determined from analyses of ore, tailings, and process fluids conducted during mill operations.

Where surveys indicate that the above criteria have not been achieved, the soil will be removed to meet the criteria. Affected soil will be excavated and transported to the Tailings Cell for disposal. Placement and compaction will be in accordance with Section 6.3.6 of these Specifications. Affected areas will be resurveyed as needed to achieve levels not exceeding 5 pCi/g of Ra-226 above background.

If required to assess potential doses from affected soil as a basis for making decisions about the extent of soil clean-up, the RESRAD code will be used to estimate radiation doses and risks from residual radioactive materials in the soil.



## 6.3.1.2 Verification Survey

After soil clean-up has been performed, and before closure of the final Tailings Cell, a verification survey will be conducted on a 30-foot (10-meter) grid on areas used (and possibly contaminated) during the decommissioning process, or that were found to have excessive Ra-226 levels in the soil during the initial survey. Soil samples will be collected as described for the initial survey at grid points where gamma readings indicate that excessive Ra-226 may persist after clean-up, and at random grid locations constituting up to 10 percent of the initial survey grid points.

## **6.3.2 Erosion Control**

Erosion control consisting of silt fences, straw bales, berms, ditches, sedimentation basins, or other suitable methods shall be constructed, as needed, to minimize erosion and prevent solids from migrating into drainage areas. Erosion control measures shall be in place and approved by the Owner prior to performing excavation or grading within or adjacent to drainage areas.

## **6.3.3 Access Roads and Dust Suppression**

The construction and maintenance of access roads as required to perform the work described in these Specifications is the responsibility of the Contractor. The Contractor shall utilize adequate volumes of water from an Owner-supplied on-site source for dust suppression on haul/access roads and stockpiles, and for all excavation, grading and compaction work.

## **6.3.4 Excavation of Affected Soils**

Affected soil excavation and grading shall include: affected mill area soil excavation, windblown tailings excavation, and excavation and grading of all other affected soil areas identified by the Owner's radiological survey. The extent and depth of excavation at each of these locations shall be determined by the Owner's radiological survey. In undisturbed areas, excavation and grading operations shall begin by clearing and grubbing of the work area as detailed in Section 2.0 of these Specifications. Care shall also be taken not to damage existing power line poles or buried utility lines during excavation operations. Any remaining foundation materials and debris encountered within excavations and fill materials shall be removed and disposed in accordance with Section 5.0 of these Specifications. If windblown tailings require removal from the State Highway 90 or State Highway 90 access road, appropriate traffic control shall be used in accordance with Colorado State Highway regulations. Any damage to state property such as asphalt or fences shall be repaired at the cost of the Contractor. Proper notification to local and state authorities shall be conducted prior to performance of work in these off-site areas. Any tailings material encountered during excavation of the affected soil areas shall be uniformly placed on the Tailings Cell surface in accordance with Section 6.3.6 of these Specifications. Similarly, any excavated material that is not affected soil may qualify for use as clean soil in the final Tailings Cell closure cover described in Section 11.0 of these specifications



and shall be stored at disposal area(s) designated by the Owner. Wherever practical, the more contaminated soils shall be excavated first and placed in the initial lift within the Tailings Cell.

### **6.3.5 *Regrading of Excavated Areas***

After the radiological survey confirms that all of the affected soils have been removed from a given location, the area shall be graded and stabilized as follows:

- Areas that will not be significantly disturbed by future reclamation activities shall be graded to be free draining and to meet the contours shown on the Drawings or, if not shown, the approximate contours of adjacent areas. These areas shall then be revegetated in accordance with the specifications provided in Section 13.0. Erosion control measures shall remain in place and be maintained until the area exhibits adequate revegetation as determined by the Owner.
- Areas that will be re-disturbed by reclamation activities at a later time (i.e., during future construction seasons) shall be graded to be free draining and stable. Erosion control measures shall remain in place and be maintained in these areas until reclamation is completed. The Owner may also require the Contractor to seed these areas with a fast-growing annual seed mix for erosion control purposes.
- Areas that will be excavated for Tailings Cell Closure Cover materials (i.e., unaffected soil) during the immediate construction season shall be regraded to the final contours shown on the Drawings after excavation has been completed. These areas shall be reclaimed in accordance with the specifications provided in Section 13.0 after the Tailings Cell Closure Cover is completed.

### **6.3.6 *Placement of the Affected Soil***

Unless used as a part of the flowable mix for filling debris voids as specified in Section 5.3.2, the excavated affected soil shall be placed at the surface of the Tailings Cell in controlled lifts. If not used as a part of the flowable mix, the affected soil shall be placed in maximum 12-inch-thick lifts, measured loose, and tracked into place with earth moving equipment to yield at least 85 percent of the maximum dry density using the Standard Proctor compaction method (ASTM D698). Water shall be applied, as necessary, to improve the compaction and material handling characteristics of the soil. Testing methods and frequencies are presented in Section 15.0, Construction Quality Assurance.



## 7.0 MILL DECOMMISSIONING

### 7.1 General

#### 7.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations according to the Mill Decommissioning Plan (Kleinfelder ~~2009e~~2009b) for the mill buildings, equipment, West Stormwater Pond and other structures and soils at the mill site.

The contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications. These requirements include worker's physical examinations, worker protective equipment, medical surveillance, and environmental monitoring during, but not limited to demolition, earth moving and regrading activities.

#### 7.1.2 *Regulatory and Guidance Requirements*

The work shall be conducted in accordance with applicable regulations and industry practices. Regulatory requirements and Guidance Requirements for decommissioning of the Piñon Ridge mill are contained in 6 CCR 1007-1, Part 3, RH 3.16.4 and in 6 CCR 1007-1, Part 18, RH18.3.1.5, RH18.8 (Decommissioning Requirements) and in Criteria 5A , 6(6) and 6(7) of Appendix A thereto. Additional guidance for decommissioning plans is provided by the U. S. Nuclear Regulatory Commission (NRC) in NUREG 1757, Vol. 1 (NRC 2006) and in NUREG 1620 (NRC 2003), as well as Regulatory Guide 4.14 (NRC 1980). The contents of the Mill Decommissioning Plan are organized according to the applicable topics of Table D.1, Appendix D of NUREG 1757.

#### 7.1.3 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 4.0 - Decontamination
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 7.2 Products

Not applicable.



## 7.3 Execution

### 7.3.1 *Systems and Equipment Decommissioning*

The uranium and vanadium processing areas of the mill, including all equipment, structures, and support facilities, will be decommissioned and disposed of in the Tailings Cell Vault, or removed from site for alternative use (refer to Sections 0 and 0). All equipment to be disposed in the final Tailings Cell will be cut up and removed in general accordance with Section 5.0 of these Specifications.

#### 7.3.1.1 Uncontaminated Systems and Equipment

Upon permanent cessation of milling, the inventory and radiological assessment (surveying) of mill systems and equipment will be updated following the procedures outlined in Section 6.3.1, with the exception that a closer grid spacing of 30 feet (10 meters) will be employed within identified areas of contamination. Based on the results of these surveys and the radiological release limits in effect at the time of decommissioning, the systems and equipment will be classified as uncontaminated or contaminated. Prior to removal of contaminated equipment, other equipment, materials and structures that are shown by appropriate screening procedures to be uncontaminated (radiological levels below release limits) will be removed from the mill area and sold, recycled for off-site use, or disposed of in accordance with regulatory requirements in effect at that time.

#### 7.3.1.2 Contaminated Systems and Equipment

After uncontaminated systems and equipment are removed from the mill area, the systems and equipment that are known or likely to be contaminated above release limits will be removed from the mill area and placed in the Tailings Cell Vault, or will be decontaminated and scanned prior to leaving the mill site in accordance with Section 4.0 of these Specifications.

### 7.3.2 *Buildings, Structures and Soils Decommissioning*

Concrete structures and foundations will be demolished and removed for disposal in the Tailings Cell Vault, unless radiation surveys indicate they are below cleanup levels and CDPHE approves their in-place burial. Demolition and disposal of building, structures and soils shall be conducted per the Mill Decommissioning Plan and in general accordance with Section 5.0 and Section 6.0 of these Specifications.



## 8.0 ORE PAD RECLAMATION

### 8.1 General

#### 8.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with ore pad reclamation in accordance with the Drawings and these Specifications.

Work shall include, but is not limited to, the following:

- Removal of remaining ore and cushion material;
- Removal of synthetic liners, and any affected soils
- Removal of the dumping platform;
- Demolition and removal of the concrete ore pad;
- Removal of synthetic liners and reclamation of East Stormwater Pond; and
- Reclamation of the ore pad footprint (e.g., grading, topsoil placement, revegetation).

The Owner shall use stakes to designate the extent of the reclamation areas identified herein. The Contractor shall be responsible for providing all surveying necessary to conduct earthwork to the lines and grades specified on the Drawings.

The ~~contractor~~ Contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications.

#### 8.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 8.2 Products

None.



## 8.3 Execution

All demolition and material removal activities shall be conducted in accordance with Section 5.0 and Section 6.0 of these Specifications. After removal of the ore pad construction materials, an initial gamma (direct radiation) survey will be performed by the Owner to evaluate potential areas where soil contamination might exceed background radium levels following the procedures outlined in Section 6.3.10, with the exception that a closer grid spacing of 30 feet will be employed. All affected materials will be excavated and disposed of in the Tailings Cell in accordance with Section 5.0 and Section 6.0 of these specifications. At completion of clean-up, a verification survey will be conducted following the procedures outlined in Section 6.3.10.

Disturbed areas will be graded, covered, and vegetated per Section 6.3.5 of these Specifications.



## 9.0 EVAPORATION PONDS RECLAMATION

### 9.1 General

Reclamation of the evaporation ponds consists of evaporating each cell dry; removing raffinate precipitants (solids), synthetic liners, and any affected soils for disposal in the Tailings Cell Vault; and reclamation of the evaporation pond footprint (e.g., grading, topsoil placement, revegetation). Decommissioning of the evaporation ponds may occur in phases by consolidating raffinate solutions into a reduced number of cells during the reclamation process.

#### 9.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with evaporation pond reclamation in accordance with the Drawings and these Specifications.

Work shall include, but is not limited to, the following:

- 1) Removal of raffinate solids;
- 2) Removal of synthetic liners, and any affected soils; and
- 3) Reclamation of the evaporation ponds footprint (e.g., grading, topsoil placement, revegetation).

The Owner shall use stakes to designate the extent of the reclamation areas identified herein. The Contractor shall be responsible for providing all surveying necessary to conduct earthwork to the lines and grades specified.

The ~~contractor~~ Contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications.

#### 9.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 9.2 Products

None.



## 9.3 Execution

### 9.3.1 Reclamation Sequence

All demolition and material removal activities shall be conducted in general accordance with Section 5.0 and Section 6.0 of these Specifications. Decommissioning of the evaporation ponds may occur in phases by consolidating raffinate solutions into a reduced number of cells during the reclamation process.

The reclamation of evaporation ponds will consist of the following activities:

- 1) Drying, removal and disposal of evaporation pond solids in general accordance with Section 6.0 of these Specifications;
- 2) Removal and disposal of geosynthetic components and affected soils in general accordance with Section 5.0 and Section 6.0 of these specifications; and
- 3) Verification survey of Ra-226 levels per Section 6.3.10 of these Specifications.

### 9.3.2 Removal of Contaminated Materials

Affected soils and evaporation pond solids (mixed with soil) shall be spread over the tailings surface as practicable to provide relatively uniform settlement and consolidation rates. These materials shall be removed, placed and compacted in accordance with the guidance provided in ~~Section 0~~[this section](#) and Section 6.3.6 of these Specifications.

Removal and disposal of geosynthetics shall be conducted in accordance with the guidance provided in ~~Section 0~~[this section](#) and Section 5.0 of these Specifications.

#### 9.3.2.1 Evaporation Pond Solids

Evaporation pond solids will be allowed to dry, and then mixed with soil as needed to excavate and handle as dry solids for disposal in the Tailings Cell Vault. Placement of the evaporation pond solids will be performed as a soil fill in general accordance with Section 6.3.6. Actual excavation and placement procedures will be in general accordance with Section 6.0 of these specifications. Adjustments to general disposal and excavation procedures may be re-evaluated by the QAC during the construction process and implemented by Contractor after Owner's approval.

#### 9.3.2.2 Synthetic Liners

High density polyethylene (HDPE) geomembrane liner, HDPE geonet, and geosynthetic clay liner (GCL) will be cut up, folded or rolled (when necessary), removed from the evaporation ponds, and transported to the Tailings Cell Vault for disposal. The geosynthetic materials shall be spread as flat as practical over the designated area.



## 10.0 TAILINGS REGRADING AND INTERIM COVER PLACEMENT

### 10.1 General

#### 10.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials, and required equipment and shall perform all operations in connection with tailings regrading and interim cover excavation in accordance with the Drawings and these Specifications. Incremental closure of the tailings cells is anticipated, with closure of Tailings Cells A and B ~~occurring~~ occurring during mill operations, and closure of Tailings Cell C (including the Tailings Cell Vault) ~~occurring~~ occurring during decommissioning and closure of the mill. Work shall include, but not be limited to, the following:

- 1) Construction of access roads and dust suppression;
- 2) Abandonment of tailings dewatering (underdrain) system;
- 3) Surface water control;
- 4) Regrading of Tailings Cell Top;
- 5) Construction of Interim Cover; and
- 6) Installation, maintenance and monitoring of settlement monitoring points.

The Owner shall use stakes to designate all areas subjected to earthwork operations identified herein. The Contractor shall be responsible for providing all surveying necessary to conduct earthwork to the lines and grades specified.

The Contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications.

#### 10.1.2 Related Work

- Section 1.0 - General Project Requirements
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

#### 10.1.3 Definitions

A complete list of definitions is provided in Section 1.12.



## 10.1.4 Submittals

Upon completion of tailings regrading and placement of the interim cover, the Contractor shall provide the Owner with as-built drawings showing:

- The elevations and grades of the regraded tailings surface;
- The thickness of the interim cover layer over the tailings area placed by the Contractor; and
- The lines and grades of the interim berms.

## 10.2 Products

Materials to be used for erosion control such as silt fences and straw bales shall require Owner approval prior to installation.

## 10.3 Execution

### 10.3.1 General

Regrading of the tailings shall be performed to achieve the lines and grades (i.e., slopes, locations of channels) shown on the Drawings. The top of the Tailings Cell shall be regraded to the lines and grades shown on the Drawings. Tailings Cell Drainage Channels shall be constructed to the lines and grades shown in the Drawings and according to Section 12.0 of these Specifications.

Allowance for additional subsidence of the fine tailings area at the center of the cell as compared to the coarser tailings areas in the proximity of the discharge points, due to differential settlement, shall also be incorporated into the tailings grading plan and work schedule.

The final tailings elevations shown on the Drawings are approximate and may change depending on several factors including:

- 1) The amount of subsidence experienced by the Tailings Cell Top after placement of cover materials;
- 2) The volume of affected soil excavated from the mill and surrounding areas, as identified by the Owner's radiological survey, and placed in the Tailings Cell; and
- 3) The volume of interim cover materials placed over the top of the Tailings Cell.

The interim elevations of the Tailings Cell Top shall be determined during construction and shall be shown on the as-built drawings provided by the Contractor upon completion of the interim cover. Once the Tailings Cell dewatering is completed (after at least two quarters following the Tailings Cell cover construction), the dewatering system shall be properly plugged and abandoned in accordance with Section 10.3.3.



### 10.3.2 Access Roads and Dust Suppression

The construction of access roads as required to perform the work described in these Specifications is the responsibility of the Contractor. The Contractor shall utilize adequate volumes of water from an Owner-supplied on-site source for dust suppression on haul/access roads and stockpiles and for all grading and compaction work.

### 10.3.3 Dewatering (Underdrain) System Abandonment

The dewatering system will be used to monitor water levels in the sump riser pipes until completion of tailing cover construction and for a minimum of two consecutive quarters thereafter to confirm that no additional liquid is being collected in the sump. Once dewatering is complete in each cell, the system in that cell will be decommissioned. The sumps and risers will be backfilled with bentonite pellets and flooded with water to hydrate the bentonite and induce it to swell and seal the system. Risers will be cut off at least 3.0 feet below final cover surface.

### 10.3.4 Surface Water and Erosion Control

The Contractor shall perform all work in a manner that minimizes surface water runoff into exposed tailings and construction or fill areas. Surface water runoff from exposed tailings shall be collected and pumped, if necessary, ensuring no discharge outside the Tailings Cell area. Erosion control consisting of silt fences, straw bales, berms, ditches, and sedimentation basins shall be constructed as needed to minimize erosion and prevent migration of solids into drainage areas.

### 10.3.5 Regrading

Regrading of the tailings surface shall be performed to achieve the general configuration represented by the lines and grades shown on the Drawings. The tailing surface will be regraded after dewatering and before placement of the interim cover.

The amount of tailings excavation shown on the Drawings is based on the optimal position of the top surface of the radon barrier to be placed subsequently. The objective is to have the top of the radon barrier merge at a slope of 0.02 with the top of the Tailings Cell berm. To accomplish this objective, tailings above the base level of excavation shown on the Drawings will be relocated to create the space needed to place the interim cover and radon barrier. Tailings near the perimeter of each cell will be graded away from the inside slope of the Tailings Cell toward the cell interior. This regrading will create the vertical space, ~~6.77.7~~ feet, above the base level of tailings excavation for the 2.0 feet of interim cover and the ~~4.75.7~~ feet of cover needed at the ~~outer limit~~center of the tailings, where the final tailings thickness will ~~then be 1.0 foot or less~~be greatest.

From a point approximately ~~68-65 to 70~~ feet inside of each Tailings Cell ~~crest~~berm, the regraded tailings surface will ramp upward at a 0.02 slope to converge with the similar regraded surfaces from the other sides



of the tailing cell, as shown on the Drawings. This surface will be parallel to, and ~~9.07.7~~ feet below, the top of the radon barrier providing the space for 2.0 feet of interim cover and ~~7.05.7~~ feet of radon barrier to be placed subsequently. Any internal containment berms within each cell will be incorporated into the regraded configuration of the cell.

### 10.3.6 Placement of Interim Cover

Interim Cover shall be placed as soon as possible after regrading of the tailings surface, and placed progressively from the edges of each Tailings Cell toward the center. The Contractor shall add moisture to Interim Cover materials only if needed for dust control, as underlying tailings are expected to have high moisture content at the time of Interim Cover placement. The Contractor shall use low ground pressure dozers (Caterpillar Model D6LGP, or equivalent) for Interim Cover placement due to the condition and strength of the tailings surface at the time of construction.

The Interim Cover materials shall be placed in maximum 12-inch loose lifts, and compactive effort shall be adequate to obtain a density of eighty-five (85) percent of the maximum dry density as determined by the standard Proctor test (ASTM D698).

### 10.3.7 Settlement Monitoring Points

After regrading of the tailings and placement of the Interim Cover, settlement monitoring points will be installed to provide the means for measuring the settlement of tailings prior to, ~~during, and after~~ placement of the ~~Radon Barrier and the final cover. Geosynthetic Liner.~~ ~~Prior to placement of the Geosynthetic Liner near the top of the Radon Barrier layer, the settlement monitoring points will~~ ~~shall be surveyed and decommissioned.~~ ~~The settlement monitoring points will be re-installed again after placement of the Radon Barrier is complete and to monitor settlement of the~~ final cover. The total number and locations of settlement monitoring points to be installed on top of the Tailings Cell are shown on the Drawings.

Settlement monitoring points will be installed on a 200 ft north-to-south by 300 ft east-to-west pattern across each tailing cell, with the center of the pattern being the center point of the cell as shown on the Drawings. Each settlement monitoring point will consist of:

- A steel base plate placed on the top surface of the tailings;
- A vertical steel riser pipe or rod, welded to the base plate, threaded at the top end;
- A steel guard pipe, with diameter at least 2 inches larger than the riser, set over the riser and resting on (but not connected to) the base plate and threaded at the top; and
- A steel cap threaded to fit the top of the guard pipe.

Settlement monitoring points shall be extended upward when the ~~additional lifts of Interim Cover and/or~~ various components of the final cover are added, ~~at a later time~~ as necessary for the settlement point to



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

remain at least 2.0 feet above the surrounding surface. Additional lengths of ~~both~~ the riser and the guard pipe as well as external couplings for each will be used ~~(as shown on the Drawings,) to extend each settlement point so that the riser and guard pipe remain at least 2.0 feet above the surrounding cover surface.~~

The contractor shall clearly flag the settlement monitoring points to avoid damage by construction equipment and shall extend or lower the height of the settlement monitoring points, as necessary, as fills and cuts are made in the immediate vicinity. Construction equipment shall maintain a minimum 5-foot distance from all settlement monitoring points. Fills, cuts, and compaction within five feet of each settlement monitoring point shall be performed by hand. The Contractor shall survey the initial elevation of the settlement monitoring points after installation and periodically during subsequent construction, as specified in Section 15.0, Construction Quality Assurance. If a settlement monitoring point is disturbed during construction, all construction in the immediate area shall be discontinued and the settlement monitoring point shall be resurveyed to a new/corrected base elevation.

~~Settlement monitoring points shall be surveyed and temporarily decommissioned only after 90 percent of initial consolidation has been achieved from placement of the Interim Cover and after receiving approval for decommissioning the monitoring points by CDPHE as outlined in Section 15.3.2 prior to installation of the Geosynthetic Liner. The~~ settlement monitoring points shall be decommissioned as described below in Section 10.3.7.2, and re-installed after completion of the Radon Barrier installation placement.

The period of settlement monitoring that follows the final cover placement is estimated to be two to five years, after which the settlement monitoring points will be abandoned in place. The settlement monitoring program and abandonment measures are described below ~~in Section 0 and Section 0, respectively.~~

### 10.3.7.1 Survey Frequency

Settlement monitoring points will be surveyed initially as soon as possible after installation to obtain a baseline set of coordinates for the top of each riser. The northing, easting and elevation of the top of the riser will be surveyed to a precision of 0.05 feet, and an accuracy of 0.1 feet (northing and easting) and 0.05 feet (elevation). Survey control points shall be established with the same precision and accuracy at the Tailings Cell berm corners, providing line of sight to each monitoring point from at least two of these control points.

Settlement monitoring points shall be surveyed prior to and immediately after each extension. Settlement monitoring points and survey control points shall be surveyed daily when earthwork is occurring in the immediate vicinity, weekly during the initial month after placement of the Interim Cover and, monthly thereafter. Similarly, Contractor will execute daily monitoring of settlement monitoring points and survey control points when the Tailings Cell Closure Cover construction activities are within 10 feet of settlement



~~monitoring points, weekly during the initial month after placement of the Tailings Cell Closure Cover Materials, monthly~~ during the subsequent quarter, and quarterly thereafter. ~~Quarterly m~~Monitoring frequency will be the same after placement of the Radon Barrier and shall continue on a quarterly basis during the first ~~two years after construction of the Radon Barrier, and will continue~~ for at least two ~~quarters~~ years after construction of the final (evapotranspiration) cover. Survey frequency after that time shall be sufficient to track the settlements until an asymptotic value is identifiable in the time-settlement record. Survey measurements will be recorded in a format that can be directly imported into a GIS database maintained by the Owner and accessible to CDPHE. Each survey record will be signed and stamped by a Licensed Professional Engineer or Surveyor in the State of Colorado.

### 10.3.7.2 Settlement Monitoring Point Decommissioning

~~When CDPHE concurs with the Owner that 90 percent consolidation of the Interim Cover has been achieved, the settlement monitoring points will be removed after excavating to the base of the settlement monitoring point, or abandoned in place after cutting the metal rod extension 6 inches below the surface of the Interim Cover. The soils excavated during the settlement monitoring point removal or abandonment shall be replaced and compacted using the criteria for the Interim Cover placement as specified in Section 10.3.6.~~

When CDPHE concurs with the Owner's findings that settlements of the final cover are complete and monitoring can cease, the settlement monitoring points shall be decommissioned. The same procedure identified herein should be followed for temporary decommissioning of settlement monitoring points, as discussed above. The Contractor shall remove the monitoring points by excavating around each monitoring point and cutting off or removing the metal rod extension 6 inches below the surface of the cover material. This space below the ground surface to within 6 inches of the final cover surface shall be replaced by the same rock mulch/soil mixture used in the top 6 inches of the Tailings Cell Closure Cover, placed and compacted by hand.

### **10.3.8 Radon Flux Measurements**

#### 10.3.8.1 In-Place Radiological Testing of the Tailings

The Owner shall provide the CDPHE with a radiological sampling and testing report for each Tailings Cell after placement of the Interim Cover, but prior to installation of the ~~Geosynthetic Liner~~ Geosynthetic Liner and Radon Barrier. The testing report shall provide Ra-226 activity levels and other test parameters for the Interim Cover and tailings materials as described in Section 15.3.3.



## 11.0 TAILINGS CELL CLOSURE COVER

### 11.1 General

The Tailings Cell Closure Cover, in combination with the Tailings Cell, will provide the system of barriers for the long-term containment of the tailings according to the closure criteria in Appendix A of 6 CCR 1007-1, Part 18. The Tailings Cell closure design was based on the following performance objectives:

- Provide containment of by-product for 1,000 years (Criterion 6(1)(i));
- Limit radon flux from the cover surface to  $<20 \text{ pCi/m}^2\text{s}$  (Criterion 6(1)(ii)); and
- Limit infiltration of moisture into, and release of contaminated liquid from, the tailings (Criterion 5B(1), 5E(3), 6(7), 7).

Details of the Tailings Cell design are presented in Golder (2008c) and details of the Tailings Cell closure design are presented in Kleinfelder (~~2009~~2010).

#### 11.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with grading of drainage channels and excavating and placing soil and radon barrier layers in accordance with the Construction Drawings and these Specifications. Work shall include, but not be limited to, the following:

- Surface erosion control;
- Construction of access roads and dust suppression;
- Placement of the Tailings Cell Closure Cover;
- Excavation and grading of closure channels; and
- Maintenance and monitoring of settlement monitoring points.

The Owner shall use stakes to designate all areas to be subject to the earthwork operations identified herein. The Contractor shall provide all surveying necessary to conduct earthwork to the lines and grades specified in the Drawings including periodic surveys of settlement monitoring points throughout the course of the work. The Contractor shall comply with Health and Safety requirements in accordance with Section 16.0 of these Specifications unless relieved of these obligations by the Owner's Radiation Safety Officer.

#### 11.1.2 Related Work

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 3.0 - Utility Protection and Relocation
- Section 4.0 - Decontamination



- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 10.0 - Tailings Regrading and Interim Cover Placement
- Section 12.0 - Erosion Protection Placement
- Section 13.0 - Vegetation
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 11.1.3 Definitions

A complete list of definitions is provided in Section 1.12.

### 11.1.4 Submittals

Upon construction of the drainage channels and placement of the Tailings Cell Closure Covers on the Tailings Cell, the Contractor shall provide the Owner with as-built drawings showing the elevations and grades of the cell closure, including the associated channels. The thickness of each component layer of the Tailings Cell Closure Cover shall be surveyed.

## 11.2 Products

Materials to be used for erosion control such as silt fences and straw bales shall require Owner approval prior to installation.

## 11.3 Execution

The tailings will be closed and covered in phases, in accordance with Criteria 6(3) and 6A(1) of Appendix A, 6 CCR 1007-1, Part 18. The Tailings Cells will be covered in the same order that they were constructed. Cell A will be in the process of closure while Cell B is in operation, and Cell B will be undergoing closure while Cell C is in operation.

The first step in cover construction will be preparation of the cell surface for placement of the Interim Cover, and will begin as soon as the tailings surface is dry and firm enough to support earthwork equipment. The time of cover construction after cessation of cell operation will depend on the rate of dewatering of each cell.

### 11.3.1 Closure Cover Construction

A multi-layered earthen cover will be placed over the tailings cells during the staged Tailings Cell decommissioning process (refer to Section 1.12.30 [for Tailings Cell Closure Cover Materials](#)). This section outlines the material requirements and construction process.



## 11.3.1.1 General

Placement of cover materials will be based on a schedule determined by analysis of settlement data. Placement of the Radon Barrier shall begin only after initial consolidation of tailings due to the weight of the regraded tailings and Interim Cover is complete. Completion of initial consolidation shall be identified by the Owner and confirmed by the CDPHE as described in the Section 15.0 of these Specifications. Settlement monitoring points shall be installed and monitored in accordance with Sections 10.3.7 and 11.3.2 of these specifications. Prior to placement of the Radon Barrier, the tailings shall be resurveyed and regraded, where necessary, to conform to the lines and subgrades specified in the Drawings. Fill areas shall be scarified and soil placed and compacted in accordance with Section 6.0 of these Specifications. ~~Geosynthetic Liner rolls shall be placed with the minimum overlap recommended by the manufacturer over the full extent of the tailings surface.~~ As shown on the Drawings, the Radon Barrier shall consist of a minimum of ~~4.60.9~~ feet of radon barrier at the cell margin, where the tailings will be 1 ft or less, and a ~~maximum-minimum~~ of ~~7.05.7~~ feet over tailings areas with the thickness in excess of 15 feet. ~~Geosynthetic liner rolls shall be placed with the minimum overlap recommended by the manufacturer over the full extent of the tailings surface, and within the upper 0.9 to 1.0 ft of the Radon Barrier. The top of the Radon Barrier shall be constructed to maintain the positive drainage grade of 2 percent towards the Tailings Cell perimeter.~~ The lateral extents of cover components are shown on the Drawings. These dimensions shall be verified, and adjusted where necessary, based on the as-built drawings prepared after completion of tailings regrading and Interim Cover (See Section 10.0 of these specifications). Throughout the excavation and grading operations, debris encountered within excavations and fill materials shall be removed and disposed in accordance with Section 5.0 of these specifications. Any affected soils identified by the radiological survey shall be placed under the Interim Cover in accordance with Section 6.0 of these specifications. All work shall be performed in a manner that minimizes surface water run-on into construction or borrow areas. The Contractor shall also provide for adequate dust suppression and erosion control during the performance of all excavation, regrading, transportation, placement and compaction activities.

## 11.3.1.2 Materials

Closure cover materials used for cover construction are specified in Section 1.12.30.

## 11.3.1.3 Radon Barrier Placement

Radon Barrier shall be placed over the Interim Cover materials after the tailings settlement monitoring data indicates that primary settlement (settlement resulting from consolidation of tailings due to dewatering) has reached approximately 90 percent of the asymptotic value on the log time-settlement curve.

Prior to placement of Radon Barrier material above the Interim Cover, the Contractor shall scarify the in-situ material to a depth of 6 inches, moisture condition, and recompact the subgrade. Compactive effort and



moisture conditioning of the Interim Cover shall be adequate to obtain the dry density and moisture content within the range specified in Section 15.3.5.

Radon Barrier material shall be conditioned to a moisture content that allows compaction to the required density and that results in a firm, unyielding surface capable of allowing the movement of vehicles and equipment over the surface without causing rutting or other deleterious effects. Radon Barrier materials shall be placed in maximum 8-inch loose lifts, and compactive effort and moisture conditioning shall be adequate to obtain the dry density and moisture content within the range specified in Section 15.3.5. No density measurements will be taken during the placement of the final lift of the Radon Barrier in order to protect the integrity of the underlying Geosynthetic Liner.

#### 11.3.1.4 Geosynthetic Liner Placement

Geosynthetic Liner shall be placed within the upper 0.9 to 1.0 ft of the Radon Barrier layer, and shall be placed in accordance with the manufacturer's recommendations, with the geomembrane side of the geosynthetic clay liner (GCL) facing upward. Care must be taken to minimize the extent to which the Geosynthetic Liner is dragged across the subgrade in order to avoid damage to the bottom surface of the liner. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement. To the extent possible, the Geosynthetic Liner panels shall be placed parallel to the direction of slope. The panels shall lie flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels. The Geosynthetic Liner shall be placed with the minimum overlap of 6 inches between adjacent geosynthetic rolls and the minimum overlap of 12 inches at the end of the roll. Damaged Geosynthetic Liner shall be repaired by patching the damaged area with a new Geosynthetic Liner extending at least 24 inches beyond the damaged area. Prior to placing a patch, a bead of granular bentonite or bentonite paste at the minimum rate of 500 g per lineal meter shall be placed around the damaged area.

~~Radon Barrier layer shall be placed above the Geosynthetic Liner. Radon Barrier material shall be conditioned to a moisture content that allows compaction to the required density and that results in a firm, unyielding surface capable of allowing the movement of vehicles and equipment over the surface without causing rutting or other deleterious effects. Radon Barrier materials shall be placed in maximum 8-inch loose lifts, and compactive effort and moisture conditioning shall be adequate to obtain the dry density and moisture content within the range specified in Section 15.3.5. No density measurements will be taken during the placement of the first lift of the Radon Barrier in order to protect the integrity of the Geosynthetic Liner.~~



### 11.3.1.65 Bio-Intrusion Barrier Placement

The Bio-Intrusion Barrier shall be placed over the Radon Barrier as indicated in the closure cover design (refer to Kleinfelder, 2010). Native soil shall be added to nominal three-inch (3-inch) cobble material to achieve a final compacted layer with overlapping cobbles within a soil matrix. Mixing proportions and methods will be determined by the Task Manager (TM) and included in the Construction Specifications.

The Bio-Intrusion Barrier shall be placed in maximum 8-inch loose lifts, and compacted per a method specification to achieve the required consistency.

### 11.3.1.46 Capillary Break Placement

The Capillary Break layer shall be placed over the ~~Radon Barrier~~Bio-Intrusion Barrier layer, as indicated in the closure cover design (refer to Kleinfelder, ~~2009b~~2010). Capillary Break material shall be placed to a relative density of approximately 50 percent, or about 115 to 120 pounds per cubic foot (pcf) dry unit weight.

### ~~11.3.1.5 Filter Layer Placement~~

~~The Filter Layer shall be placed over the Capillary Break layer, as indicated in the closure cover design (refer to Kleinfelder, 2009b). The Filter Layer may be placed in either single or multiple lifts to achieve a compacted thickness of at least 0.5 feet, and compacted to ninety (90) percent of the maximum dry density (as determined by the standard Proctor test, ASTM D698) at appropriate moisture content to achieve required consistency.~~

### ~~11.3.1.6 Bio-Intrusion Barrier Placement~~

~~The Bio-Intrusion Barrier shall be placed over the Filter Layer as indicated in the closure cover design (refer to Kleinfelder, 2009b). Nominal three-inch (3-inch) cobble material shall be added to native soil to achieve a final compacted layer with overlapping cobbles within a soil matrix. Mixing proportions and methods will be determined by the Task Manager (TM) and included in the Construction Specifications.~~

~~The Bio-Intrusion Barrier shall be placed in maximum 8-inch loose lifts, and compacted per a method specification to achieve the required consistency.~~

### 11.3.1.7 Erosion Barrier Placement

The Erosion Barrier shall be placed over the ~~Bio-intrusion Barrier~~Capillary Break layer as indicated in the closure cover design (refer to Kleinfelder, ~~2009b~~2010). ~~The lower 1.5 feet of the~~ Erosion Barrier shall consist of native soil. To limit placement compaction, the Erosion Barrier material (up to 4.0 ft thickness) shall be placed in one lift ~~placed in maximum 8-inch loose lifts, and~~ compacted to eighty-five (85) percent of the maximum dry density (as determined by the standard Proctor test) at plus or minus two percent of



optimum moisture content (ASTM D698). Rock mulch shall either be mixed in-place into the upper 0.5 ft of the Erosion Barrier layer after placement, or mixed off-site and placed in a 0.5 ft lift, with approximately 20 percent of the upper layer consisting of rock.

~~The upper 0.5 feet of the Erosion Barrier may be placed in a single or multiple lifts. The Erosion Barrier shall be placed and compacted to eighty-five (85) percent of the maximum dry density (as determined by the standard Proctor test) at plus or minus two percent of optimum moisture content (ASTM D698).~~ The finished cover will be sloped at a grade of two percent (2%) away from the center of each cell toward the cell perimeter as shown in the Drawings.

The Erosion Barrier shall be vegetated as outlined in Section 13.0.

### **11.3.2 Settlement Monitoring Points**

Immediately after the Interim Cover materials are placed, settlement points will be installed as described in Section 10.3.7 to provide a means for measuring the settlement of tailings after placement of the Interim Cover and during and after placement of the Tailings Cell Closure Cover. After completion of settlement monitoring, the settlement points will be abandoned in place per Section 10.3.7~~340~~.

### **11.3.3 Radon Flux Measurements**

#### **11.3.3.1 Radon Flux Testing of Radon Barrier**

After completion of the Radon Barrier layer, and prior to placement of the remaining closure cover layers, a radon flux survey shall be conducted over the tailings area according to the procedures outlined in Section 6.3.1~~0~~ at a grid spacing of 30 feet (10 meters). The radon flux measurements shall be provided to the CDPHE.



## 12.0 EROSION PROTECTION PLACEMENT

### 12.1 General

#### 12.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with erosion protection placement in accordance with the Drawings and these Specifications. Erosion protection placement consists of covering the berm slopes and lining designated parts of drainage channels with erosion protection, as indicated in the Drawings. The work shall consist of the following:

- Placing Rock Blanket material on Tailings Cell sideslopes;
- Placement of CDOT Type I Bedding and CDOT Type II Bedding as the filter layer beneath Riprap; and
- Placement of Riprap protection as required on Tailings Cell sideslopes and in surface water control channels.

Borrow sources, size, layer thickness, areal extent and gradation requirements will vary across the site according to the Drawings and these Specifications.

#### 12.1.2 Related Work

- Section 11.0 - Tailings Cell Closure Cover;
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 12.2 Materials

The following sections of these Specifications indicate the design nominal stone size ( $D_{50}$ ) for each of the erosion protection layers. These materials shall conform to the following criteria:

- A minimum of 50 percent by weight of the material shall be greater than the design  $D_{50}$ ;
- The material shall be well-graded as quantified by USCS and shall meet the requirements of these Specifications; and
- Rock to be used for Riprap, Rock Blanket, Toe Protection, CDOT Type I Bedding and CDOT Type II Bedding shall have a minimum rock durability rating as specified in Section 12.3.1.

When oversizing of the rock is required, based on durability rating discussed in Section 12.3.1, the rock shall be oversized by applying an oversizing factor that is the difference between the tested durability and the required durability rating, expressed as a percentage to be increased. For example, if the rock durability rating is 65, but must have a durability of 80, the rock would require oversizing by at least 15 percent:  $80 - 65 = 15$ .



At least five days before placing any erosion control material, particle size analysis of the rock shall be developed and approved for each rock gradation. The Contractor shall provide the Owner with samples of rock material for each application for Quality Assurance gradation checks at the frequencies described in Section 15.0.

### **12.2.1 Riprap**

Riprap shall have a nominal stone size ( $D_{50}$ ) of 9 inches or 18 inches, as indicated in the Drawings. Riprap shall meet the requirements of Colorado Department of Transportation (CDOT) Section 506 of the Standard Specifications for Road and Bridge Construction, latest Edition, and the durability criteria Specified in Section 12.3.1.

### **12.2.2 Rock Blanket**

Rock Blanket shall have a nominal stone size ( $D_{50}$ ) of 2.5 inches for placement on outslopes of 10H:1V or flatter, and shall have a nominal stone size ( $D_{50}$ ) of 3.5 inches for placement on outslopes of 5H:1V or flatter, and shall meet the requirements of CDOT Section 506 of the Standard Specifications for Road and Bridge Construction, latest Edition, and the durability criteria Specified in Section 12.3.1.

### **12.2.3 Toe Protection**

Toe Protection used for erosion protection of run-out rock aprons shall have a nominal stone size ( $D_{50}$ ) of 8 inches and meet the requirements of CDOT Section 506 of the Standard Specifications for Road and Bridge Construction, latest Edition, and the durability criteria Specified in Section 12.3.1.

### **12.2.4 CDOT Type I Bedding and CDOT Type II Bedding**

CDOT Type I Bedding and CDOT Type II Bedding shall consist of materials meeting CDOT Section 703.03 of the Standard Specifications for Road and Bridge Construction, latest Edition, for these materials.

Erosion protection components for the tailings cover are summarized in the following table:



**Table 2: Erosion Protection Components**

Erosion Protection Element	Material Size	Layer Thickness
Vegetated Soil Top Cover, 0.02 Slope	Minimum D <sub>50</sub> = 0.5 inches for rock-mulch size	Rock mulch in top 0.5 feet
10H:1V Rock Cover Outslopes	D <sub>50</sub> = 2.5 inches	12-inch minimum thickness Filter layer required
5H:1V Rock Cover Side Slope <sup>1</sup>	D <sub>50</sub> = 3.5 inches	12-inch minimum thickness Filter layer required
Riprap Channels Rundown	D <sub>50</sub> = 18 inches	36-inch minimum thickness Filter layer required
Cell Berm Toe Protection	D <sub>50</sub> = 8.0 inches	24-inch minimum thickness Filter layer required

<sup>1</sup>Sideslope between Cells A and B and between Cells B and C.

## 12.3 Execution

### 12.3.1 Rock Durability Testing

Laboratory test results and a durability rating for each rock borrow area shall be developed before use of the rock material. Durability tests shall consist of the following:

- Absorption and Specific Gravity – ASTM C97 and ASTM C127
- Sodium Sulfate Soundness – ASTM C88
- LA Abrasion at 100 cycles – ASTM C131 or ASTM C535

The results of the above testing shall be used to determine a rock durability rating in accordance with Table D1 of the NRC’s Staff Technical Position (STP) “Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites,” August 1990. The following criteria shall be used to determine acceptable uses of rock borrow based on the rock durability rating:

- Rock having a durability rating greater than or equal to 80 may be used as Riprap, Toe Protection, Rock Blanket, CDOT Type I Bedding or CDOT Type II Bedding.
- Rock having a durability rating less than 80 and greater than or equal to 65 may be placed in surface water control ditches (i.e. “critical areas”) as Riprap or filter materials (i.e. CDOT Type I Bedding or CDOT Type II Bedding) only after being oversized in accordance with the criteria in Section 12.2 of these Specifications.
- Rock having a durability rating less than 80 and greater than or equal to 50 may be used on the sideslopes as Rock Blanket (i.e. “non-critical areas”) only after being oversized in accordance with the criteria in Section 12.2 of these Specifications.



- Rock having a durability rating of less than 65 may not be used for Riprap, CDOT Type I Bedding or CDOT Type II Bedding.
- Rock having a durability rating of less than 50 may not be used for any application.

In addition to performing rock durability testing prior to use, rock durability testing shall be conducted periodically during construction. Details of testing frequencies and requirements are presented in Section 15.0.

## 12.4 Placement

### 12.4.1 Riprap

Riprap shall be placed at the locations and to the depths and grades shown on the Drawings. The Riprap shall be placed in a manner to ensure that the larger rock fragments are uniformly distributed and the smaller rock fragments serve to fill the spaces between the larger rock fragments to achieve a densely-placed, uniform layer of Riprap of the specified thickness. Hand placement will be required only to the extent necessary to ensure the results indicated. Riprap shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.

Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.

### 12.4.2 Rock Blanket

Rock Blanket materials will be placed on the outslopes and side slopes of the tailings cover, as indicated in the Drawings. Rock Blanket materials shall be placed to a minimum thickness of 12 inches, overlying a bedding layer consisting of CDOT Type I or Type II Bedding materials (refer to the Drawings). Care shall be taken while placing the Rock Blanket to prevent segregation of materials. The thickness of the Rock Blanket shall be verified by construction control, staking, and probing, as described in Section 15.0. If the Rock Blanket thickness measures less than the minimum, additional rock shall be spread until measurements verify the appropriate thickness has been placed. Rock Blanket shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.

Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.

### 12.4.3 Toe Protection

Toe Protection materials shall be provided as indicated in the design drawings. Toe Protection shall be placed to a nominal thickness of 24 inches, overlying the Filter Layer. Toe Protection shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.



Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.

#### ***12.4.4 CDOT Type I Bedding and CDOT Type II Bedding***

CDOT Type I Bedding and CDOT Type II Bedding shall be placed as the filter layer beneath Riprap. The CDOT Type I Bedding shall be placed above the CDOT Type II Bedding, and in contact with the Riprap. Each layer shall be placed in one lift and tracked in place. Placement shall be in a manner which prevents segregation of the material. CDOT Type I Bedding and CDOT Type II Bedding shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.

Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.



## 13.0 VEGETATION

### 13.1 General

#### 13.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with revegetation in accordance with the Construction Drawings and these Specifications. Revegetation efforts shall be directed at all areas disturbed by construction and not covered with erosion protection and shall include, but not be limited to, any areas from which windblown tailings have been removed, the regraded mill and evaporation pond areas, the tailings cover, and all other areas from which mill facilities and/or affected soils were removed.

#### 13.1.2 Related Work

- Section 2.0 - Clearing and Grubbing
- Section 6.0 - Affected Soil Excavation and Placement
- Section 11.0 - Tailings Cell Closure Cover;
- Section 16.0 - Health and Safety

### 13.2 Products

Mulch and seed mixture shall be approved by the Owner prior to application based on the criteria specified in Section 13.2.1 and Section 13.2.2.

#### 13.2.1 ~~Windblown Tailings Area and Mill Site~~ Seed Mixture Specifications and Planting Locations

Two similar seed mixtures have been developed to revegetate disturbed areas associated with the Piñon Ridge Project. These seed mixtures are composed of native species that are adapted to the project area soils and climatic conditions and do not require supplemental irrigation for germination and establishment.

Seeding rates are based on Pure Live Seed (PLS) and for drill seeding methods. If broadcast or hydroseeding is used, the seeding rate should be doubled. All seed ~~for excavated windblown tailings and affected soil areas and the mill site surface~~ shall be fresh, clean, new crop seed and will be tested for purity, germination, and for weeds. The seed will be free of noxious weeds, and the quantity of total weed seed will be low or within the limits allowed by Colorado seed laws and labeling. All seed will be used within one year from testing date. Seed species will be from genetically appropriate seed sources/seed zones (i.e., collected from ecological conditions approximating those of the project location). Seed will be furnished in original bags showing seed testing analysis including percentage of PLS, year of production, net weight, date, origin and location of packaging. Seed which has become moldy or otherwise damaged in transit or storage shall not be accepted. Modification of seed mixtures, if necessary for any reason, will be done in consultation with



~~a qualified vegetation specialist. of the composition by weight of pure live seed (PLS) per acre provided in Table 3.~~

## **Seed Mixture 1**

~~Seed Mixture 1 (Shallow Rooted), presented in Table 3, will be used to revegetate the closure cover on the tailings cells and the surrounding areas within 200 ft of the toes of the reclaimed embankments. Seed Mixture 1 will also be used to revegetate topsoil and subsoil stockpiles since these soils will be used in large part for building the closure covers over the tailings cells.~~

## **Seed Mixture 2**

~~Seed Mixture 2, presented in Table 4, will be used to revegetate areas disturbed during initial construction, during facility operation, and during closure operations. This seed mix will be used for all areas of the site except for the tailings cells and soil stockpiles. This seed mixture may also be used for interim stabilization purposes. Seed Mixture 2 is similar to Seed Mixture 1, but includes five additional deeper-rooted shrub species to improve habitat quality.~~

~~The specified application rates are for drill seeding. The application rates for broadcast methods should be increased by a factor of two times the rate given. All seed shall be furnished in original containers showing analysis of seed mixture, percentage of PLS, year of production, net weight, date, and location of packaging. Seed which has become moldy or otherwise damaged in transit or storage shall not be accepted. Modification of the seed mix, if necessary for any reason, shall require approval by the Owner.~~

## **13.2.2 Mulch**

~~Mulch~~ Mulch shall be small-grain hay or straw in a dry condition. Mulch shall be free of weeds and foreign matter detrimental to plant life.



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

**Table 3: Proposed Seed Mixture 1 – Shallow Rooted**

Common name ( <i>Scientific Name – Kartesz</i> )	Variety <sup>1</sup>	Seeding Rate (lbs/Acre – PLS) <sup>2</sup>
Needle and Thread ( <i>Stipa comata</i> )	N/A	<del>2.0</del> 1.8
Indian Ricegrass ( <i>Oryzopsis hymenoides</i> )	N/A	1.58
Thickspike Wheatgrass ( <i>Elymus lanceolatus</i> )	Critana	<del>2.0</del> 1.8
<u>Slender Wheatgrass</u> ( <i>Elymus trachycaulus</i> )	<u>Pryor</u>	<u>0.5</u>
Sandberg Bluegrass ( <i>Poa Secunda</i> )	Sandberg	0.59
Bottlebrush Squirreltail ( <i>Elymus elmoides</i> )	N/A	<del>40.9</del>
Blue Grama ( <i>Bouteloua gracilis</i> )	Alma	0.59
Galleta ( <i>Hilaria jamesii</i> )	Viva	<del>4.50.9</del>
<b>Forbs</b>		
<u>Blue Flax</u> ( <i>Linum lewisii</i> )	<u>Appar</u>	<u>0.5</u>
<u>Utah Sweetvetch</u> ( <i>Hedysarum boreale</i> )	<u>Timp or native</u>	<u>1.0</u>
<u>Palmer Penstemon</u> ( <i>Penstemon palmerii</i> )		<u>1.0</u>
<b>Total PLS/Acre:</b>		<b><u>129.0 lbs/Acre</u></b>

<sup>1</sup> Where variety is not specified, use native genetically appropriate seed source/ seed zone for all species to be planted.

<sup>2</sup> Double rate if broadcast seeded.



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

**Table 4: Proposed Seed Mixture 2 – Deep Rooted**

<u>Common name</u> <u>(Scientific Name – Kartesz)</u>	<u>Variety<sup>1</sup></u>	<u>Seeding Rate</u> <u>(lbs/Acre – PLS)<sup>2</sup></u>
<u>Needle and Thread</u> <u>(Stipa comata)</u>		<u>1.8</u>
<u>Indian Ricegrass</u> <u>(Oryzopsis hymenoides)</u>		<u>1.8</u>
<u>Thickspike Wheatgrass</u> <u>(Elymus lanceolatus)</u>	<u>Critana</u>	<u>1.8</u>
<u>Sandberg Bluegrass</u> <u>(Poa Secunda)</u>	<u>Sandberg</u>	<u>0.9</u>
<u>Bottlebrush Squirreltail</u> <u>(Elymus elmoides)</u>		<u>0.9</u>
<u>Blue Grama</u> <u>(Bouteloua graceilis)</u>	<u>Alma</u>	<u>0.9</u>
<u>Galleta</u> <u>(Hilaria jamesii)</u>	<u>Viva</u>	<u>0.9</u>
<b><u>Forbs</u></b>		
<u>Blue Flax</u> <u>(Linum lewisii)</u>	<u>Appar</u>	<u>0.5</u>
<u>Palmer Penstemon</u> <u>(Penstemon palmerii)</u>		<u>1.0</u>
<u>Scarlet Globemallow</u> <u>(Sphaeralcea coccinea)</u>		<u>1.0</u>
<u>Utah Sweetvetch</u> <u>(Hedysarum boreale)</u>	<u>Timp or native</u>	<u>1.0</u>
<b><u>Shrubs</u></b>		
<u>Fourwing Saltbush</u> <u>(Atriplex canescens)</u>		<u>2.0</u>
<u>Gardner's Saltbush</u> <u>(Atriplex gardneri)</u>		<u>2.0</u>
<u>Wyoming Sage</u> <u>(Artemisia tridentate spp</u> <u>wyomingensis)<sup>3</sup></u>		<u>0.25</u>
<u>Black Sage</u> <u>(Artemisia nova)<sup>3</sup></u>		<u>0.25</u>
<u>Winterfat</u> <u>(Krascheninnikovia lanata)<sup>4</sup></u>		<u>0.5</u>
<b><u>Total PLS/Acre:</u></b>		<b><u>17.5 lbs/Acre</u></b>

<sup>1</sup> Where variety is not specified, use native genetically appropriate seed source/ seed zone for all species to be planted.

<sup>2</sup> Double rate if broadcast seeded.

<sup>3</sup> Sagebrush if drill seed should be seeded through a separate drill box to permit very shallow seeding (i.e., <1/8 inch) and proper seed placement for plant establishment. Best seeding results comes from surface broadcast seeding that is pressed into the soil to provide for a good soil-seed contact. Sagebrush seed can also be broadcasted directly onto snow or broadcast seeding followed by a cultipacker or drag chain.

<sup>4</sup> Seeding rate in mixture is recommended as 0.5 lbs/acre if drilled and 1.0 if broadcasted.



When drill seeded, seed at depths <1/4 inch. Winterfat may also be broadcast on snow.

## 13.3 Execution

### 13.3.1 General

Revegetation shall be conducted as specified on the mill area, and any other areas as specified in Section 13.1.1. Salvaged topsoil, where available, shall be spread at locations designated by the Owner in 4- to 6-inch loose lifts. Seeding shall be performed only in the autumn months (i.e., from September through November).

### 13.3.2 Soil Preparation

The soil to be revegetated shall be prepared by first cultivating to a minimum depth of six inches. Fertilizer shall be added, if required, to the soil at an application rate to be determined after soil analyses are conducted by the Owner and shall be worked into the upper six inches of soil by disking along the contours to the extent practical. This application shall not precede seeding by more than one day.

### 13.3.3 Seeding

Seeding shall be conducted by drill or broadcast seeding the specified seed mixture at the specified application rates along the contours or opposite the direction of the prevailing wind. Broadcast seeding may be allowed upon approval by the Owner using an application rate equal to twice the rate specified for drill seeding. Seeding shall not be performed immediately following a heavy rain, during windy periods, or when the ground is determined to be too dry (particularly if broadcast seeding is considered), as determined by the Owner. Drill seeding shall use a roller attachment or its equivalent attached behind the drill to inhibit movement of seeds previously sown. No seeding shall be performed in areas in excess of that which can be mulched the same day.

### 13.3.4 Mulching

Mulch shall be applied to seeded areas at the application rate of two tons per acre ~~and crimped into the surface utilizing means approved by the Owner.~~ Mulch will be crimped into the surface utilizing a crimper designed for this purpose or other equipment that achieves satisfactory results.

### 13.3.5 Restoration

Planted areas damaged during execution of the site work shall be restored. The areas which fail to show a "catch" or uniform stand with bare spots larger than 10 feet by 10 feet within one growing season shall be reseeded by the Contractor during the next planting season with the specified seed mixture and methodology.



## 14.0 FENCING

### 14.1 General

#### 14.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with the construction of fencing in accordance with the Drawings and these Specifications. The work shall consist of installation of a chain link fence to minimize unauthorized access to the reclaimed tailings area and repair or replacement of the existing barbed wire fence around the Piñon Ridge Project Area, where necessary.

Work associated with the chain link fence shall include excavation of post foundation holes to a minimum depth of 30 inches into the subgrade and installation of the posts in concrete foundations. The overall height of the chain link fence shall be approximately 6-8 feet high, using 7296-inch wide chain link fabric. The fabric shall be composed of individual wire pickets which are helically wound and interwoven in the form of a continuous chain link fabric, having a 2-inch mesh,  $\pm$  1/16 inch between parallel wires. The top selvage shall be twisted and barbed, and the bottom selvage shall be knuckled. The fence shall be constructed at the location indicated on the Drawings. Work associated with the barbed wire fence shall include installation of steel T-posts and four strands of ~~barbed~~-wire (top and bottom wires smooth; inner wires barbed), where necessary, to form a complete fence around the Piñon Ridge Project area, as indicated on the Drawings.

#### 14.1.2 Related Work

- Section 16.0 - Health and Safety

### 14.2 Products

Submittals for the following products shall be provided to the Owner for approval prior to use. Contractor shall provide product data including manufacturer's technical data (galvanized wire), test data (strength), and specifications sufficient to allow evaluation by the Owner. Submittals shall include shop drawings showing at a minimum brace sections, gate details, and any details pertinent to the long-term effectiveness of the fences.

#### 14.2.1 Chain Link Fence

The Chain link fencing shall consist of galvanized steel posts (Line, Pull, Corner and End Posts) embedded in concrete foundation, post caps, and chain link fence fabric. In addition, the chain link fence consists of the rails, compression braces, tension rods, stretcher bards, ties, etc., required to connect the chain link fence fabric to the posts and provide chain link fence stability.

All standard mill tolerances as described in ASTM specifications applicable to framework and fabric shall apply.



## 14.2.1.1 Chain Link Fence Fabric

The chain link fence fabric shall be nine-gauge after coating and shall have a minimum tensile strength of 80,000 pounds per square inch (psi). The fabric shall be zinc coated and shall meet the requirements of ASTM A392. The weight of the zinc coating per square foot (psf) of uncoated wire surface shall be not less than two ounces as specified for Class 2 galvanizing, or the fabric shall be aluminum-coated steel fence fabric. Coating shall be Class 2, with a minimum coating weight of 0.35 ounce of aluminum (psf) of uncoated surface. Fabric shall meet all the test requirements of ASTM A491. The fabric shall be composed of individual wire pickets which are helically wound and interwoven in the form of a continuous chain link fabric, having a 2-inch mesh,  $\pm 1/16$  inch between parallel wires. The top selvage shall be twisted and barbed, and the bottom selvage shall be knuckled.

## 14.2.1.2 Line Posts

Line posts shall be 2-inch by 2.25-inch "H" column, or 2-3/8-inch outside diameter (O.D.) Schedule 40 pipe, or 2.25-inch by 1.70-inch rolled form posts. Posts shall be hot-dipped galvanized after cutting with 2-ounce zinc (psf) in accordance with ASTM A123. Line posts shall be of sufficient length to extend 36 inches below grade into concrete footings.

## 14.2.1.3 End, Pull and Corner Posts

End, pull, and corner posts shall be carbon steel standard pipe sections of 2-7/8-inch O.D. Schedule 40 pipe or 3.5-inch by 3.5-inch rolled form posts. Pipe shall be hot-dipped galvanized with 2-ounce zinc per square foot (ASTM A123) and shall be of sufficient length to extend 36 inches below grade into concrete footings.

## 14.2.1.4 Top Rails

Top rails shall be standard 1-5/8-inch O.D. Schedule 40 pipe or 1-5/8-inch by 1-1/4-inch rolled form hot-dipped galvanized with 2-ounce zinc psf (ASTM A123). Pipe rails shall be furnished in random lengths and shall be joined with heavy steel outside galvanized couplings at least 7 inches in length.

## 14.2.1.5 Compression Braces and Tension Rods

Compression braces for all truss or branch panels shall be 1-5/8-inch O.D. Schedule 40 pipe or 1-5/8-inch by 1-1/4-inch rolled form as described for top rails. Tension members shall be 3/8 inch diameter steel rods with heavy steel post bands and tension adjusting threaded rod and nut, all galvanized (ASTM A153).

## 14.2.1.6 Post Tops (Post Caps)

Post tops shall be one-piece malleable iron or pressed steel designed to exclude all moisture and hot-dipped galvanized with 1.2 ounces zinc psf (ASTM A153).



#### 14.2.1.7 Stretcher Bars

Stretcher bars shall be of 1/4-inch by 3/4-inch flat hot-dipped galvanized steel. All terminal post bands shall be a minimum of 1/8 inch by 1 inch wide and secured with a 3/8-inch carriage bolt. Stretch bar bands shall be spaced not to exceed 14-inch intervals.

~~be nine-gauge after coating and shall have a minimum tensile strength of 80,000 pounds per square inch (psi). The fabric shall be zinc coated and shall meet the requirements of ASTM A392. The weight of the zinc coating per square foot (psf) of uncoated wire surface shall be not less than two ounces as specified for Class 2 galvanizing, or the fabric shall be aluminum-coated steel fence fabric. Coating shall be Class 2, with a minimum coating weight of 0.35 ounce of aluminum (psf) of uncoated surface. Fabric shall meet all the test requirements of ASTM A491.~~

~~Line posts shall be 2 inch by 2.25 inch "H" column, or 2-3/8 inch O.D. Schedule 40 pipe, or 2.25 inch by 1.70 inch rolled form posts. Posts shall be hot-dipped galvanized after cutting with 2-ounce zinc (psf) in accordance with ASTM A123. Line posts shall be of sufficient length to extend 36 inches below grade into concrete footings. End, pull, and corner posts shall be carbon steel standard pipe sections of 2-7/8 inch outer diameter (O.D.) Schedule 40 pipe or 3.5 inch by 3.5 inch rolled form posts. Pipe shall be hot dipped galvanized with 2-ounce zinc per square foot (ASTM A123) and shall be of sufficient length to extend 36 inches below grade into concrete footings.~~

~~Top rails shall be standard 1-5/8 inch O.D. Schedule 40 pipe or 1-5/8 inch by 1-1/4 inch rolled form hot-dipped galvanized with 2-ounce zinc psf (ASTM A123). Pipe rails shall be furnished in random lengths and shall be joined with heavy steel outside galvanized couplings at least 7 inches in length. Compression braces for all truss or branch panels shall be 1-5/8 inch O.D. Schedule 40 pipe or 1-5/8 inch by 1-1/4 inch rolled form as described for top rails. Tension members shall be 3/8 inch diameter steel rods with heavy steel post bands and tension adjusting threaded rod and nut, all galvanized (ASTM A153).~~

~~Post tops shall be one-piece malleable iron or pressed steel designed to exclude all moisture and hot-dipped galvanized with 1.2 ounces zinc psf (ASTM A153).~~

~~Stretcher bars shall be of 1/4-inch by 3/4-inch flat hot-dipped galvanized steel. All terminal post bands shall be a minimum of 1/8 inch by 1 inch wide and secured with a 3/8-inch carriage bolt. Stretch bar bands shall be spaced not to exceed 14-inch intervals.~~

~~All standard mill tolerances as described in ASTM specifications applicable to framework and fabric shall apply.~~



## 14.2.2 Barbed Wire Fence

The four-strand barbed wire fence shall consist of 12-1/2 gauge galvanized steel wire with zinc coating (top and bottom wires smooth), which shall meet the requirements of ASTM A121, and standard steel T-posts and corner posts.

## 14.2.3 Chain Link Gates

The chain link gate frames shall consist of the Gate Frame (corner bars and diagonal rods) and the fabric used for chain link fence. ~~be fabricated from carbon steel standard pipe of nominal 2-inch square (1.90 inch) with a nominal weight of 2.72 pounds per foot and galvanized with 2-ounce zinc psf (ASTM A123).~~ Fabric for the gates shall be of the same gauge as for the link fence. The following accessories shall be furnished for each gate and galvanized in accordance with ASTM A153.

### 14.2.3.1 Gate Frame

Gate Frame corner bars shall be fabricated from carbon steel standard pipe of nominal 2-inch square (1.90 inch) with a nominal weight of 2.72 pounds per foot and galvanized with 2-ounce zinc psf (ASTM A123). Diagonal rods shall have two 3/8-inch galvanized adjustable truss rods providing double diagonal trussing. Gate Frame components (corner bars and diagonal rods) shall be welded together and hot-dipped galvanized after fabrication. All welded joints shall be continuous, reasonably smooth, and cleaned of slag and spatter after fabrication, prior to galvanizing. Alternatively, the Gate Frame components may be connected using fittings. Fittings shall be of malleable iron or pressed steel having means for attaching diagonal bracing members.

### 14.2.3.2 Gate Posts

The gate posts shall be carbon steel standard tube of 3.5 inch by 3.5 inch rolled from section galvanized as specified for other posts, having a minimum weight of 5.85 pounds per square foot.

### 14.2.3.3 Gate Hinges

Gate hinges shall be of malleable iron providing for a full 180 degrees swing, with bottom hinge to be ball and socket type. Gate hinges shall be bolted or welded to the Gate Frame corner bars and Gate Posts.

### 14.2.3.4 Drop Rod, Latches, Padlocks and Catches

Chain Link Gates shall be equipped with a plunger-type drop rod assembly, securely bolted to the frame. Latches for single gates shall have two fork latches mounted on the center plunger rod with means for padlocking available from either side of the gate. Hold-back catches shall be provided for each leaf of vehicular gates, employing a semi-automatic hold-back catch to be anchored at least 12 inches into a 12-inch diameter by minimum 24-inch deep concrete footing.



#### **14.2.4 Hardware Wire Cloth (Wire Cloth)**

Hardware wire cloth shall consist of welded galvanized steel wire fabric galvanized by the hot-dip process per ASTM A740. The maximum wire gage is specified as a function of the mesh size in the following table:

**Table 5: Hardware Wire Cloth Wire Gage**

<b><u>Mesh Size</u></b>	<b><u>Max. Wire Gage</u></b>
<u>1/8-inch x 1/8-inch</u>	<u>23</u>
<u>1/2-inch x 1/2-inch</u>	<u>19</u>
<u>3/4-inch x 3/4-inch</u>	<u>16</u>

~~The gate frames shall have two, 3/8-inch galvanized adjustable truss rods providing double diagonal trussing. The gate frames constructed by welding shall be hot-dipped galvanized after fabrication. All welded joints shall be continuous, reasonably smooth, and cleaned of slag and spatter after fabrication, prior to galvanizing. If the gate frames are constructed using fittings, fittings shall be of malleable iron or pressed steel having means for attaching diagonal bracing members. Hinges shall be of malleable iron providing for a full 180 degrees swing, with bottom hinge to be ball and socket type.~~

~~Gates shall be equipped with a plunger-type drop rod assembly, securely bolted to the frame. Latches for single gates shall have two fork latches mounted on the center plunger rod with means for padlocking available from either side of the gate. Hold-back catches shall be provided for each leaf of vehicular gates, employing a semi-automatic hold-back catch to be anchored at least 12-inches into a 12-inch diameter by minimum 24-inch deep concrete footing. The gate posts shall be carbon steel standard tube of 3.5-inch by 3.5-inch rolled from section galvanized as specified for other posts, having a minimum weight of 5.85 psf.~~

#### **14.2.414.2.5 Concrete Foundations**

Concrete used in the installation shall conform to:

- Portland Cement, Type I: ASTM C150;
- Aggregates: Fine and coarse, ASTM C33; and
- Water: Clean, potable and free of oil, strong acids, salt or organic matter.

### **14.3 Execution**

#### **14.3.1 Fence Installation**

Fence and gates shall be installed as directed by the Owner and specified herein. Work shall be constructed, monitored, and tested in accordance with these specifications. Any work found unsatisfactory



or any work disturbed by subsequent operations before acceptance is granted shall be corrected by the Contractor.

### **14.3.2 Chain Link Fence Installation**

Fabric ties shall be fastened to line posts with galvanized, preformed, six-gauge fabric bands spaced approximately 14 inches apart, and to top rail, braces, and tension wire at not more than 24-inch spacing. Fabric bands for top rail, braces, and tension wire shall not be less than nine gauge, galvanized, preformed steel wire.

Maximum spacing for posts shall be 10 feet from center to center.

A malleable iron center rest designed to receive the plunger rod of the gate shall be furnished and anchored at least 12 inches into a 12-inch by 24-inch diameter concrete footing. The top of the gate frame shall align with the top of the fence fabric or the top rail.

A horizontal pipe brace shall be installed at the top rail midway between top and bottom of the fabric with a truss rod extending from midpoint of the line post diagonally to the bottom of the terminal post.

All posts shall extend at least 24 inches into concrete. Post holes are to be at least four inches deeper than the posts. All post foundations, other than gate posts which may be larger as indicated herein, shall be 12 inches in diameter.

All posts shall be set accurately to established lines and grades and plumbed in all directions. Concrete shall be required to produce a 28 day compressive strength of not less than 2,500 psi. All concrete footings shall be poured up to a smooth finish grade and slightly crowned to shed water. Excess concrete or any other construction debris shall be removed from the site.

The finished fence shall be plumb, taut, true-to-line, and complete in every detail. All work shall be performed by experienced ~~workmen~~personnel.

Wire Cloth shall be installed around the entire perimeter of the Tailings Cells. Wire Cloth shall extend from two feet below the base to three feet above the base of the barbed wire or the chain link fence to preclude access by small, ground-dwelling wildlife.

Bottom of the Wire Cloth shall be placed in the narrow trench excavated approximately 30 inches below the ground surface and backfilled after placing the Wire Cloth. The bottom of the Wire Cloth in the vicinity of the post foundation (24 inches from each side of the concrete foundation) may be secured by backfilling the trench with concrete or using the coarse gravel backfill (the backfill material  $D_{50}$  equal to at least 2 inches or greater).



The top of the Wire Cloth shall be secured to the Chain Link Fence Fabric using hog rings.

### **14.3.3 Barbed Wire Fence Installation**

~~Barbed wire strands shall be fastened to T-posts and corner posts with wire that shall not be less than nine-gauge, galvanized, preformed steel wire. Maximum spacing for posts shall be 15 feet from center to center. All T-posts shall extend at least 18 inches into the ground.~~

Repair and extend, where directed, the existing barbed wire perimeter fencing around the property boundary. Fence shall be no taller than 42 inches, constructed with four strands of wire (top and bottom smooth wire; inner two wires barbed), with at least 12-inch spacing between the top two wires. Bottom wire would be at least 16 to 18 inches off the ground.

Work associated with the barbed wire fence shall include installation of steel T-posts and four strands of barbed wire, as indicated on the drawings.

Barbed wire strands shall be fastened to T-posts and corner posts with wire that shall not be less than nine-gauge, galvanized, preformed steel wire. Maximum spacing for posts shall be 15 feet from center to center. All T-posts shall extend at least 18 inches into the ground.

The finished fence shall be plumb, taut, true-to-line, and complete in every detail.



## 15.0 CONSTRUCTION QUALITY ASSURANCE

### 15.1 General

This section addresses the construction quality assurance (CQA) procedures for the demolition and earthwork (soils) components of the decommissioning and reclamation activities. This program has been developed to assure that the construction of the soil components and placement of demolition debris and soil/cement slurry are in compliance with the project Specifications, and to demonstrate that the regulatory requirements for construction are achieved.

The objective of this plan is to assure that proper materials, construction techniques, and procedures are followed by the Contractor and that the intent of the design is met. This plan also provides the means for resolution of problems that may occur during construction.

The additional objective of this plan is to assure that the demolition activities are performed in accordance with the current industry practices and applicable regulatory safety requirements. This plan addresses quality assurance (QA), not quality control (QC). This CQA Plan is independent of the QC programs conducted by the Contractor. The intent of the CQA Plan is to provide verification and testing to demonstrate that the Contractor has met its obligations in the supply and installation of earthwork (soils) materials and demolition backfill according to the design, project Specifications, and contractual and regulatory requirements. QC is provided by the Contractor and refers to those actions taken by the Contractor to ensure that materials and workmanship meet the requirements of the design Drawings and Specifications.

#### **15.1.1 Submittals**

##### **15.1.1 ~~15.1.1.1~~ Environmental Submittals**

As required by the preliminary “Mill Decommission Plan (Kleinfelder ~~2009e~~2009b)” submitted with the License Application for the Piñon Ridge Mill, a detailed decommissioning plan will be prepared by the Owner prior to the start of decommissioning activities. The detailed plan will include permits, work plans (including identification of Radiation Work Permits needed), waste-handling plans, health and safety operating protocols, environmental monitoring and control programs, quality assurance plan, and requirements for the as-built completion reports. Decommissioning shall not begin until CDPHE approves the decommissioning plan.

The Contractor shall be required to submit documentation of the qualifications of its superintendent and others who supervise critical tasks as specified by the Owner, including the person responsible for safety. The surveyor’s proof of licensure shall also be submitted to the Owner.



## 15.1.2 ~~15.1.1.2~~ — *Cleanup Verification Plan*

The Owner shall submit a Cleanup Verification Plan to the CDPHE for approval at least 90 days prior to the start of affected soil excavation. This plan shall be consistent with the guidelines presented in NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination", and shall describe the gamma survey and sampling procedures to be implemented prior to, during, and after reclamation of the site.

## 15.1.3 ~~15.1.1.3~~ — *In-Place Radiological Testing of Surface Tailings*

The Owner shall provide the CDPHE with a radiological sampling and testing report for the Tailings Cell Top prior to construction of the Radon Barrier as described in Section 15.3.3.

## 15.1.4 ~~15.1.1.4~~ — *Settlement Monitoring Report*

The Owner shall provide the CDPHE with a tailings settlement monitoring report prior to construction of the Tailings Cell Closure Cover as described in Section 15.3.2.

## 15.1.5 ~~15.1.1.5~~ — *Radon Barrier Prequalification*

The Owner shall provide the CDPHE with a Radon Barrier prequalification report prior to construction of the Radon Barrier closure cover layer as described in Section 15.3.4~~0~~. This report may be submitted separately or as part of the report for the radiological testing of surface tailings described in Sections ~~0 and~~ 15.3.3.

## 15.1.6 ~~15.1.1.6~~ — *Tailings Cell Closure Cover Quality Control Report*

The Owner shall provide a summary report to the CDPHE of the quality control test results performed during construction of the Tailings Cell Closure Cover after construction of the cover is completed. The summary shall include a grid map providing points of reference for test locations and a complete set of records of field and laboratory quality control (QC) data.

## 15.1.7 ~~15.1.1.7~~ — *Radon Flux Measurements*

The Owner shall submit the results of radon flux measurements from the Tailings Cell to the CDPHE. The measurements shall be taken after construction of the Radon Barrier Layer in accordance with Section 15.3.4~~0~~ of these Specifications.

## **15.2 Products**

Not applicable.



## 15.3 Execution

### 15.3.1 Verification of Demolition Activities

All construction demolition activities shall be recorded on a Demolition Field Form including the following information:

- Type and location of debris;
- Approximate volume of soil debris or dimensions of the structural member;
- Decommissioning method (e.g., cutting, excavation);
- Relevant radiation readings and release forms required for off-site disposal or re-use; and

For on-site disposal, the form should indicate the deposition lift thickness, amount of soil/cement slurry required to fill the voids and amount of soil required to achieve compaction and grading requirements in accordance with Section 5.0 of these Specifications.

All Demolition Field Forms shall be signed and dated by the QAC and reviewed and signed by DPM or the authorized representative.

### 15.3.2 Settlement Monitoring

To monitor settlement of the tailings, settlement monitoring points shall be installed during or immediately after placement of the Interim Cover over the regraded tailings at the locations and coordinates indicated on the Drawings. Settlement elevation readings shall be recorded after placement of the Interim Cover and throughout placement of the Radon Barrier and final cover. Survey frequencies are specified in Section 10.3.7~~9~~. Placement of the Radon Barrier layer shall not begin until 90 percent of the initial consolidation due to Interim Cover placement has occurred. The Owner shall determine when 90 percent of consolidation has been achieved, as approved by the CDPHE, through evaluation of the settlement survey results.

The settlement monitoring points shall be monitored during and after placement of the Radon Barrier and final cover as described in Section 11.3.2. Unless surveying indicates significant subsidence after construction of the final cover, the settlement monitoring points shall be removed as described in Section 10.3.7~~9~~ of these Specifications.

The Contractor shall be responsible for surveying of the settlement monitoring points during placement of the closure covers layers, and shall provide the Owner with the survey results on a periodic basis. The Owner shall be responsible for surveying of the settlement monitoring points prior to and after cover placement operations and for maintaining charts plotting the magnitude of settlement versus logarithm of time. Time zero for each phase of cover construction shall correspond to the start date of loading around the settlement monitoring points.



The Owner shall provide CDPHE with a report providing the settlement monitoring data after 90 percent of initial consolidation has been achieved from placement of the Interim Cover. Placement of the Radon Barrier layer shall not be initiated until approved by CDPHE. The Owner shall also provide a report providing the settlement monitoring data after 90 percent of final consolidation has been achieved from placement of the Radon Barrier and final cover. The settlement monitoring points shall not be removed until approved by CDPHE.

### ***15.3.3 Testing of In-Place Tailings and Interim Cover***

After regrading of the surface tailings and placement of the Interim Cover, the surface and near surface tailings shall be sampled and analyzed to verify their radiological properties. A uniform grid with 16 sampling locations shall be established on top of the Interim Cover.

The sampling depth shall vary with eight samples collected from 0 to 18 inches below the tailings surface and eight samples collected from 30 to 48 inches below the tailings surface. In-situ samples shall be collected for analysis and testing to allow for determination of in-place physical parameters. The depth of the Interim Cover material at the 16 sampling locations shall also be measured and recorded during sampling and eight in-situ samples of Interim Cover shall be collected for analysis and testing. If shallow trenches are used to collect tailings and Interim Cover samples, the excavation shall be filled and compacted in 6 inch lifts until reaching the lines and grades existing prior to the sampling. Trench excavations shall be filled and compacted in accordance with the Interim Cover specifications in Section 15.3.5. If a hand operated hollow stem auger is used to collect tailings and Interim Cover samples, the excavations shall be backfilled with tailings cuttings and interim cover (in that order) and compacted by hand.

Each of the tailings samples shall be classified using the USCS and analyzed for grain size distribution (ASTM D 422), in-place density and moisture content (ASTM D 1556), specific gravity (ASTM C 127 and/or ASTM D 854), Ra-226 concentration (EPA Method 903.0); and emanation fraction. In addition, the 8 samples of Interim Cover shall be tested to determine their radon diffusion coefficient at a dry density corresponding to the average measured in-place density and a moisture content corresponding to the estimated long-term moisture content using CDPHE-approved empirical methods (i.e. the radon diffusion coefficient will be determined on the Interim Cover samples recompacted to their average field density).

The results of the sampling and testing program shall be reported to the CDPHE for its review prior to starting the construction of the Radon Barrier.

### ***15.3.4 Radon Barrier Placement, Compaction and Testing***

The quality control and testing procedures described in this section are applicable to material used to construct the Radon Barrier layer. Inspection and testing described herein of all Radon Barrier materials



shall be conducted by the Owner to ensure that specified materials are placed and compacted as designated on the Drawings and in these Specifications.

### 15.3.4.1 Material Prequalification

On-site soils excavated and stockpiled during initial construction of the mill and subsequent expansions will be used for construction of the Radon Barrier. Materials used to construct the Radon Barrier layer shall be tested by the Owner prior to their use to verify that the material has geotechnical parameters consistent with those used in the design model. These soils shall also be analyzed to verify that their Ra-226 concentrations are within background levels for the mill and tailings area. Once the Radon Barrier borrow area is prequalified, i.e. once the Ra-226 concentrations are determined to be within acceptable limits, gradation testing, USCS classification, and Atterberg Limits determination shall continue during placement at the frequencies specified in Section 15.3.5 of this document.

Sample location and depth for prequalification testing shall be based on a uniform grid system designed to represent the borrow area in terms of both areal extent and depth (i.e., each sample will represent an approximately equal volume of soil). A minimum of 20 samples shall be collected, classified according to the USCS, and tested for gradation (ASTM D422) and Atterberg Limits (ASTM D423 and ASTM D424). In addition, a representative sample shall be collected for each 50,000 cubic yards of material and analyzed for Ra-226 concentrations (EPA Method 903.0), and tested to determine their specific gravities (ASTM D854), Standard Proctor curves (ASTM D698), radon emanation fractions and diffusion coefficients. The diffusion tests shall be conducted using a pre-defined moisture content by weight specified by the Owner.

The geotechnical test results, emanation fractions and diffusion coefficients shall be compared to the design values used in the radon flux model to verify the adequacy of the proposed borrow material. The Ra-226 concentrations shall be compared to the background levels recorded in the mill and tailings vicinity to verify that they are within nominal background ranges, i.e. at or below Ra-226 concentrations measured prior to mill construction.

Soils which do not have comparable or superior cover characteristics to the test values used in the model or which are above acceptable Ra-226 concentrations shall not be used for Radon Barrier layer construction. Alternately, if sufficient borrow material is not available to meet the design criteria, the Owner may propose a thicker cover design based on representative parameters for the proposed additional borrow material.

The sampling and analytical results from the proposed additional borrow area shall be submitted as a report to the CDPHE. This report may be submitted separately or as part of the verification report for the surface tailings described in Section 15.3.3 of these Specifications. The radon attenuation cover shall not be constructed until the CDPHE has approved the Radon Barrier layer borrow source.



## 15.3.4.2 Radon Barrier General Classification Testing

Gradation and Atterberg Limit testing of Radon Barrier materials shall be conducted during construction at the testing frequencies specified in Section 15.3.5 of this document.

## 15.3.4.3 Radon Barrier Compaction Testing

Compaction testing of Radon Barrier materials shall be conducted during construction at the testing frequencies specified in Section 15.3.5 of this document.

## 15.3.4.4 Radon Flux Measurement

After construction of the Radon Barrier layer, but before placement of the Bio-Intrusion Barrier, Capillary Break, ~~Filter Layer, Bio-Intrusion Barrier~~ and Erosion Barrier/Vegetative Cover layers, the radon flux from the Radon Barrier layer surface shall be measured. Measurement of the radon flux shall be performed in accordance with the requirements of 40 CFR Part 61, Method 115 and 10 CFR Part 40, Appendix A Criterion 6. A minimum of 100 measurements at rectangular grid locations over the completed Radon Barrier surface shall be made, using large-area activated charcoal canisters (see EPA 520/5-85-0029 and 520/5-90-032). The measurements shall continue on a monthly basis until determining that radon flux has reached a steady-state condition. The mean radon flux from the Tailings Cell shall be calculated and shall be reported to the CDPHE along with the locations and results of the individual flux measurements in accordance with 10 CFR Part 40, Appendix A Criterion 6 (4).

## 15.3.5 Earthworks and Geosynthetic Liner Quality Assurance

Construction of the earthwork components and the geosynthetic liner of the Decommissioning Plan shall be in accordance with these Specifications and Drawings. A CQA monitoring and testing program shall be implemented by the Owner to ensure construction compliance by the Contractor. The CQA testing program shall consist of construction testing and materials testing. During construction, the QAC shall sample and test the construction materials to verify that they meet the Specifications. All testing shall either be conducted on-site, or at a laboratory approved by the DPM.

### 15.3.5.1 Construction Testing

The QAC shall conduct testing in concurrence with the construction activities. Soil tests to be performed by QAC, and the testing frequency, for each material type are listed in Table 6. Geosynthetic Liner shall have properties shown in Table 7. During manufacturing of the Geosynthetic Liner or after delivery on-site, QAC will coordinate sampling and forwarding of samples to the approved laboratory for testing to ensure conformance with the Specifications. Samples will be taken across the entire width of the roll and shall not include the first three (3) feet. Unless otherwise stated, samples will be three (3) feet long by the width of the roll. QAC will mark the machine direction on the samples with an arrow. Unless otherwise stated, samples shall be taken at a frequency of no less than one per one hundred fifty-thousand (1500,000) square feet. As



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

a minimum, the tests will be performed to verify conformance to the Specifications with minimum values specified in Table 7.

- The testing frequencies specified shall be increased when the QAC determines that construction conditions (such as adverse weather, equipment breakdown, improperly ballasted compactor, excessive lift thickness, improper soil type, improper moisture conditioning and compaction) warrant additional tests. Additional tests will be approved by the TM and directed by the QAC. Quality Control (QC) testing is the responsibility of the Contractor, with the required testing and minimum testing frequencies corresponding to the earthwork QAC testing program ~~as~~ summarized in Table 6. Similarly, the required QC testing, including manufacturer's quality control (MQC), and minimum testing frequencies for the Geosynthetic Liner installation are summarized in Table 7.



**Table 6: Soil Construction Minimum Testing Frequencies<sup>1</sup>**

Test and ASTM Designation <sup>1</sup>	Interim Cover, Radon Barrier, Erosion Barrier (cy)	Capillary Break, <del>Filter Layer</del> (cy)	Bio-Intrusion Barrier, Riprap, Rock Blanket, CDOT Type I Bedding, CDOT Type II Bedding, Toe Protection (cy)
Compaction (ASTM D698)	50,000	N/A	Note 4
Compaction (ASTM D1557)	N/A	50,000	N/A
Particle Size <sup>2</sup> (ASTM C117, C136, D1140)	50,000	50,000	10,000
Atterberg Limits (ASTM D4318)	50,000	N/A	10,000
Moisture Content <sup>3</sup> (ASTM D2216, D4643, D6938)	2,000	2,000	Note 4
Sand Cone (ASTM D1556) and Nuclear Density <sup>3</sup> (ASTM D6938)	2,000	2,000	Note 4

<sup>1</sup> Test shall be performed at the specified frequency, or one per material type, whichever is greater.

<sup>2</sup> Use the USCS description and identification (ASTM D2488).

<sup>3</sup> In-place moisture content and in-place density using D6938 acceptable only after accuracy established by D2216 and D1556 methods with the correlation coefficient of 0.9 or greater.

<sup>4</sup> Will be placed in accordance with an approved method specification.

Soil compaction requirements for the Interim Cover material are 90 percent or greater of the maximum dry density and within minus 2 to plus 3 percent of optimum moisture as determined by the Standard Proctor method (ASTM D698).



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

**Table 7: Geosynthetic Liner Minimum Testing Frequencies**

<u>Test and ASTM Designation</u>	<u>Test Frequency (sq.ft.)</u>	<u>Required Values</u>
<u>Bentonite Swell Index<sup>1</sup></u> <u>(ASTM D5890)</u>	<u>1 per 50 tons</u>	<u>24 mL/2g min.</u>
<u>Bentonite Fluid Loss<sup>1</sup></u> <u>(ASTM D5891)</u>	<u>1 per 50 tons</u>	<u>18 mL max.</u>
<u>Bentonite Mass/Area<sup>2</sup></u> <u>(ASTM D5993)</u>	<u>40,000 ft<sup>2</sup></u>	<u>0.75 lb/ft<sup>2</sup> min</u>
<u>GCL Grab Strength<sup>3</sup></u> <u>(ASTM D6768)</u>	<u>200,000 ft<sup>2</sup></u>	<u>45 lbs/in MARV</u>
<u>GCL Peel Strength<sup>3</sup></u> <u>(ASTM D6496)</u>	<u>40,000 ft<sup>2</sup></u>	<u>3.5 lb/in min</u>
<u>GCL Index Flux<sup>4</sup></u> <u>(ASTM D5887)</u>	<u>Periodic</u>	<u>1 x 10<sup>-9</sup> m<sup>3</sup>/m<sup>2</sup>/sec max</u>
<u>GCL Hydraulic Conductivity<sup>4,f</sup></u> <u>(ASTM D5887)</u>	<u>Periodic</u>	<u>5 x 10<sup>-10</sup> cm/sec max</u>
<u>GCL Hydrated Internal Shear Strength<sup>5,6</sup></u> <u>(ASTM D5321, ASTM D6243)</u>	<u>Periodic</u>	<u>500 psf typical</u>

<sup>1</sup> Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities. Test shall be performed at the specified frequency, or one per material type, whichever is greater.

<sup>2</sup> Bentonite mass/area reported at 0 percent moisture content. Use the USGS description and identification (ASTM D2488).

<sup>3</sup> All tensile strength testing is performed in the machine direction using ASTM D 6768. Upon request, tensile results can be reported per modified ASTM D 4632 using 4 inch grips.

<sup>4</sup> Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5x10<sup>-9</sup> cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided. ASTM D5887 testing is performed only on a periodic basis because the membrane is essentially impermeable.

<sup>5</sup> Peak value measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

<sup>6</sup> The reinforced GCL shall have 10,000 hour test data for large-scale constant load (creep) shear testing under hydrated conditions. The displacement shall be 0.07 inches or less at a constant shear load of 250 pounds per square foot (psf) and a normal load of 500 psf.

<sup>7</sup> The reinforced GCL shall have seam test data from an independent laboratory showing that the seam flow with a grooved cut in one of the nonwoven geotextiles is less than 1x10<sup>-9</sup> m<sup>3</sup>/m<sup>2</sup>/sec at 2 psi hydraulic pressure.

<sup>8</sup> In-place moisture content and in-place density using D6938 acceptable only after accuracy established by D2216 and D1556 methods with the correlation coefficient of 0.9 or greater.

The Standard Proctor test (ASTM D698) shall be used to determine the maximum density for Radon Barrier compaction. The compacted material shall be placed at a density equal to or greater than 95 percent of the



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

maximum density and at a moisture content between minus 1 percent and plus 3 percent of optimum moisture content as determined using the Standard Proctor test.

### 15.3.5.2 Construction Monitoring

The QAC will monitor the installation of earthwork and geosynthetic components ~~of the construction~~ to verify that the construction is in accordance with the Specifications. The QAC shall identify inadequate construction methodologies or materials that may adversely impact the performance of the closure construction. The QAC will record visual observations throughout the construction process to ensure that the materials are placed to the minimum dimensions as shown on the Drawings.

The QAC shall observe and document foundation preparation, confirming that foundations are free of soft, organic and otherwise deleterious materials (such as debris, branches, vegetation, ice or frozen materials) as well as sufficiently dewatered for handling construction equipment. Dewatering activities will be performed by the Owner, and will begin well in advance of cover placement in the Tailings Cells. During placement of soil materials, the QAC shall:

- Verify the use of appropriate fills;
- Monitor and document placement, including soil type, particle size, loose lift thickness, moisture conditioning process, compaction equipment and methods used to attain compaction including number of passes, uniformity of compaction coverage, compacted lift thickness, bonding of lifts and in-place moisture content and dry density is in compliance with the Specifications;
- Monitor surface preparation to verify that the surface is properly prepared;
- Monitor the placement of fill materials to ensure that the Contractor exercises care in the vicinity of pipes, and that underlying geosynthetics are not damaged; and
- Monitor equipment being used to place the fill materials to verify that the Contractor places the material in accordance with the Specifications.

QAC monitoring of Geosynthetic Liner placement shall include the following:

- Verify that the subgrade is free of deleterious materials prior to deployment, that anchoring is achieved as specified (if applicable), and deployment procedures are performed in compliance with the Specifications;
- Verify sufficient overlap and that the specified seam procedures were followed in compliance with the Specifications;
- Verify that all repairs are performed in compliance with the Specifications; ~~and~~
- Observe and document that the final lift of the Radon Barrier material is placed on top of the Geosynthetic Liner in such a manner as to ensure that the Geosynthetic Liner and underlying Interim Cover materials are not damaged; ~~and-~~



- In addition, the QAC shall verify that prior, during and after construction, the rolls of Geosynthetic Liner material are handled and stored in accordance with the manufacturer's recommendations.

### **15.3.6 Tailings Cell Construction Documentation**

Documentation by the QAC shall consist of daily record-keeping, construction problem resolutions, design and Specification changes, photographic records of decommissioning and closure construction activities, weekly progress reports, chain of custody forms for test sample tracking, and a CQA Report.

#### **15.3.6.1 Daily Record Keeping**

Daily records kept by the QAC shall consist of field notes, observation and testing data sheets, summary of meetings with the Contractor, and reporting of construction problems and resolutions. The QAC shall submit this information on a regular basis to the DPM for review.

#### **15.3.6.2 Soils Observation and Testing Forms**

The QAC will document soils observations on forms that generally include the following information:

- Date, project name, location, and weather data, including high and low daily temperatures and precipitation (if any);
- A site plan showing work areas and test locations;
- Descriptions of ongoing construction detailing work areas and equipment used by the Contractor;
- Summary of test results and samples obtained, with locations and elevations;
- Resolutions of deficient test results;
- Test equipment calibrations, if necessary;
- Summary of meetings held; and
- Signature or initials of the QAC.

#### **15.3.6.3 Geosynthetic Liner Placement Observation and Testing Forms**

The QAC will document Geosynthetic Liner observations on forms that generally include the following information:

- Date, project name, location, and weather data, including high and low daily temperatures and precipitation (if any);
- Descriptions of ongoing construction detailing work areas and equipment used by the Contractor;
- Numbering system identifying test or sample number;
- Location and identification of repairs and date of repair (if applicable);



- Measurements for geomembrane panels or seams;
- Location of tests and test results;
- Identification of testing technicians and time of tests;
- Summary of meetings held; and
- Signature or initials of the QAC.

■

### 15.3.6.43 Photo Documentation

The QAC shall photograph the various phases of decommissioning and closure construction. Photographs shall be identified by location, time, date, and name of the QAC taking the photograph.

### 15.3.6.54 Design and Specification Changes

During closure construction, the need to address design and Specification changes, modifications or clarifications may arise. In such cases, the QAC shall notify the TM, who shall notify the DPM. Design and Specification changes shall be approved, signed and sealed by a Professional Engineer (P.E.) licensed in the State of Colorado. Design and Specification changes shall only be made with written agreement from the Owner and DPM, and may require review and/or approval by CDPHE.

### 15.3.6.65 Weekly Progress Reports

The QAC shall prepare weekly progress reports summarizing decommissioning, closure construction and CQA activities. This report shall be submitted to the DPM, and shall include the following:

- Date, project name and location;
- Summary of decommissioning activities;
- Summary of construction-related activities;
- Summary of samples taken and test results;
- Summary of deficiencies and/or defects and resolutions; and
- Signature of the QAC.

### 15.3.6.76 CQA Report

At the completion of the decommissioning and closure construction, the QAC shall submit a CQA Report to the DPM. This report shall confirm that the work was performed in accordance with the approved Decommissioning Plan, and will contain the following information:

- Summary of decommissioning and closure construction activities;
- Photographic documentation;



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

- Test data sheets;
- Geosynthetic Liner QA and QC documents;
- Earthwork CQA test results, including date, test locations and resolutions of deficient test results;
- CQA observation of Contractor's QC activities;
- Copies of surveyors' certificates;
- Fill temperature monitoring results;
- Staff schedule summary;
- A description of significant construction problems and resolution for these problems;
- Changes to the Drawings or Specifications, and the justification for these changes;
- Record Drawings;
- A statement that the decommissioning and closure construction was completed in compliance with the Drawings and Specifications, signed and sealed by the QAC; and
- As-built drawings signed and sealed by a Professional Engineer (P.E.) licensed in the State of Colorado.



## 16.0 HEALTH AND SAFETY

### 16.1 General

This section defines the working conditions and monitoring designed to protect the health and safety of workers. The safety equipment, monitoring devices and frequencies, action levels, and training programs are intended to comply with EFRC's "Material License Application," dated 2009.

Standard operating protocols, including most of the radiological and non-radiological health and safety training and procedures developed for mill operations, will be used for decommissioning. These protocols are included in the Piñon Ridge Mill Health and Safety Plan (EFRC 2009).

An environmental monitoring and control program will be in place for the decommissioning activities, which will comply with the regulatory requirements in 10 CFR Part 20 to protect workers, the public and the environment from ionizing radiation during decommissioning and reclamation activities.

#### 16.1.1 Scope of Work

This section addresses health and safety requirements and activities for work performed by the Contractor. These requirements include:

- Pre- and post-work physical examinations for all on-site personnel unless specifically waived by the project industrial hygienist and Radiation Safety Officer (RSO);
- Adherence to 10 CFR Parts 19 and 20;
- Site orientation meeting;
- Training in proper implementation of protective measures for worker health and safety during the project including Radiation Work Permits (RWPs); and
- Adherence to the Health and Safety Plan.

The Contractor shall comply with the Mine Safety and Health Administration (MSHA) and CDPHE regulations. The Owner shall provide the Contractor and subcontractors with a copy of the Health and Safety Plan.

Analytical testing related to radiological contamination surveys and radiological monitoring shall be performed by the Owner. Site conditions are expected to vary. The RSO, with approval of the DPM, may authorize deviations from the schedule of reclamation activities after evaluating the potential hazards of changing the sequence.

#### 16.1.2 Related Work

All sections included in these Specifications.



## 16.2 Safety Equipment

### 16.2.1 Personal Protective Equipment

Personal protective equipment shall consist of a hard hat, gloves (rubber, where appropriate), work clothes or coveralls, particulate Level C half-mask cartridge or full face respirators, safety glasses, and work boots.

### 16.2.2 Exposure Monitoring

Each of the Contractor's employees shall be required to wear a dosimeter badge to measure external radiation exposure. A low-volume air sampler shall be used in the general work area during non-routine work tasks in accordance with the Occupational General Air Particulate Survey procedure (EFRC, 2009) unless otherwise directed by the RSO. The filter paper from the air sampler shall be collected and analyzed for uranium. At least one employee shall also be outfitted by the Contractor with a breathing zone sampler to measure airborne uranium in accordance with the Occupational Breathing Zone Monitoring procedure (EFRC, 2009) and one sample shall be obtained per day for each location where work is being performed. The breathing zone samplers will run continuously during each shift with the filter paper being collected daily and analyzed for uranium.

## 16.3 Execution

### 16.3.1 Responsible Personnel

The Contractor shall designate key project personnel and provide each person's resume for review by the DPM. A line of authority shall be established between the RSO and the Contractor's supervisory personnel.

### 16.3.2 Hazard Analysis

The potential hazards associated with the site activities include chemical, physical, and radiological hazards. The chemical hazards involve potential exposure to affected soils and uranium tailings with the associated process chemicals used in the milling of ore.

The physical hazards associated with construction activities primarily involve working with and around heavy equipment, including elevated noise levels, diesel fume, overhead and buried utility lines, moving parts on equipment, and potential equipment rollover or other accidents. Demolition activities include additional physical hazards such as dust from construction debris, elevated tripping and falling hazards, hazards associated with unstable (unsecured, rolling or falling) structural members and hazards associated with the demolition of high-pressure hydraulic lines and electrical installations.

The radiological hazards include exposure to external radiation (gamma), and internal radiation, including alpha and beta radiation associated with inhalation and ingestion of airborne contamination. The Contractor



shall specify the measures to be taken to mitigate or minimize these hazards and any other hazards anticipated during site activities.

### 16.3.3 Radiological Safety

The radiation safety program consists of the following elements:

- 1) Written and practiced "as low as is reasonably achievable" (ALARA) philosophy is shared in responsibility by the Owner, the RSO, and all workers.
- 2) The RSO has the authority to suspend, postpone, or modify any work activity that is potentially hazardous to workers or, a violation of CDPHE rules or license conditions.
- 3) The RSO is delegated the authority to enforce regulations and administrative policy that affects any aspect of the radiological safety program.
- 4) The RSO develops and administers the ALARA program and is active in review and approval of plans for new equipment, process changes, or changes in operating procedures to ensure that the plans do not adversely affect the protection program against uranium and its decay products.
- 5) Radiation Work Plans are required for non-routine activities.
- 6) Daily inspections are conducted by the RSO or his designee.
- 7) Weekly inspections are conducted and documented by the radiation personnel.
- 8) Monthly reports shall be submitted by the RSO to the Vice President of Governmental and Regulatory Affairs of EFRC.
- 9) Technically qualified personnel are employed and key personnel receive continued training.
- 10) A comprehensive radiation safety training program is implemented.
- 11) An extensive surveying and monitoring program is conducted by the radiation and environmental personnel.
- 12) Respiratory protection for employees is used as necessary.
- 13) Bioassay program(s) for employees are performed.
- 14) Facilities and equipment are properly designed to ensure adequate protection for the employees and environment.
- 15) Proper facility layout maintains employee exposures ALARA.
- 16) Access is restricted for areas of potential exposure to airborne radioactivity.
- 17) Dusting of tailings areas is minimized.
- 18) Fume hoods are present in analytical areas.
- 19) Written analytical procedures are available to personnel.
- 20) Written procedures for instrument operation, sample collection, instrument calibration, and documentation are available.



21) Records and filing relating to the radiation safety program are maintained.

The Contractor shall specify minimum equipment requirements for the levels of protection to be maintained on-site, in accordance with the RSO's program. The Contractor shall provide equipment for its employees. Personal protection equipment (PPE) equipment shall meet or exceed the levels specified in the Health and Safety Plan. The Contractor shall conduct a medical monitoring program to meet or exceed requirements stipulated by the Piñon Ridge Mill Health and Safety Plan (EFRC 2009).

A bioassay program to periodically evaluate the urinary levels of uranium in accordance with the Piñon Ridge Mill Health and Safety Plan (EFRC 2009) shall also be required. The Construction Health and Safety Plan shall specify that all site visitors shall be required to demonstrate compliance with these requirements before being allowed on-site in any active work area.

### **16.3.4 Exposure Monitoring**

#### **16.3.4.1 Radiation Exposure**

Radiation monitoring will be provided for all employees, including contract employees, assisting in reclamation.

Primary monitoring of external radiation exposure of employees shall be provided by a commercial badge service company utilizing dosimeter badges measuring beta and gamma radiation. All employees assigned to work in the restricted area shall wear such a badge. The badges shall be worn and corrective actions taken in accordance with the Personal Radiation monitoring procedure (EFRC 2009).

Area air monitoring will be conducted in accordance with Occupational General Air Particulate Survey procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

Breathing zone air monitoring will be conducted in accordance with the Occupational Breathing Zone Monitoring procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

Urinalysis bioassays will be conducted in accordance with the Bioassay procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

Radon and Radon daughters shall be sampled in accordance with the Radon-222/Radon-220 Decay Product Surveys procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

#### **16.3.4.2 Radiological Contamination Survey Program**

Radiological contamination surveys shall be conducted in the lunch rooms, change rooms, and offices at in accordance with the Alpha Beta Gamma Contamination Surveys procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.



Release of equipment or materials from the restricted area shall be performed in accordance with the Release of Equipment to Unrestricted Areas procedure (EFRC 2009).

Policy statements shall be issued regarding housekeeping and cleanup requirements.

### ***16.3.5 Emergency Procedures***

The Contractor shall designate a local facility for treatment of work injuries. The name and address of this facility shall be provided to the Owner and posted at the job site.

Appropriate routes to the treatment center and methods of emergency contact shall also be specified by the Contractor in the designation and posting.

A list of emergency phone numbers shall be maintained on-site.

### ***16.3.6 Site Control and Decontamination***

Release procedures for personnel shall include a radioactive activity scan of skin and clothing prior to leaving the site each day in accordance with the Personnel Release Surveys procedure (EFRC 2009).

All personnel, clothing, equipment, materials and vehicles coming in contact with tailings shall be decontaminated in an area designated by the Owner prior to removal from the restricted area in accordance with the Decontamination procedure (EFRC 2009) and surveyed in accordance with the appropriate procedure.

### ***16.3.7 General Site Health and Safety and Work Rules***

The Contractor shall delineate its standard operating rules as they apply to job safety. Incorporation of the Owner's rules shall also be required.

### ***16.3.8 Health and Safety Training***

The Contractor's employees shall receive site-specific radiation safety training by the Owner's RSO. The Contractor shall also schedule periodic on-site training meetings.

All visitors and regulatory personnel who require access to the active work area/restricted area shall be expected to demonstrate compliance with these requirements.

Radiation protection training shall be conducted for all employees, including contract employees, assisting in reclamation.

All new employees shall be instructed by means of an established course in the inherent risk of exposure to radiation and the fundamentals of protection against exposure to uranium and its decay products in accordance with the Radiological Health and Safety Training procedure (EFRC 2009). Each female



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

employee of reproductive age shall be given additional training in accordance with the Pregnant Women procedure (EFRC 2009).

The radiation safety training program shall include the following topics:

- 1) Fundamental radiation chemistry - primarily terms and definitions related to radiation.
- 1) What radiation is and where it comes from.
- 2) Types of radiation exposure.
- 3) Health effects.
- 4) ALARA definition and measures to maintain ALARA exposures.
- 5) Radiation protection regulations (10 CFR Parts 19 and 20).
- 6) Site-specific radiation types.
- 7) Site-specific radiation hazards.
- 8) Fundamentals of health protection.
- 9) Personal hygiene.
- 10) Facility-provided protection.
- 11) Health protection measurements and instrumentation.

A written test with questions directly relevant to the principles of radiation safety and health protection covered in the training shall be given to each worker. The test results shall be reviewed and wrong answers shall be discussed to make sure the worker understands the correct answer. The test results shall be maintained in each employee's file.

Retraining shall be conducted at least annually covering radiation safety regulations, problems, and operating procedures. Employees shall be encouraged to make suggestions relating to work assignments that could make their job safer and/or their exposure levels lower.

Hazard training and task training shall be conducted by the Contractor to instruct new employees on the job. This training shall be documented.

Individual instruction or advice shall be given by the RSO upon issuance of a Radiation Monitoring Request Form.

All visitors and contractors shall be instructed in industrial and/or radiation safety requirements relating to their project-specific function. All visitors touring the restricted area shall be escorted by someone properly trained and knowledgeable about the hazards of the site.



## 17.0 REFERENCES

CH2M Hill, 2009. *Basic Engineering Report, Piñon Ridge Project, Colorado*. Report prepared for Energy Fuels Resources. 4 February 2009.

Colorado Department of Transportation (CDOT). 2008. State Highway Access Permit. CDOT Permit No. 508015. Permittee: Stephen Antony, Energy Fuels Resources Corporation. 21 May 2008.

Energy Fuels Resources Corporation (EFRC). 2009. Piñon Ridge Mill Health and Safety Plan, Lakewood, Colorado.

Environmental Restoration Group (ERG). 2009. Baseline Radiological Investigation Report, Piñon Ridge Uranium Mill, Montrose County, Colorado.

Golder Associates Inc. (Golder). 2008a. Technical Specifications, Piñon Ridge Project, Montrose County, Colorado. Revision A – Issued for Permitting. Prepared for Energy Fuels Resources Corporation. September. Project No. 073-81694.0009.

Golder Associates Inc. (Golder). 2008b. Ore Pad Design Report, Piñon Ridge Project, Montrose County, Colorado. Prepared for Energy Fuels Resources Corporation. October. Project No. 073-81694.0005.

Golder Associates Inc. (Golder). 2008c. Tailings Cell Design Report, Piñon Ridge Project, Montrose County, Colorado. Prepared for Energy Fuels Resources Corporation. October. Project No. 073-81694.0003.

Golder Associates Inc. (Golder). 2008d. Evaporation Pond Design Report, Piñon Ridge Project, Montrose County, Colorado. Prepared for Energy Fuels Resources Corporation. October. Project No. 073-81694.0004.

Kleinfelder. 2009a. Piñon Ridge Project – Tailings Cell Cover and Site Closure Grading Plans, Montrose County, Colorado. February 13, 2009.

~~Kleinfelder. 2009b. Tailings Cell Closure Design Report, Energy Fuels Corporation, Piñon Ridge Project, Montrose County, Colorado. February 13, 2009.~~

Kleinfelder. ~~2009c~~2009b. Mill Decommissioning Plan – Energy Fuels Resources Corporation – Uranium Mill Licensing Support, Montrose County, Colorado, April 9, 2009.

~~Kleinfelder. 2010. Tailings Cell Closure Design Report, Energy Fuels Corporation, Piñon Ridge Project, Montrose County, Colorado. September 10, 2010.~~

**ATTACHMENT B**  
**REVISED SPECIFICATIONS FOR CLOSURE AND**  
**RECLAMATION OF MILL FACILITIES**



OCTOBER 2010

SPECIFICATIONS

## PIÑON RIDGE PROJECT, MONTROSE COUNTY, COLORADO

### Specifications for Closure and Reclamation of Mill Facilities

**Submitted to:**  
Energy Fuels Resources Corporation  
44 Union Blvd., Suite 600  
Lakewood, CO 80228



**Project Number:** 073-81694.0022

**Revision Number:** B –Revised, Issued for Permitting

  
A world of  
capabilities  
delivered locally





## Table of Contents

- 1.0 GENERAL PROJECT REQUIREMENTS..... 1
  - 1.1 General Description of Work ..... 1
  - 1.2 Reclamation Work Items..... 1
  - 1.3 Sanitary Facilities..... 2
  - 1.4 Drawings ..... 2
  - 1.5 As-Built Drawings ..... 2
  - 1.6 Communications ..... 2
  - 1.7 Federal, State, and Local Laws and Permits..... 3
  - 1.8 Project Completion ..... 3
  - 1.9 Codes and Standards ..... 3
  - 1.10 Submittals ..... 4
    - 1.10.1 Permits ..... 4
    - 1.10.2 Manufactured Products ..... 5
    - 1.10.3 Fabrication/Construction Details ..... 5
  - 1.11 Testing of Soil and Rock Materials ..... 5
  - 1.12 Definitions ..... 5
    - 1.12.1 General Terminology..... 5
    - 1.12.2 Description of Parties ..... 6
      - 1.12.2.1 Owner ..... 6
      - 1.12.2.2 Decommissioning Project Manager (DPM) ..... 6
      - 1.12.2.3 Task Manager (TM) ..... 6
      - 1.12.2.4 Contracting Officer (CO)..... 6
      - 1.12.2.5 Radiation Safety Officer (RSO) ..... 7
      - 1.12.2.6 Quality Assurance Coordinator (QAC) ..... 7
      - 1.12.2.7 Contractor ..... 7
    - 1.12.3 Materials..... 8
      - 1.12.3.1 Soil..... 8
      - 1.12.3.2 Topsoil ..... 8
      - 1.12.3.3 Rock..... 8
      - 1.12.3.4 Tailings ..... 8
      - 1.12.3.5 Windblown Tailings..... 9
      - 1.12.3.6 Affected Soil..... 9
      - 1.12.3.7 Ore ..... 9
      - 1.12.3.8 By-Product ..... 9
      - 1.12.3.9 Interim Cover ..... 9
      - 1.12.3.10 Tailings Cell Closure Cover Materials ..... 10



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

2.0	CLEARING AND GRUBBING .....	12
2.1	General .....	12
2.1.1	Scope of Work.....	12
2.1.2	Related Work.....	12
2.2	Products.....	12
2.3	Execution .....	12
3.0	UTILITY PROTECTION AND RELOCATION.....	13
3.1	General .....	13
3.1.1	Scope of Work.....	13
3.1.2	Related Work.....	13
3.2	Products.....	13
3.3	Execution .....	13
4.0	DECONTAMINATION.....	15
4.1	General .....	15
4.1.1	Scope of Work.....	15
4.1.2	Related Work.....	15
4.1.3	Definitions.....	15
4.1.4	Submittals.....	15
4.2	Products.....	15
4.3	Execution .....	16
5.0	BUILDING DEMOLITION AND DEBRIS DISPOSAL .....	17
5.1	General .....	17
5.1.1	Scope of Work.....	17
5.1.2	Related Work.....	17
5.2	Products.....	17
5.3	Execution .....	17
5.3.1	General.....	17
5.3.2	Disposal Method .....	17
5.3.2.1	Demolition Debris Disposal .....	18
5.3.2.2	Compaction Requirements .....	18
5.3.3	Disposal Locations .....	18
5.3.4	Backfilling .....	19
6.0	AFFECTED SOIL EXCAVATION AND PLACEMENT .....	20
6.1	General .....	20
6.1.1	Scope of Work.....	20
6.1.2	Related Work.....	20
6.1.3	Definitions.....	20
6.1.4	Submittals.....	21



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

6.2	Products.....	21
6.3	Execution .....	21
6.3.1	Radiological Survey .....	21
6.3.1.1	Initial Soil Survey .....	21
6.3.1.2	Verification Survey.....	22
6.3.2	Erosion Control.....	22
6.3.3	Access Roads and Dust Suppression.....	22
6.3.4	Excavation of Affected Soils.....	22
6.3.5	Regrading of Excavated Areas .....	23
6.3.6	Placement of the Affected Soil .....	23
7.0	MILL DECOMMISSIONING.....	24
7.1	General .....	24
7.1.1	Scope of Work.....	24
7.1.2	Regulatory and Guidance Requirements .....	24
7.1.3	Related Work.....	24
7.2	Products.....	24
7.3	Execution .....	25
7.3.1	Systems and Equipment Decommissioning.....	25
7.3.1.1	Uncontaminated Systems and Equipment .....	25
7.3.1.2	Contaminated Systems and Equipment .....	25
7.3.2	Buildings, Structures and Soils Decommissioning.....	25
8.0	ORE PAD RECLAMATION.....	26
8.1	General .....	26
8.1.1	Scope of Work.....	26
8.1.2	Related Work.....	26
8.2	Products.....	26
8.3	Execution .....	26
9.0	EVAPORATION PONDS RECLAMATION.....	28
9.1	General .....	28
9.1.1	Scope of Work.....	28
9.1.2	Related Work.....	28
9.2	Products.....	28
9.3	Execution .....	29
9.3.1	Reclamation Sequence .....	29
9.3.2	Removal of Contaminated Materials.....	29
9.3.2.1	Evaporation Pond Solids .....	29
9.3.2.2	Synthetic Liners .....	29



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

10.0	TAILINGS REGRADING AND INTERIM COVER PLACEMENT .....	30
10.1	General .....	30
10.1.1	Scope of Work.....	30
10.1.2	Related Work.....	30
10.1.3	Definitions.....	30
10.1.4	Submittals.....	30
10.2	Products.....	31
10.3	Execution .....	31
10.3.1	General.....	31
10.3.2	Access Roads and Dust Suppression.....	31
10.3.3	Dewatering (Underdrain) System Abandonment .....	31
10.3.4	Surface Water and Erosion Control .....	32
10.3.5	Regrading.....	32
10.3.6	Placement of Interim Cover.....	32
10.3.7	Settlement Monitoring Points .....	33
10.3.7.1	Survey Frequency.....	34
10.3.7.2	Settlement Monitoring Point Decommissioning.....	34
10.3.8	Radon Flux Measurements .....	35
11.0	TAILINGS CELL CLOSURE COVER .....	36
11.1	General .....	36
11.1.1	Scope of Work.....	36
11.1.2	Related Work.....	36
11.1.3	Definitions.....	37
11.1.4	Submittals.....	37
11.2	Products.....	37
11.3	Execution .....	37
11.3.1	Closure Cover Construction .....	37
11.3.1.1	General .....	37
11.3.1.2	Materials .....	38
11.3.1.3	Radon Barrier Placement .....	38
11.3.1.4	Geosynthetic Liner Placement.....	39
11.3.1.5	Bio-Intrusion Barrier Placement.....	39
11.3.1.6	Capillary Break Placement .....	39
11.3.1.7	Erosion Barrier Placement.....	39
11.3.2	Settlement Monitoring Points .....	40
11.3.3	Radon Flux Measurements .....	40



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

12.0	EROSION PROTECTION PLACEMENT .....	41
12.1	General .....	41
12.1.1	Scope of Work.....	41
12.1.2	Related Work.....	41
12.2	Materials .....	41
12.2.1	Riprap.....	42
12.2.2	Rock Blanket .....	42
12.2.3	Toe Protection.....	42
12.2.4	CDOT Type I Bedding and CDOT Type II Bedding .....	42
12.3	Execution .....	43
12.4	Placement.....	44
12.4.1	Riprap.....	44
12.4.2	Rock Blanket .....	44
12.4.3	Toe Protection.....	44
12.4.4	CDOT Type I Bedding and CDOT Type II Bedding .....	45
13.0	VEGETATION.....	46
13.1	General .....	46
13.1.1	Scope of Work.....	46
13.1.2	Related Work.....	46
13.2	Products.....	46
13.2.1	Seed Mixture Specifications and Planting Locations .....	46
13.2.1.1	Seed Mixture 1.....	47
13.2.1.2	Seed Mixture 2.....	47
13.2.2	Mulch.....	47
13.3	Execution .....	50
13.3.1	General.....	50
13.3.2	Soil Preparation.....	50
13.3.3	Seeding .....	50
13.3.4	Mulching.....	50
13.3.5	Restoration .....	50
14.0	FENCING.....	51
14.1	General .....	51
14.1.1	Scope of Work.....	51
14.1.2	Related Work.....	51
14.2	Products.....	51
14.2.1	Chain Link Fence .....	51
14.2.1.1	Chain Link Fence Fabric.....	52
14.2.1.2	Line Posts.....	52



# PIÑÓN RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

14.2.1.3	End, Pull and Corner Posts .....	52
14.2.1.4	Top Rails.....	52
14.2.1.5	Compression Braces and Tension Rods.....	52
14.2.1.6	Post Tops (Post Caps).....	52
14.2.1.7	Stretcher Bars.....	53
14.2.2	Barbed Wire Fence .....	53
14.2.3	Chain Link Gates.....	53
14.2.3.1	Gate Frame.....	53
14.2.3.2	Gate Posts .....	53
14.2.3.3	Gate Hinges.....	53
14.2.3.4	Drop Rod, Latches, Padlocks and Catches.....	53
14.2.4	Hardware Wire Cloth (Wire Cloth).....	54
14.2.5	Concrete Foundations.....	54
14.3	Execution .....	54
14.3.1	Fence Installation .....	54
14.3.2	Chain Link Fence Installation .....	54
14.3.3	Barbed Wire Fence Installation .....	55
15.0	CONSTRUCTION QUALITY ASSURANCE.....	56
15.1	General .....	56
15.1.1	Environmental Submittals .....	56
15.1.2	Cleanup Verification Plan.....	57
15.1.3	In-Place Radiological Testing of Surface Tailings.....	57
15.1.4	Settlement Monitoring Report .....	57
15.1.5	Radon Barrier Prequalification .....	57
15.1.6	Tailings Cell Closure Cover Quality Control Report.....	57
15.1.7	Radon Flux Measurements .....	57
15.2	Products.....	57
15.3	Execution .....	58
15.3.1	Verification of Demolition Activities .....	58
15.3.2	Settlement Monitoring .....	58
15.3.3	Testing of In-Place Tailings and Interim Cover.....	59
15.3.4	Radon Barrier Placement, Compaction and Testing.....	59
15.3.4.1	Material Prequalification .....	60
15.3.4.2	Radon Barrier General Classification Testing .....	61
15.3.4.3	Radon Barrier Compaction Testing.....	61
15.3.4.4	Radon Flux Measurement .....	61
15.3.5	Earthworks and Geosynthetic Liner Quality Assurance.....	61
15.3.5.1	Construction Testing.....	61



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

15.3.5.2	Construction Monitoring.....	64
15.3.6	Tailings Cell Construction Documentation .....	65
15.3.6.1	Daily Record Keeping .....	65
15.3.6.2	Soils Observation and Testing Forms .....	66
15.3.6.3	Geosynthetic Liner Placement Observation and Testing Forms.....	66
15.3.6.4	Photo Documentation .....	66
15.3.6.5	Design and Specification Changes.....	66
15.3.6.6	Weekly Progress Reports.....	67
15.3.6.7	CQA Report .....	67
16.0	HEALTH AND SAFETY .....	68
16.1	General .....	68
16.1.1	Scope of Work.....	68
16.1.2	Related Work.....	68
16.2	Safety Equipment .....	69
16.2.1	Personal Protective Equipment.....	69
16.2.2	Exposure Monitoring .....	69
16.3	Execution .....	69
16.3.1	Responsible Personnel .....	69
16.3.2	Hazard Analysis .....	69
16.3.3	Radiological Safety .....	70
16.3.4	Exposure Monitoring .....	71
16.3.4.1	Radiation Exposure .....	71
16.3.4.2	Radiological Contamination Survey Program.....	71
16.3.5	Emergency Procedures.....	72
16.3.6	Site Control and Decontamination .....	72
16.3.7	General Site Health and Safety and Work Rules.....	72
16.3.8	Health and Safety Training.....	72
17.0	REFERENCES .....	74

## List of Tables

Table 1: Acceptable Surface Contamination Levels.....	16
Table 2: Erosion Protection Components .....	43
Table 3: Proposed Seed Mixture 1 – Shallow Rooted.....	48
Table 4: Proposed Seed Mixture 2 – Deep Rooted.....	49
Table 5: Hardware Wire Cloth Wire Gage.....	54
Table 6: Soil Construction Minimum Testing Frequencies .....	63
Table 7: Geosynthetic Liner Minimum Testing Frequencies .....	64



## 1.0 GENERAL PROJECT REQUIREMENTS

### 1.1 General Description of Work

The work covered by these Technical Specifications (Specifications) consists of decommissioning and reclamation construction activities for the uranium mill, ore pad, tailings cells, and evaporation pond areas at Energy Fuels Resources Corporation's (EFRC) Piñon Ridge Project located in the Paradox Valley of western Montrose County, Colorado. All work performed shall be in accordance with these Specifications and the Construction Drawings (Drawings). In the event of discrepancies, or if any aspect of the work is questionable, it shall be solely the responsibility of the Contractor to request clarification from the Owner. Work shall be performed in basic accordance with the schedule provided by the Owner. The work will be considered completed upon inspection and written approval by the Owner.

Unless otherwise specified by the Owner, the Contractor shall furnish all materials, products, equipment, supplies, utilities, skill, and labor required and all other items necessary for the work hereinafter described for decommissioning and reclamation of the tailings cells, mill areas, ore pad and evaporation ponds. Work by the Contractor shall be performed in compliance with the Health and Safety procedures identified herein.

The materials and products used shall be as specified herein for the services intended and shall be subject to review and written approval by the Owner. Such review and acceptance shall not be construed as relieving the Contractor of any responsibility or warranty stipulated in the Contract. Products or materials may be substituted only with the written consent of the Owner. The methods used by the Contractor shall produce satisfactory work for the services intended and shall be in accordance with standard construction industry practices.

### 1.2 Reclamation Work Items

Reclamation shall be performed to stabilize the mill, tailings cells, ore pad and evaporation pond areas, and to prevent migration of tailings by either wind or surface water runoff. Primary activities to be performed during reclamation are as follows:

<b>Activity</b>	<b>Specifications Section</b>
Clearing and Grubbing	2.0
Utility Protection and Relocation	3.0
Decontamination	4.0
Building Demolition and Debris Disposal	5.0
Affected Soil Excavation and Placement	6.0
Mill Decommissioning	7.0
Ore Pad Reclamation	8.0
Evaporation Ponds Reclamation	9.0
Tailings Regrading and Interim Cover Placement	10.0
Tailings Cell Closure Cover	11.0
Erosion Protection Placement	12.0
Vegetation	13.0



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Fencing	14.0
Construction Quality Assurance	15.0
Health and Safety	16.0
References	17.0

## 1.3 Sanitary Facilities

The Contractor shall provide and maintain a potable water supply, suitable sanitary facilities and shower facilities on the construction site at all times. These facilities shall be subject to approval of the county and state health departments.

## 1.4 Drawings

Drawings (Kleinfelder 2009a) accompany and form a part of the Specifications and Contract Documents. The location, extent, and general character of the work are shown on the Drawings and/or are described within these Specifications. Drawings (Kleinfelder 2009a) accompanying these Specifications are intended for preliminary design (not for construction). The Owner will furnish additional Construction Drawings prior to construction. The work shall be executed in accordance with these Drawings, Construction Drawings (with information on Construction Drawings superseding information on Drawings), and additional or supplemental Drawings or schedule as may be furnished from time to time by the Owner.

## 1.5 As-Built Drawings

The Contractor shall be responsible for preparing and providing the Owner with "as-built" Drawings by properly recording all dimensions that are necessary for construction but are not indicated on the plans. The Contractor shall also provide the Owner with measurements and data used to develop the "as-built" Drawings, including survey of decommissioned and reclaimed areas (post-closure), final site grading, and thickness of tailings cover layers on an appropriate survey grid with additional survey points at slope breaks.

## 1.6 Communications

All notices, demands, requests, instructions, approvals, proposals, and claims must be in writing. Any notice to, or demand upon, the Contractor shall be sufficiently given if delivered at the office of the Contractor, stated on the signature page of the agreement (or at such other offices as the Contractor may from time to time designate in writing to the Owner), or if deposited in the United States mail, in a sealed, postage-paid envelope, and sent certified mail, or delivered with charges prepaid by courier express, in each case addressed to such office. All correspondence required to be delivered to the Owner, unless otherwise specified in writing to the Contractor, shall be delivered to the Owner at the following address:

Energy Fuels Resources Corporation  
44 Union Blvd., Suite 600  
Lakewood, CO 80228.



## 1.7 Federal, State, and Local Laws and Permits

It shall be the responsibility of the Contractor to acquaint himself with all federal, state, and local laws and regulations governing the work to be completed and to conduct his obligations under the Contract in compliance with said laws and regulations. Permit acquisition for performance of any aspect of the work, including Radiation Work Permits (RWPs), shall be the responsibility of the Contractor unless otherwise identified by the Owner.

## 1.8 Project Completion

The project shall commence within 30 days after the date of an Owner-issued Notice to Proceed. Within this period, the Contractor shall estimate the required time period for completion of the project and provide the Owner with a detailed bar chart schedule of construction activities. The schedule shall be updated at regular intervals and provided to the Owner with special notation of any significant schedule changes proposed. The Owner shall approve any schedule changes that significantly affect completion of the work before such changes become part of the Contract Documents.

## 1.9 Codes and Standards

Work described herein shall be conducted in accordance with industry Standards including, but not limited to, the most current designation of the codes and standards designated herein. Wherever the following abbreviations are used in these Specifications or on the plans, they shall be construed the same as the respective expressions represented:

1. ASTM, "American Society for Testing and Materials."
2. USCS, "Unified Soil Classification System."
3. ASTM A 121, "Specifications for Zinc-Coated (Galvanized) Steel Barbed Wire."
4. ASTM A 123, "Specification for Zinc (Hot-dip Galvanized) Coatings on Iron/Steel Products (Made from Rolled Pressed and Forged Shapes/Castings/Plates/Bars/Strips)."
5. ASTM A 153, "Specifications for Zinc Coating (Hot-dip) on Iron/Steel Hardware."
6. ASTM A 392, "Specifications for Zinc-Coated Steel Chain-Link Fence Fabric."
7. ASTM A 491, "Specifications for Aluminum-Coated Steel Chain-Link Fence Fabric."
8. ASTM C 33, "Standard Specification for Concrete Aggregate."
9. ASTM C 88, "Test Methods for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate."
10. ASTM C 97, "Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone."
11. ASTM C 127, "Test Methods for Specific Gravity and Absorption of Coarse Aggregate."



12. ASTM C 131, "Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion Impact in the Los Angeles Machine."
13. ASTM C 136, "Methods for Sieve Analysis of Fine and Coarse Aggregates."
14. ASTM C 150, "Standard Specification for Portland Cement."
15. ASTM C 295, "Petrographic Analysis of Aggregates."
16. ASTM C 535, "Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion Impact in the Los Angeles Machine."
17. ASTM D 422, "Standard Test Method for Particle Size Analysis of Soils."
18. ASTM D 423, "Liquid Limit of Soils."
19. ASTM D 424, "Plastic Limit and Plasticity Index of Soils."
20. ASTM D 698, "Test Method for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb. (2.49-kg) Hammer and 12-in (305-mm) Drop."
21. ASTM D 854, "Test Method for Specific Gravity of Soils."
22. ASTM D 1556, "Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method."
23. ASTM D 2216, "Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil-Aggregate Mixtures (Oven-drying Method)."
24. ASTM D 2922, "Test Methods for Density of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth)."
25. ASTM D 3017, "Test Methods for Water Content of Soil and Rock In-Place by Nuclear Methods (Shallow Depth)."
26. ASTM D 3441, "Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil."
27. ASTM D 4643 "Determination of Water (Moisture) Content by the Microwave Oven Method for Expedited Test Results (Microwave Method)."

## 1.10 Submittals

### 1.10.1 Permits

If required by federal, state, or local ordinances, the Contractor shall furnish copies of all permits to the Owner prior to the commencement of the permitted activity including, but not limited to, the following:

- Fugitive dust;
- Water control;
- Burning;
- Road use;



- Radiation Work Permits (RWPs);
- General construction; and
- Off-site materials disposal.

## 1.10.2 *Manufactured Products*

Prior to use, the Contractor shall submit to the Owner manufacturer's certification and/or test data for all products utilized in construction, stating and supplying supporting data that the products meet or exceed the specification requirements given for each product. The products requiring submittals prior to use include, but are not limited to:

- Seed mixture;
- Fertilizer;
- Mulch; and
- Fence.

## 1.10.3 *Fabrication/Construction Details*

The Contractor shall submit to the Owner details of the relocation of each utility prior to initiation of relocation construction activities. The Owner and the utility company must approve the relocation in writing prior to the Contractor initiating relocation work.

## 1.11 **Testing of Soil and Rock Materials**

The Contractor shall provide the Owner access for sampling and testing of all soil and rock materials to be used in construction activities. These materials shall not be used without prior approval of the Owner. Materials requiring sampling and testing include, but are not limited to:

- Soil;
- Tailings Cell Closure Cover Materials;
- Riprap; and
- Filter Material.

## 1.12 **Definitions**

### 1.12.1 *General Terminology*

As used in these Specifications, the following terms are defined as follows:

Tailings Cell - The entire tailings cell structure which consists of the lined excavation, upstream embankment berms and hydraulically placed tailings.

Tailings Cell Top - The top of the tailings surface beginning at the upstream embankment berm of the cell.



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Berms - The Tailings Cell embankments constructed of fill which form the outer perimeter of the Tailings Cell.

Tailings Cell Drainage Channels – Surface water channels that collect surface water runoff from the reclaimed Tailings Cell area as indicated in the Drawings.

Tailings Cell Vault – Final Tailings Cell area designated for disposal of contaminated buildings, debris and affected soils.

### ***1.12.2 Description of Parties***

The following sections provide descriptions of the parties, including their responsibilities and qualifications.

#### **1.12.2.1 Owner**

The Owner refers specifically to Energy Fuels Resources Corporation (EFRC). EFRC is the Owner, and will be responsible for decommissioning and reclamation of the facility.

#### **1.12.2.2 Decommissioning Project Manager (DPM)**

The Decommissioning Project Manager (DPM) will be appointed by, and report to, the Owner. The DPM will have training and experience in radiological facility operations and/or decommissioning that is acceptable to the Colorado Department of Public Health and Environment (CDPHE). The DPM will have the primary responsibility for preparing the detailed Decommissioning Plan and for managing the decommissioning activities.

The DPM will serve as the communications coordinator for the Project, initiating construction and resolution meetings. As communications coordinator, the DPM will serve as a liaison between all parties involved in the Project to ensure that ongoing communications are maintained.

#### **1.12.2.3 Task Manager (TM)**

The decommissioning activities will be executed as tasks, each with a designated Task Manager (TM). A TM may have responsibility for more than one task. The TM will oversee the task, including work of Contractors performing the task. Each TM will have training and experience in the activity of their assigned task and will be responsible for the work plan associated with their assigned task. The TMs will report directly to the DPM.

#### **1.12.2.4 Contracting Officer (CO)**

The Contracting Officer (CO) will be appointed by the Owner, and will report to the DPM. The CO will be responsible for procurement of subcontracted services, and of materials and equipment required for decommissioning. The CO will issue bid documents and will receive and maintain records of measurement and payment for completed work.



### 1.12.2.5 Radiation Safety Officer (RSO)

The Radiation Safety Officer (RSO) will report to the Vice President of Regulatory Affairs, and will be responsible for the radiological health and safety training and procedures for all on-site workers. The RSO must have completed training in radiation protection in a program approved by the CDPHE. The RSO will approve Radiation Work Permits (RWP), and will monitor work to assess compliance with RWPs and procedures.

### 1.12.2.6 Quality Assurance Coordinator (QAC)

The Quality Assurance Coordinator (QAC) will report to the DPM and will be responsible for establishing and confirming compliance with the Quality Assurance Program. The QAC will maintain the Document Control Program, and will maintain control of the measuring and testing equipment. The QAC will alert the DPM and TMs when corrective actions are required, and will maintain records of compliance with the program requirements.

Specific responsibilities of the QAC include:

- Reviewing the Drawings, Specifications and related guidance document;
- Review all Contractor QC submittals and make appropriate recommendations regarding compliance with the Drawings and Specifications;
- Obtain construction samples and perform material evaluation testing as required;
- Monitor foundation preparation activities and material placement activities;
- Assure that testing equipment used and tests performed are conducted according to the Specifications and industry standards;
- Document and report test results to the DPM;
- Report any deficiencies to the DPM and TM that are not corrected to the satisfaction of the QAC, including Design or Specification changes;
- Prepare a Construction Quality Assurance (CQA) Report describing the decommissioning, closure and reclamation activities, and details of field and laboratory test data; and
- Maintain an on-site soils laboratory and perform regular calibration of equipment.

### 1.12.2.7 Contractor

The Contractor is responsible for reclamation construction activities. The Contractor may provide Subcontractors to fulfill portions of the reclamation construction activities, which may include demolition, radiological surveying, earthworks, and revegetation.



## 1.12.3 Materials

### 1.12.3.1 Soil

Soil consists of all earth materials capable of being excavated with conventional earthwork excavation equipment without the use of rippers, hammers, or blasting, as may be required for rock. Soil shall be free from ore and windblown tailings materials, affected soil, debris, roots, branches, stumps or other organic matter. Soils to be used in the Tailings Cell Closure Cover may be a mixture of soils from different borrow sources to achieve the required gradation. No more than 10 percent of the soil volume shall contain particles greater than 6 inches in diameter. Clean soil considered acceptable for use as final cover material shall meet the following criteria:

- Soil shall be classified as an ML, CL, SP, SP-SM, SC, or SM soil type as defined by the USCS; and
- Soil shall have a Ra-226 concentration of less than or equal to the background criterion approved by CDPHE. Soil exceeding this background criterion is defined as tailings, affected soil, or windblown tailings.

### 1.12.3.2 Topsoil

Topsoil is the upper A soil horizon containing organic matter. Affected topsoil shall be excavated and placed in the Tailings Cell Vault area. Non-affected topsoil excavated during the reclamation activities shall be stockpiled for later use during re-vegetation.

### 1.12.3.3 Rock

Rock shall consist of all earth materials harder than soil, which must be excavated by ripping with a D9 Caterpillar bulldozer or equivalent equipped with a single shank ripper, hammering, or blasting. Rock has a Ra-226 concentration less than or equal to the CDPHE-approved background criterion.

### 1.12.3.4 Tailings

Tailings consist of milled ore materials which are a by-product of the extraction of uranium. The tailings are wastes hydraulically discharged to the Tailings Cells as identified on the Drawings. The tailings, for the purposes of this work, are subdivided into the categories described below:

- Coarse Tailings - Coarse tailings consist of all tailings materials of which the predominant fraction (i.e., greater than 50 percent) is retained on the No. 200 sieve (i.e., sand size), using the procedures outlined in ASTM D 422.
- Fine Tailings - Fine tailings are fine-grained and consist of all tailings materials of which the predominant fraction (i.e., greater than 50 percent) passes the No. 200 sieve (i.e., silts and clays), using the procedures described in ASTM D 422.



### 1.12.3.5 Windblown Tailings

Windblown tailings are surface soils consisting of tailings transported by wind. Windblown tailings represent one type of affected soil and shall be defined and handled as an affected soil.

### 1.12.3.6 Affected Soil

Affected soil is any soil in the mill area or adjacent areas that contains an average Ra-226 concentration greater than:

- The background cleanup criterion approved by CDPHE for excavated soil.

Or

- Five (5) picoCuries per gram (pCi/g) above the mean background concentration for soil that will remain in the upper 15 centimeters (cm) of soil; and
- Fifteen (15) pCi/g above the mean background concentration averaged over any other 15-cm layers of soil that will remain below the surface after reclamation.

Affected soil shall be delineated by the Owner's radiological survey during the course of the work. Affected soil shall be placed within the Tailings Cell.

### 1.12.3.7 Ore

Ore is rock, soil or other material which has been transported to the mill for uranium and/or vanadium extraction. For purposes of these Specifications, "ore" is any imported material in the tailings disposal or mill area, or adjacent areas that contains an average uranium content of 0.05% or more and/or a Ra-226 concentration greater than or equal to the criterion for affected soil. Prior to reclamation of the final Tailing Cell, the remaining ore shall be placed within the Tailings Cell Vault.

### 1.12.3.8 By-Product

By-product material is tailings and wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Non-tailings by-product material encountered during the performance of reclamation activities shall be treated in the same manner as tailings material.

### 1.12.3.9 Interim Cover

Interim cover is a two-foot or greater layer of soil placed on top of the tailings. A portion of the interim cover over the fine tailings may contain a synthetic geogrid for added support. Interim cover placed over the tailings shall be left in place during construction of the radon barrier unless excavation is necessary to achieve specified grades.



## 1.12.3.10 Tailings Cell Closure Cover Materials

Materials for use as closure cover soils shall be free of organic and inorganic debris, organic soils, frozen material, and other deleterious materials, and shall be excavated and/or processed, as required. The physical properties of materials for use as cover soils are described in the following sections.

Interim Cover - Interim Cover will consist of on-site colluvium and alluvium materials. Interim Cover shall be derived from on-site stockpiles developed during project construction, consisting predominantly of material sourced from local excavations within the Tailings Cells, or other approved borrow sources.

Interim Cover shall consist of material having Unified Soil Classification (USCS) of SP, SW, SC, SM, ML, CL or CH. Interim Cover will have a maximum particle size of eight (8) inches or sixty-seven (67) percent of the approved lift height, whichever is smaller. Oversized material will be controlled through selective excavation at the stockpiles, and through the use of construction equipment to cull oversize from the fill, or break down the oversize materials.

Radon Barrier - Radon Barrier materials will consist of on-site colluvium and alluvium materials. Radon Barrier shall be derived from on-site stockpiles developed during project construction, consisting predominantly of material sourced from local excavations within the Tailings Cells, or other approved borrow sources. Radon Barrier shall consist of material having USCS of SP, SW, SC, SM, ML, CH or CL. Radon Barrier will have a maximum particle size of five (5) inches or sixty-seven (67) percent of the approved lift height, whichever is smaller. Oversized material will be controlled through selective excavation at the stockpiles, and through the use of construction equipment to either cull oversize from the fill, or break down the oversize materials.

Geosynthetic Liner – Geosynthetic Liner shall be positioned in the upper portion of the Radon Barrier and shall consist of laminated GCL such as Bentomat<sup>®</sup> CL or Bentomat<sup>®</sup> CLT produced by CETCO Lining Technology (1350 West Shure Drive, Arlington Heights, Illinois 60004), or approved equivalent.

Bio-Intrusion Barrier – The Bio-Intrusion Barrier shall be placed over the Radon Barrier, as shown in the design (refer to Kleinfelder 2010), to restrict burrowing by animals up to the size of prairie dogs. Bio-Intrusion Barrier shall consist of nominal three (3) inch rock (sound cobbles) in a native soil matrix.

Capillary Break - The Capillary Break material shall consist of free-draining granular soil (sand and gravel) imported from off-site for use in the Capillary Break layer as shown in the design (refer to Kleinfelder 2010). Specific soil gradation characteristics of the Capillary Break material shall be determined by the Task Manager for the Tailings Cell closure prior to Capillary Break construction.

Erosion Barrier – The Erosion Barrier (also referred to as the Vegetative Cover or Vegetative Cover Layer) shall be placed over the Capillary Break, as indicated in the design (refer to Kleinfelder 2010), to resist erosion by wind and runoff as well as provide a growth medium for vegetative cover. The Erosion Barrier



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

shall consist of native soil meeting the Interim Cover specifications, with rock mulch mixed in to the upper 0.5 feet of the Erosion Barrier. Rock mulch shall have a minimum  $D_{50}$  of 0.5 inches, consist of durable rock (meeting the durability scoring criteria in Appendix D of NUREG-1623), and shall comprise approximately 20 percent of the upper 0.5 feet of the Erosion Barrier.



## 2.0 CLEARING AND GRUBBING

### 2.1 General

#### 2.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials, and required equipment and shall perform all operations in connection with clearing, grubbing, and topsoil removal in accordance with the Construction Drawings and these Specifications. This work shall also include the preservation from damage of vegetation and objects intended to remain.

#### 2.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 11.0 - Tailings Cell Closure Cover
- Section 13.0 - Vegetation
- Section 16.0 - Health and Safety

### 2.2 Products

Not applicable.

### 2.3 Execution

Clearing and grubbing shall be performed primarily within the approximate limits of the affected soil areas as shown on the Drawings. Clearing and grubbing within construction work areas to be disturbed as shown on the Drawings shall be considered incidental to other items of work specified herein. Clearing and grubbing shall also be performed to a minimum distance of 20 feet outside of the limits to be disturbed by construction activities. The work performed shall completely remove all brush and trees on the surface and major root systems near the surface. Vegetative debris shall be chipped and incorporated into a topsoil stockpile as designated by the Owner or shall be burned by the Contractor, if approved in writing by the Owner. Under no circumstances shall vegetated debris material be used in the Tailings Cell closure cover layers.

Following removal of trees and shrubs, unaffected topsoil containing roots, grasses, and forbs shall be stripped to a minimum depth of six inches. This material shall be stockpiled in a loose condition for later use as seed bed material for the areas to be revegetated. The topsoil stockpile shall be broadcast seeded with the seed mixture and at the application rate specified in Section 13.0, if it is not used for revegetation during the immediate construction season. Affected topsoil shall be placed in layers of eight inches or less within the Tailings Cell and shall be compacted. Affected topsoil shall be placed below the Interim Cover and shall not be used for construction of the Tailings Cell Closure Cover. Affected and unaffected topsoil shall be delineated by the Owner's radiological survey during the course of the work.



## 3.0 UTILITY PROTECTION AND RELOCATION

### 3.1 General

#### 3.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall be responsible for the location, protection and, where necessary, relocation of the utility lines in the Piñon Ridge restricted areas and other areas as specified by the Reclamation Plan and shown on the Drawings.

All necessary coordination between the respective utility company and the relocation survey shall be performed by the Contractor at no additional cost to the Owner. All utilities shall be adequately protected during construction and, where necessary, relocated so as to not interfere with the lines and grades of the Reclamation Plan as shown on the Drawings. Any relocation of the utility lines shall be consistent with the requirements of the respective utility company and shall be approved by the Owner prior to initiation. Relocation may include lowering, elevating, laterally moving, or removing a specific utility line. Additional buried utilities may exist within the project area. A complete utility check shall be performed by the Contractor prior to construction to locate all buried utilities.

#### 3.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 6.0 - Affected Soil Excavation and Placement
- Section 11.0 - Tailings Cell Closure Cover
- Section 14.0 - Fencing
- Section 16.0 - Health and Safety

### 3.2 Products

Not applicable.

### 3.3 Execution

All utilities shall be located, protected and, where necessary, relocated prior to construction activities being performed in areas where utilities exist. The utilities shall be relocated in a manner that shall not interfere with the grade lines shown on the Drawings. Relocated buried utilities shall be placed and backfilled in accordance with the requirements of the utility company or local codes or ordinances. Utility lines relocated within the Colorado State Highway easement shall be placed and buried according to Colorado State Highway specifications. Unless otherwise stated in these Specifications, utility line relocation shall be on the same side of all roadways as existing locations.



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Marker tape shall be placed 12 inches above all relocated underground lines. Laths shall be placed every 100 feet directly above relocated underground lines. Ownership of line and depth to line shall be indicated on the lath and flagged with a blue ribbon. After reconfiguration and final regrading, permanent markers shall be installed in accordance with the specifications of the respective utility company.



## 4.0 DECONTAMINATION

### 4.1 General

#### 4.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform decontamination activities in accordance with these Specifications.

Work shall include, but not be limited to, the following:

- Radiological survey data interpretation as provided by the Owner's radiological survey;
- Demarcation and isolation of contaminated areas;
- Radiological survey of equipment and materials prior to decontamination;
- Decontamination of contaminated equipment and materials;
- Radiological survey of equipment, materials and reclamation areas after decontamination; and
- Disposal of wastes produced during the decontamination process.

The contractor shall perform all work in strict accordance with the Health and Safety requirements included as Section 16.0 of these Specifications and procedures outlined in the Owner's Health and Safety Plan (EFRC 2009). These requirements include worker physical examinations, worker protective equipment, medical surveillance, and radiation monitoring during, but not limited to, activities related to equipment and material decontamination and release to areas below acceptable radiation limits.

#### 4.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 5.0 - Building Demolition and Debris Disposal
- Section 11.0 - Tailings Cell Closure Cover
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

#### 4.1.3 *Definitions*

A complete list of definitions is provided in Section 1.12.

#### 4.1.4 *Submittals*

Provide copies of the Radiation Work Permits (RWP) and the Equipment/Material Release forms to RSO or its representative after specific decontamination task is completed.

### 4.2 Products

None.



### 4.3 Execution

Decontamination procedures shall be executed in accordance with the Owner’s Health and Safety Plan (EFRC 2009) using the following procedures:

- Wash the equipment or material to remove contamination;
- Survey appropriate area based on the equipment/material classification;
- Determine alpha and beta emissions;
- Compare alpha and beta with the acceptable contamination limits (Table 1); and
- Release equipment and material with emissions at or below the acceptable limits.

Equipment and material that does not meet release criteria in Table 1 upon completion of the decontamination process shall be deposited in the Tailings Cell Vault in accordance with Section 5.0 of these Specifications. Surfaces of materials, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits and deposited in Tailings Cell Vault in accordance with Section 5.0 of these Specifications.

**Table 1: Acceptable Surface Contamination Levels**

Nuclides <sup>a</sup>	Average <sup>b,c</sup> (dpm per 100 cm <sup>2</sup> )	Maximum <sup>d,e</sup> (dpm per 100 cm <sup>2</sup> )	Removable <sup>e,f</sup> (dpm per 100 cm <sup>2</sup> )
Alpha Emissions from U-nat, U-235, U-238 and associated decay products	5,000	15,000	1,000
Alpha emissions from Ra-226, Ra-228, Th-230, Th-228, Ac-227	100	300	20
Alpha Emissions from Th-nat, Th-232, Ra-223, Ra-224, U-232	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission, except others noted above)	5,000	15,000	1,000

Notes:

- <sup>a</sup> Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.
- <sup>b</sup> As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
- <sup>c</sup> Measurements of average contamination should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- <sup>d</sup> The maximum contamination level applies to an area of not more than 100 cm<sup>2</sup>.
- <sup>e</sup> The amount of removable radioactive material per 100 cm<sup>2</sup> of surface area should be determined by wiping that area with dry filters or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
- <sup>f</sup> The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.



## 5.0 BUILDING DEMOLITION AND DEBRIS DISPOSAL

### 5.1 General

#### 5.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with demolition and on-site disposal of the mill buildings, concrete and other debris associated with mill decommissioning.

The contractor shall perform all work in strict accordance with the Health and Safety procedures included in Section 16.0 of these Specifications and the Owner's Health and Safety Plan (EFRC 2009). These requirements include worker's physical examinations, worker protective equipment, medical surveillance, and environmental monitoring during, but not limited to demolition, earth moving and regrading activities.

#### 5.1.2 *Related Work*

- Section 2.0 - Clearing and Grubbing
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 5.2 Products

Not applicable.

### 5.3 Execution

#### 5.3.1 *General*

The decommissioning of mill facilities includes demolishing and disposing of the mill structures, equipment, asphalt, concrete pads and foundations, boneyard material, and appurtenant facilities as specified in greater detail in Section 7.0 - Mill Decommissioning of these Specifications. Contaminated demolition materials shall be placed in the Tailings Cell Vault. The main office building and concrete, and other foundation debris not removed as part of mill decommissioning shall be excavated and placed in the designated disposal area(s) specified in the Drawings, or if necessary, in the Tailings Cell Vault. During demolition, uncontaminated structural steel and miscellaneous equipment and materials may be salvaged for reuse. Salvage of materials shall be performed in accordance with the Decommissioning Plan approved by the CDPHE.

#### 5.3.2 *Disposal Method*

All debris, regardless of dimensions, shall be placed in a disposal area in a manner that fills the voids with soil/cement slurry or soil to the extent practicable. Debris which has natural voids shall be broken down to the extent possible (e.g., large tanks shall be cut into pieces to minimize voids). Debris shall be stacked in lifts of nominal 5-foot thickness, then flooded with soil/cement slurry designed to flow into and fill the residual



voids in the debris prior to setting. The mix may include coarse tailings, affected soil, soil, stockpiled materials, cement, slag, fly ash and water, and will have low strength (less than 500 psi compressive strength). Soils and/or affected soils may be placed with the debris and above the debris to allow the debris to be driven over with equipment to further reduce voids and minimize long-term settlement.

### 5.3.2.1 Demolition Debris Disposal

Demolition debris will be reduced in size to maintain the 5-foot deposition lift limitation, and to reduce volume prior to Tailings Cell Vault disposal. Materials exceeding these limits will be reduced to within acceptable limits by breaking, cutting or other approved methods. Empty drums, tanks, or other objects having a hollow volume greater than 5 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 soil/cement slurry and/or other approved materials to enter the object at the time of covering in the Tailings Cell Vault. The demolition debris, after having been reduced in dimension and volume (if required), will be placed in the Tailings Cell Vault as directed by the Quality Assurance Coordinator (QAC) (see Section 1.12.2). Any demolition debris allowed to be placed in a Tailings Cell Vault will be spread across the top of the tailings surface to avoid nesting, and to reduce the volume of voids present in the disposed mass. Soil/cement slurry and/or other approved materials will be placed into the demolition debris in sufficient quantity to fill the voids between the large pieces, and the volume within the hollow pieces. The debris will vary in composition, size and shape; therefore, debris will be selectively handled such that larger less compressible debris is mixed with smaller material to reduce residual voids in the deposited debris. Approval of the Decommissioning Project Manager (DPM) (see Section 1.12.2) or a designated representative will be required for use of materials other than those specified for the purpose of filling voids.

### 5.3.2.2 Compaction Requirements

The demolition debris, affected soils and other materials for the first lift will be placed over the existing tailings surface to a nominal depth of 5 feet in a bridging lift to allow access for construction equipment. The first lift will be compacted by tracking with a Caterpillar D6 dozer (or equivalent) at least four times prior to the placement of a subsequent lift. Subsequent layers will be placed in nominal 5-foot lifts, and will be compacted to the same requirements.

Affected soils placed after the initial bridging lift will be compacted to at least 80 percent of the standard Proctor maximum dry density (ASTM D698).

### **5.3.3 Disposal Locations**

The demolition debris shall be reduced to approximately 5 feet in length or less and placed in the Tailings Cell Vault except for the steel beams and columns with the maximum dimensions reduced to 12 inch x 8 inch x 20 feet prior to disposal in the Tailings Cell Vault (with long dimension placed horizontally). If the sequence of site-wide reclamation necessitates disposal elsewhere, the Tailings Cell Top areas (other than Tailings



Cell Vault) may be used for disposal purposes upon approval by the Owner. If Tailings Cell areas other than the Tailings Cell Vault are used for disposal, the contaminated debris shall be placed in the lower portion of a fill section in accordance with the procedures described in Section 5.3.2 above.

### **5.3.4 Backfilling**

After debris disposal has been completed, the respective disposal area shall be backfilled to the subgrade contours shown on the Drawings using affected soils and/or soil. Placement and compaction of the backfill soils shall be performed in accordance with Section 6.0 of these Specifications.



## 6.0 AFFECTED SOIL EXCAVATION AND PLACEMENT

### 6.1 General

#### 6.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with affected soil excavation and placement in accordance with the Drawings and these Specifications.

Work shall include, but not be limited to, the following:

- Surface erosion control;
- Construction of access roads and dust suppression;
- Excavation of affected soils;
- Regrading of excavated areas;
- Placement of the affected soil; and
- Maintenance and monitoring of settlement monitoring points.

The Contractor shall be responsible for providing all surveying necessary to excavate affected soil to the lines and grades determined by the Owner's radiological survey and to place the affected soil to the lines and grades shown in the Drawings. The contractor shall perform all work in strict accordance with the Health and Safety requirements and procedures included as Section 16.0 of these Specifications. These requirements include worker physical examinations, worker protective equipment, medical surveillance, and environmental monitoring during, but not limited to, all earth moving and regrading activities.

#### 6.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 3.0 - Utility Protection and Relocation
- Section 5.0 - Building Demolition and Debris Disposal
- Section 11.0 - Tailings Cell Closure Cover
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

#### 6.1.3 *Definitions*

A complete list of definitions is provided in Section 1.12.



## 6.1.4 Submittals

Upon placement of the affected soil within the Tailings Cell, the Contractor shall provide the Owner with as-built drawings showing the elevations and grades of the Tailings Cell and the thickness of the affected soil cover.

## 6.2 Products

Materials to be used for erosion control such as silt fences, straw bales, and fast growing seed mixes shall require Owner approval prior to installation or application.

## 6.3 Execution

### 6.3.1 Radiological Survey

#### 6.3.1.1 Initial Soil Survey

An initial gamma (direct radiation) survey will be performed by the Owner to evaluate potential areas where soil contamination might exceed background radium levels, based on gamma-radium correlations established in the baseline radiological investigation (ERG 2009). Areas with potentially affected soils include, but are not limited to, evaporation ponds, mill and ore pad areas, Tailings Cell and windblown tailings areas and all other areas identified by the Owner's radiological survey. The initial gamma survey will be performed on grids with 100-foot (30-meter) spacing across the disturbance area. Closer survey intervals will be applied to delineate the extent of contamination, if detected within the 100-foot survey.

Soil sampling will be conducted on a 30-foot (10-meter) grid at locations that register gamma readings correlating with Ra-226 concentrations exceeding 5 pCi/g above background. Samples will be tested for Ra-226 concentrations at depth intervals of 0 to 15 cm, and over a 15 cm thick layer of soils more than 15 cm below the surface. The necessity of conducting Th-232/Ra-228 testing (refer to NUREG 1620 [Appendix H]) as part of the initial survey (or verification survey discussed below) will be determined from analyses of ore, tailings, and process fluids conducted during mill operations.

Where surveys indicate that the above criteria have not been achieved, the soil will be removed to meet the criteria. Affected soil will be excavated and transported to the Tailings Cell for disposal. Placement and compaction will be in accordance with Section 6.3.6 of these Specifications. Affected areas will be resurveyed as needed to achieve levels not exceeding 5 pCi/g of Ra-226 above background.

If required to assess potential doses from affected soil as a basis for making decisions about the extent of soil clean-up, the RESRAD code will be used to estimate radiation doses and risks from residual radioactive materials in the soil.



## 6.3.1.2 Verification Survey

After soil clean-up has been performed, and before closure of the final Tailings Cell, a verification survey will be conducted on a 30-foot (10-meter) grid on areas used (and possibly contaminated) during the decommissioning process, or that were found to have excessive Ra-226 levels in the soil during the initial survey. Soil samples will be collected as described for the initial survey at grid points where gamma readings indicate that excessive Ra-226 may persist after clean-up, and at random grid locations constituting up to 10 percent of the initial survey grid points.

## **6.3.2 Erosion Control**

Erosion control consisting of silt fences, straw bales, berms, ditches, sedimentation basins, or other suitable methods shall be constructed, as needed, to minimize erosion and prevent solids from migrating into drainage areas. Erosion control measures shall be in place and approved by the Owner prior to performing excavation or grading within or adjacent to drainage areas.

## **6.3.3 Access Roads and Dust Suppression**

The construction and maintenance of access roads as required to perform the work described in these Specifications is the responsibility of the Contractor. The Contractor shall utilize adequate volumes of water from an Owner-supplied on-site source for dust suppression on haul/access roads and stockpiles, and for all excavation, grading and compaction work.

## **6.3.4 Excavation of Affected Soils**

Affected soil excavation and grading shall include: affected mill area soil excavation, windblown tailings excavation, and excavation and grading of all other affected soil areas identified by the Owner's radiological survey. The extent and depth of excavation at each of these locations shall be determined by the Owner's radiological survey. In undisturbed areas, excavation and grading operations shall begin by clearing and grubbing of the work area as detailed in Section 2.0 of these Specifications. Care shall also be taken not to damage existing power line poles or buried utility lines during excavation operations. Any remaining foundation materials and debris encountered within excavations and fill materials shall be removed and disposed in accordance with Section 5.0 of these Specifications. If windblown tailings require removal from the State Highway 90 or State Highway 90 access road, appropriate traffic control shall be used in accordance with Colorado State Highway regulations. Any damage to state property such as asphalt or fences shall be repaired at the cost of the Contractor. Proper notification to local and state authorities shall be conducted prior to performance of work in these off-site areas. Any tailings material encountered during excavation of the affected soil areas shall be uniformly placed on the Tailings Cell surface in accordance with Section 6.3.6 of these Specifications. Similarly, any excavated material that is not affected soil may qualify for use as clean soil in the final Tailings Cell closure cover described in Section 11.0 of these specifications



and shall be stored at disposal area(s) designated by the Owner. Wherever practical, the more contaminated soils shall be excavated first and placed in the initial lift within the Tailings Cell.

### **6.3.5 Regrading of Excavated Areas**

After the radiological survey confirms that all of the affected soils have been removed from a given location, the area shall be graded and stabilized as follows:

- Areas that will not be significantly disturbed by future reclamation activities shall be graded to be free draining and to meet the contours shown on the Drawings or, if not shown, the approximate contours of adjacent areas. These areas shall then be revegetated in accordance with the specifications provided in Section 13.0. Erosion control measures shall remain in place and be maintained until the area exhibits adequate revegetation as determined by the Owner.
- Areas that will be re-disturbed by reclamation activities at a later time (i.e., during future construction seasons) shall be graded to be free draining and stable. Erosion control measures shall remain in place and be maintained in these areas until reclamation is completed. The Owner may also require the Contractor to seed these areas with a fast-growing annual seed mix for erosion control purposes.
- Areas that will be excavated for Tailings Cell Closure Cover materials (i.e., unaffected soil) during the immediate construction season shall be regraded to the final contours shown on the Drawings after excavation has been completed. These areas shall be reclaimed in accordance with the specifications provided in Section 13.0 after the Tailings Cell Closure Cover is completed.

### **6.3.6 Placement of the Affected Soil**

Unless used as a part of the flowable mix for filling debris voids as specified in Section 5.3.2, the excavated affected soil shall be placed at the surface of the Tailings Cell in controlled lifts. If not used as a part of the flowable mix, the affected soil shall be placed in maximum 12-inch-thick lifts, measured loose, and tracked into place with earth moving equipment to yield at least 85 percent of the maximum dry density using the Standard Proctor compaction method (ASTM D698). Water shall be applied, as necessary, to improve the compaction and material handling characteristics of the soil. Testing methods and frequencies are presented in Section 15.0, Construction Quality Assurance.



## 7.0 MILL DECOMMISSIONING

### 7.1 General

#### 7.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations according to the Mill Decommissioning Plan (Kleinfelder 2009b) for the mill buildings, equipment, West Stormwater Pond and other structures and soils at the mill site.

The contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications. These requirements include worker's physical examinations, worker protective equipment, medical surveillance, and environmental monitoring during, but not limited to demolition, earth moving and regrading activities.

#### 7.1.2 *Regulatory and Guidance Requirements*

The work shall be conducted in accordance with applicable regulations and industry practices. Regulatory requirements and Guidance Requirements for decommissioning of the Piñon Ridge mill are contained in 6 CCR 1007-1, Part 3, RH 3.16.4 and in 6 CCR 1007-1, Part 18, RH18.3.1.5, RH18.8 (Decommissioning Requirements) and in Criteria 5A , 6(6) and 6(7) of Appendix A thereto. Additional guidance for decommissioning plans is provided by the U. S. Nuclear Regulatory Commission (NRC) in NUREG 1757, Vol. 1 (NRC 2006) and in NUREG 1620 (NRC 2003), as well as Regulatory Guide 4.14 (NRC 1980). The contents of the Mill Decommissioning Plan are organized according to the applicable topics of Table D.1, Appendix D of NUREG 1757.

#### 7.1.3 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 4.0 - Decontamination
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 7.2 Products

Not applicable.



## 7.3 Execution

### 7.3.1 *Systems and Equipment Decommissioning*

The uranium and vanadium processing areas of the mill, including all equipment, structures, and support facilities, will be decommissioned and disposed of in the Tailings Cell Vault, or removed from site for alternative use (refer to Sections 0 and 0). All equipment to be disposed in the final Tailings Cell will be cut up and removed in general accordance with Section 5.0 of these Specifications.

#### 7.3.1.1 Uncontaminated Systems and Equipment

Upon permanent cessation of milling, the inventory and radiological assessment (surveying) of mill systems and equipment will be updated following the procedures outlined in Section 6.3.1, with the exception that a closer grid spacing of 30 feet (10 meters) will be employed within identified areas of contamination. Based on the results of these surveys and the radiological release limits in effect at the time of decommissioning, the systems and equipment will be classified as uncontaminated or contaminated. Prior to removal of contaminated equipment, other equipment, materials and structures that are shown by appropriate screening procedures to be uncontaminated (radiological levels below release limits) will be removed from the mill area and sold, recycled for off-site use, or disposed of in accordance with regulatory requirements in effect at that time.

#### 7.3.1.2 Contaminated Systems and Equipment

After uncontaminated systems and equipment are removed from the mill area, the systems and equipment that are known or likely to be contaminated above release limits will be removed from the mill area and placed in the Tailings Cell Vault, or will be decontaminated and scanned prior to leaving the mill site in accordance with Section 4.0 of these Specifications.

### 7.3.2 *Buildings, Structures and Soils Decommissioning*

Concrete structures and foundations will be demolished and removed for disposal in the Tailings Cell Vault, unless radiation surveys indicate they are below cleanup levels and CDPHE approves their in-place burial. Demolition and disposal of building, structures and soils shall be conducted per the Mill Decommissioning Plan and in general accordance with Section 5.0 and Section 6.0 of these Specifications.



## 8.0 ORE PAD RECLAMATION

### 8.1 General

#### 8.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with ore pad reclamation in accordance with the Drawings and these Specifications.

Work shall include, but is not limited to, the following:

- Removal of remaining ore and cushion material;
- Removal of synthetic liners, and any affected soils
- Removal of the dumping platform;
- Demolition and removal of the concrete ore pad;
- Removal of synthetic liners and reclamation of East Stormwater Pond; and
- Reclamation of the ore pad footprint (e.g., grading, topsoil placement, revegetation).

The Owner shall use stakes to designate the extent of the reclamation areas identified herein. The Contractor shall be responsible for providing all surveying necessary to conduct earthwork to the lines and grades specified on the Drawings.

The Contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications.

#### 8.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 8.2 Products

None.

### 8.3 Execution

All demolition and material removal activities shall be conducted in accordance with Section 5.0 and Section 6.0 of these Specifications. After removal of the ore pad construction materials, an initial gamma (direct radiation) survey will be performed by the Owner to evaluate potential areas where soil contamination might exceed background radium levels following the procedures outlined in Section 6.3.1, with the exception that



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

a closer grid spacing of 30 feet will be employed. All affected materials will be excavated and disposed of in the Tailings Cell in accordance with Section 5.0 and Section 6.0 of these specifications. At completion of clean-up, a verification survey will be conducted following the procedures outlined in Section 6.3.1.

Disturbed areas will be graded, covered, and vegetated per Section 6.3.5 of these Specifications.



## 9.0 EVAPORATION PONDS RECLAMATION

### 9.1 General

Reclamation of the evaporation ponds consists of evaporating each cell dry; removing raffinate precipitants (solids), synthetic liners, and any affected soils for disposal in the Tailings Cell Vault; and reclamation of the evaporation pond footprint (e.g., grading, topsoil placement, revegetation). Decommissioning of the evaporation ponds may occur in phases by consolidating raffinate solutions into a reduced number of cells during the reclamation process.

#### 9.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with evaporation pond reclamation in accordance with the Drawings and these Specifications.

Work shall include, but is not limited to, the following:

- 1) Removal of raffinate solids;
- 2) Removal of synthetic liners, and any affected soils; and
- 3) Reclamation of the evaporation ponds footprint (e.g., grading, topsoil placement, revegetation).

The Owner shall use stakes to designate the extent of the reclamation areas identified herein. The Contractor shall be responsible for providing all surveying necessary to conduct earthwork to the lines and grades specified.

The Contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications.

#### 9.1.2 *Related Work*

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### 9.2 Products

None.



## 9.3 Execution

### 9.3.1 Reclamation Sequence

All demolition and material removal activities shall be conducted in general accordance with Section 5.0 and Section 6.0 of these Specifications. Decommissioning of the evaporation ponds may occur in phases by consolidating raffinate solutions into a reduced number of cells during the reclamation process.

The reclamation of evaporation ponds will consist of the following activities:

- 1) Drying, removal and disposal of evaporation pond solids in general accordance with Section 6.0 of these Specifications;
- 2) Removal and disposal of geosynthetic components and affected soils in general accordance with Section 5.0 and Section 6.0 of these specifications; and
- 3) Verification survey of Ra-226 levels per Section 6.3.1 of these Specifications.

### 9.3.2 Removal of Contaminated Materials

Affected soils and evaporation pond solids (mixed with soil) shall be spread over the tailings surface as practicable to provide relatively uniform settlement and consolidation rates. These materials shall be removed, placed and compacted in accordance with the guidance provided in this section and Section 6.3.6 of these Specifications.

Removal and disposal of geosynthetics shall be conducted in accordance with the guidance provided in this section and Section 5.0 of these Specifications.

#### 9.3.2.1 Evaporation Pond Solids

Evaporation pond solids will be allowed to dry, and then mixed with soil as needed to excavate and handle as dry solids for disposal in the Tailings Cell Vault. Placement of the evaporation pond solids will be performed as a soil fill in general accordance with Section 6.3.6. Actual excavation and placement procedures will be in general accordance with Section 6.0 of these specifications. Adjustments to general disposal and excavation procedures may be re-evaluated by the QAC during the construction process and implemented by Contractor after Owner's approval.

#### 9.3.2.2 Synthetic Liners

High density polyethylene (HDPE) geomembrane liner, HDPE geonet, and geosynthetic clay liner (GCL) will be cut up, folded or rolled (when necessary), removed from the evaporation ponds, and transported to the Tailings Cell Vault for disposal. The geosynthetic materials shall be spread as flat as practical over the designated area.



## 10.0 TAILINGS REGRADING AND INTERIM COVER PLACEMENT

### 10.1 General

#### 10.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials, and required equipment and shall perform all operations in connection with tailings regrading and interim cover excavation in accordance with the Drawings and these Specifications. Incremental closure of the tailings cells is anticipated, with closure of Tailings Cells A and B occurring during mill operations, and closure of Tailings Cell C (including the Tailings Cell Vault) occurring during decommissioning and closure of the mill. Work shall include, but not be limited to, the following:

- 1) Construction of access roads and dust suppression;
- 2) Abandonment of tailings dewatering (underdrain) system;
- 3) Surface water control;
- 4) Regrading of Tailings Cell Top;
- 5) Construction of Interim Cover; and
- 6) Installation, maintenance and monitoring of settlement monitoring points.

The Owner shall use stakes to designate all areas subjected to earthwork operations identified herein. The Contractor shall be responsible for providing all surveying necessary to conduct earthwork to the lines and grades specified.

The Contractor shall perform all work in strict accordance with the Health and Safety requirements included in Section 16.0 of these Specifications.

#### 10.1.2 Related Work

- Section 1.0 - General Project Requirements
- Section 6.0 - Affected Soil Excavation and Placement
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

#### 10.1.3 Definitions

A complete list of definitions is provided in Section 1.12.

#### 10.1.4 Submittals

Upon completion of tailings regrading and placement of the interim cover, the Contractor shall provide the Owner with as-built drawings showing:

- The elevations and grades of the regraded tailings surface;
- The thickness of the interim cover layer over the tailings area placed by the Contractor; and
- The lines and grades of the interim berms.



## 10.2 Products

Materials to be used for erosion control such as silt fences and straw bales shall require Owner approval prior to installation.

## 10.3 Execution

### 10.3.1 General

Regrading of the tailings shall be performed to achieve the lines and grades (i.e., slopes, locations of channels) shown on the Drawings. The top of the Tailings Cell shall be regraded to the lines and grades shown on the Drawings. Tailings Cell Drainage Channels shall be constructed to the lines and grades shown in the Drawings and according to Section 12.0 of these Specifications.

Allowance for additional subsidence of the fine tailings area at the center of the cell as compared to the coarser tailings areas in the proximity of the discharge points, due to differential settlement, shall also be incorporated into the tailings grading plan and work schedule.

The final tailings elevations shown on the Drawings are approximate and may change depending on several factors including:

- 1) The amount of subsidence experienced by the Tailings Cell Top after placement of cover materials;
- 2) The volume of affected soil excavated from the mill and surrounding areas, as identified by the Owner's radiological survey, and placed in the Tailings Cell; and
- 3) The volume of interim cover materials placed over the top of the Tailings Cell.

The interim elevations of the Tailings Cell Top shall be determined during construction and shall be shown on the as-built drawings provided by the Contractor upon completion of the interim cover. Once the Tailings Cell dewatering is completed (after at least two quarters following the Tailings Cell cover construction), the dewatering system shall be properly plugged and abandoned in accordance with Section 10.3.3.

### 10.3.2 Access Roads and Dust Suppression

The construction of access roads as required to perform the work described in these Specifications is the responsibility of the Contractor. The Contractor shall utilize adequate volumes of water from an Owner-supplied on-site source for dust suppression on haul/access roads and stockpiles and for all grading and compaction work.

### 10.3.3 Dewatering (Underdrain) System Abandonment

The dewatering system will be used to monitor water levels in the sump riser pipes until completion of tailing cover construction and for a minimum of two consecutive quarters thereafter to confirm that no additional



liquid is being collected in the sump. Once dewatering is complete in each cell, the system in that cell will be decommissioned. The sumps and risers will be backfilled with bentonite pellets and flooded with water to hydrate the bentonite and induce it to swell and seal the system. Risers will be cut off at least 3.0 feet below final cover surface.

### **10.3.4 Surface Water and Erosion Control**

The Contractor shall perform all work in a manner that minimizes surface water runoff into exposed tailings and construction or fill areas. Surface water runoff from exposed tailings shall be collected and pumped, if necessary, ensuring no discharge outside the Tailings Cell area. Erosion control consisting of silt fences, straw bales, berms, ditches, and sedimentation basins shall be constructed as needed to minimize erosion and prevent migration of solids into drainage areas.

### **10.3.5 Regrading**

Regrading of the tailings surface shall be performed to achieve the general configuration represented by the lines and grades shown on the Drawings. The tailing surface will be regraded after dewatering and before placement of the interim cover.

The amount of tailings excavation shown on the Drawings is based on the optimal position of the top surface of the radon barrier to be placed subsequently. The objective is to have the top of the radon barrier merge at a slope of 0.02 with the top of the Tailings Cell berm. To accomplish this objective, tailings above the base level of excavation shown on the Drawings will be relocated to create the space needed to place the interim cover and radon barrier. Tailings near the perimeter of each cell will be graded away from the inside slope of the Tailings Cell toward the cell interior. This regrading will create the vertical space, 7.7 feet, above the base level of tailings excavation for the 2.0 feet of interim cover and the 5.7 feet of cover needed at the center of the tailings, where the final tailings thickness will be greatest.

From a point approximately 65 to 70 feet inside of each Tailings Cell berm, the regraded tailings surface will ramp upward at a 0.02 slope to converge with the similar regraded surfaces from the other sides of the tailing cell, as shown on the Drawings. This surface will be parallel to, and 7.7 feet below, the top of the radon barrier providing the space for 2.0 feet of interim cover and 5.7 feet of radon barrier to be placed subsequently. Any internal containment berms within each cell will be incorporated into the regraded configuration of the cell.

### **10.3.6 Placement of Interim Cover**

Interim Cover shall be placed as soon as possible after regrading of the tailings surface, and placed progressively from the edges of each Tailings Cell toward the center. The Contractor shall add moisture to Interim Cover materials only if needed for dust control, as underlying tailings are expected to have high moisture content at the time of Interim Cover placement. The Contractor shall use low ground pressure



dozers (Caterpillar Model D6LGP, or equivalent) for Interim Cover placement due to the condition and strength of the tailings surface at the time of construction.

The Interim Cover materials shall be placed in maximum 12-inch loose lifts, and compactive effort shall be adequate to obtain a density of eighty-five (85) percent of the maximum dry density as determined by the standard Proctor test (ASTM D698).

### **10.3.7 Settlement Monitoring Points**

After regrading of the tailings and placement of the Interim Cover, settlement monitoring points will be installed to provide the means for measuring the settlement of tailings prior to placement of the Radon Barrier and the final cover. Prior to placement of the Geosynthetic Liner near the top of the Radon Barrier layer, the settlement monitoring points shall be surveyed and decommissioned. The settlement monitoring points will be re-installed again after placement of the Radon Barrier is complete to monitor settlement of the final cover. The total number and locations of settlement monitoring points to be installed on top of the Tailings Cell are shown on the Drawings.

Settlement monitoring points will be installed on a 200 ft north-to-south by 300 ft east-to-west pattern across each tailing cell, with the center of the pattern being the center point of the cell as shown on the Drawings. Each settlement monitoring point will consist of:

- A steel base plate placed on the top surface of the tailings;
- A vertical steel riser pipe or rod, welded to the base plate, threaded at the top end;
- A steel guard pipe, with diameter at least 2 inches larger than the riser, set over the riser and resting on (but not connected to) the base plate and threaded at the top; and
- A steel cap threaded to fit the top of the guard pipe.

Settlement monitoring points shall be extended upward when the various components of the final cover are added, as necessary for the settlement point to remain at least 2.0 feet above the surrounding surface. Additional lengths of the riser and the guard pipe as well as external couplings for each will be used as shown on the Drawings. The contractor shall clearly flag the settlement monitoring points to avoid damage by construction equipment and shall extend or lower the height of the settlement monitoring points, as necessary, as fills and cuts are made in the immediate vicinity. Construction equipment shall maintain a minimum 5-foot distance from all settlement monitoring points. Fills, cuts, and compaction within five feet of each settlement monitoring point shall be performed by hand. The Contractor shall survey the initial elevation of the settlement monitoring points after installation and periodically during subsequent construction, as specified in Section 15.0, Construction Quality Assurance. If a settlement monitoring point is disturbed during construction, all construction in the immediate area shall be discontinued and the settlement monitoring point shall be resurveyed to a new/corrected base elevation.



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Settlement monitoring points shall be surveyed and temporarily decommissioned prior to installation of the Geosynthetic Liner. The settlement monitoring points shall be decommissioned as described below in Section 10.3.7.2, and re-installed after completion of the Radon Barrier installation.

The period of settlement monitoring that follows the final cover placement is estimated to be two to five years, after which the settlement monitoring points will be abandoned in place. The settlement monitoring program and abandonment measures are described below.

### 10.3.7.1 Survey Frequency

Settlement monitoring points will be surveyed initially as soon as possible after installation to obtain a baseline set of coordinates for the top of each riser. The northing, easting and elevation of the top of the riser will be surveyed to a precision of 0.05 feet, and an accuracy of 0.1 feet (northing and easting) and 0.05 feet (elevation). Survey control points shall be established with the same precision and accuracy at the Tailings Cell berm corners, providing line of sight to each monitoring point from at least two of these control points.

Settlement monitoring points shall be surveyed prior to and immediately after each extension. Settlement monitoring points and survey control points shall be surveyed daily when earthwork is occurring in the immediate vicinity, weekly during the initial month after placement of the Interim Cover and monthly thereafter. Similarly, Contractor will execute daily monitoring of settlement monitoring points and survey control points when the Tailings Cell Closure Cover construction activities are within 10 feet of settlement monitoring points, weekly during the initial month after placement of the Tailings Cell Closure Cover Materials, monthly during the subsequent quarter, and quarterly thereafter. Quarterly monitoring will continue for at least two years after construction of the final (evapotranspiration) cover. Survey frequency after that time shall be sufficient to track the settlements until an asymptotic value is identifiable in the time-settlement record. Survey measurements will be recorded in a format that can be directly imported into a GIS database maintained by the Owner and accessible to CDPHE. Each survey record will be signed and stamped by a Licensed Professional Engineer or Surveyor in the State of Colorado.

### 10.3.7.2 Settlement Monitoring Point Decommissioning

When CDPHE concurs with the Owner's findings that settlements of the final cover are complete and monitoring can cease, the settlement monitoring points shall be decommissioned. The same procedure identified herein should be followed for temporary decommissioning of settlement monitoring points, as discussed above. The Contractor shall remove the monitoring points by excavating around each monitoring point and cutting off or removing the metal rod extension 6 inches below the surface of the cover material. This space below the ground surface to within 6 inches of the final cover surface shall be replaced by the same rock mulch/soil mixture used in the top 6 inches of the Tailings Cell Closure Cover, placed and compacted by hand.



### ***10.3.8 Radon Flux Measurements***

The Owner shall provide the CDPHE with a radiological sampling and testing report for each Tailings Cell after placement of the Interim Cover, but prior to installation of the Geosynthetic Liner and Radon Barrier. The testing report shall provide Ra-226 activity levels and other test parameters for the Interim Cover and tailings materials as described in Section 15.3.3.



## 11.0 TAILINGS CELL CLOSURE COVER

### 11.1 General

The Tailings Cell Closure Cover, in combination with the Tailings Cell, will provide the system of barriers for the long-term containment of the tailings according to the closure criteria in Appendix A of 6 CCR 1007-1, Part 18. The Tailings Cell closure design was based on the following performance objectives:

- Provide containment of by-product for 1,000 years (Criterion 6(1)(i));
- Limit radon flux from the cover surface to  $<20 \text{ pCi/m}^2\text{s}$  (Criterion 6(1)(ii)); and
- Limit infiltration of moisture into, and release of contaminated liquid from, the tailings (Criterion 5B(1), 5E(3), 6(7), 7).

Details of the Tailings Cell design are presented in Golder (2008c) and details of the Tailings Cell closure design are presented in Kleinfelder (2010).

#### 11.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with grading of drainage channels and excavating and placing soil and radon barrier layers in accordance with the Construction Drawings and these Specifications. Work shall include, but not be limited to, the following:

- Surface erosion control;
- Construction of access roads and dust suppression;
- Placement of the Tailings Cell Closure Cover;
- Excavation and grading of closure channels; and
- Maintenance and monitoring of settlement monitoring points.

The Owner shall use stakes to designate all areas to be subject to the earthwork operations identified herein. The Contractor shall provide all surveying necessary to conduct earthwork to the lines and grades specified in the Drawings including periodic surveys of settlement monitoring points throughout the course of the work. The Contractor shall comply with Health and Safety requirements in accordance with Section 16.0 of these Specifications unless relieved of these obligations by the Owner's Radiation Safety Officer.

#### 11.1.2 Related Work

- Section 1.0 - General Project Requirements
- Section 2.0 - Clearing and Grubbing
- Section 3.0 - Utility Protection and Relocation
- Section 4.0 - Decontamination
- Section 5.0 - Building Demolition and Debris Disposal
- Section 6.0 - Affected Soil Excavation and Placement



- Section 10.0 - Tailings Regrading and Interim Cover Placement
- Section 12.0 - Erosion Protection Placement
- Section 13.0 - Vegetation
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

### **11.1.3 Definitions**

A complete list of definitions is provided in Section 1.12.

### **11.1.4 Submittals**

Upon construction of the drainage channels and placement of the Tailings Cell Closure Covers on the Tailings Cell, the Contractor shall provide the Owner with as-built drawings showing the elevations and grades of the cell closure, including the associated channels. The thickness of each component layer of the Tailings Cell Closure Cover shall be surveyed.

## **11.2 Products**

Materials to be used for erosion control such as silt fences and straw bales shall require Owner approval prior to installation.

## **11.3 Execution**

The tailings will be closed and covered in phases, in accordance with Criteria 6(3) and 6A(1) of Appendix A, 6 CCR 1007-1, Part 18. The Tailings Cells will be covered in the same order that they were constructed. Cell A will be in the process of closure while Cell B is in operation, and Cell B will be undergoing closure while Cell C is in operation.

The first step in cover construction will be preparation of the cell surface for placement of the Interim Cover, and will begin as soon as the tailings surface is dry and firm enough to support earthwork equipment. The time of cover construction after cessation of cell operation will depend on the rate of dewatering of each cell.

### **11.3.1 Closure Cover Construction**

A multi-layered earthen cover will be placed over the tailings cells during the staged Tailings Cell decommissioning process (refer to Section 1.12.3 for Tailings Cell Closure Cover Materials). This section outlines the material requirements and construction process.

#### **11.3.1.1 General**

Placement of cover materials will be based on a schedule determined by analysis of settlement data. Placement of the Radon Barrier shall begin only after initial consolidation of tailings due to the weight of the regraded tailings and Interim Cover is complete. Completion of initial consolidation shall be identified by the



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

Owner and confirmed by the CDPHE as described in the Section 15.0 of these Specifications. Settlement monitoring points shall be installed and monitored in accordance with Sections 10.3.7 and 11.3.2 of these specifications. Prior to placement of the Radon Barrier, the tailings shall be resurveyed and regraded, where necessary, to conform to the lines and subgrades specified in the Drawings. Fill areas shall be scarified and soil placed and compacted in accordance with Section 6.0 of these Specifications. As shown on the Drawings, the Radon Barrier shall consist of a minimum of 0.9 feet of radon barrier at the cell margin, where the tailings will be 1 ft or less, and a minimum of 5.7 feet over tailings areas with the thickness in excess of 15 feet. Geosynthetic liner rolls shall be placed with the minimum overlap recommended by the manufacturer over the full extent of the tailings surface, and within the upper 0.9 to 1.0 ft of the Radon Barrier. The top of the Radon Barrier shall be constructed to maintain positive drainage grade of 2 percent towards the Tailings Cell perimeter. The lateral extents of cover components are shown on the Drawings. These dimensions shall be verified, and adjusted where necessary, based on the as-built drawings prepared after completion of tailings regrading and Interim Cover (See Section 10.0 of these specifications). Throughout the excavation and grading operations, debris encountered within excavations and fill materials shall be removed and disposed in accordance with Section 5.0 of these specifications. Any affected soils identified by the radiological survey shall be placed under the Interim Cover in accordance with Section 6.0 of these specifications. All work shall be performed in a manner that minimizes surface water run-on into construction or borrow areas. The Contractor shall also provide for adequate dust suppression and erosion control during the performance of all excavation, regrading, transportation, placement and compaction activities.

### 11.3.1.2 Materials

Closure cover materials used for cover construction are specified in Section 1.12.3.

### 11.3.1.3 Radon Barrier Placement

Radon Barrier shall be placed over the Interim Cover materials after the tailings settlement monitoring data indicates that primary settlement (settlement resulting from consolidation of tailings due to dewatering) has reached approximately 90 percent of the asymptotic value on the log time-settlement curve.

Prior to placement of Radon Barrier material above the Interim Cover, the Contractor shall scarify the in-situ material to a depth of 6 inches, moisture condition, and recompact the subgrade. Compactive effort and moisture conditioning of the Interim Cover shall be adequate to obtain the dry density and moisture content within the range specified in Section 15.3.5.

Radon Barrier material shall be conditioned to a moisture content that allows compaction to the required density and that results in a firm, unyielding surface capable of allowing the movement of vehicles and equipment over the surface without causing rutting or other deleterious effects. Radon Barrier materials shall be placed in maximum 8-inch loose lifts, and compactive effort and moisture conditioning shall be



adequate to obtain the dry density and moisture content within the range specified in Section 15.3.5. No density measurements will be taken during the placement of the final lift of the Radon Barrier in order to protect the integrity of the underlying Geosynthetic Liner.

### 11.3.1.4 Geosynthetic Liner Placement

Geosynthetic Liner shall be placed within the upper 0.9 to 1.0 ft of the Radon Barrier layer, and shall be placed in accordance with the manufacturer's recommendations, with the geomembrane side of the geosynthetic clay liner (GCL) facing upward. Care must be taken to minimize the extent to which the Geosynthetic Liner is dragged across the subgrade in order to avoid damage to the bottom surface of the liner. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement. To the extent possible, the Geosynthetic Liner panels shall be placed parallel to the direction of slope. The panels shall lie flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels. The Geosynthetic Liner shall be placed with the minimum overlap of 6 inches between adjacent geosynthetic rolls and the minimum overlap of 12 inches at the end of the roll. Damaged Geosynthetic Liner shall be repaired by patching the damaged area with a new Geosynthetic Liner extending at least 24 inches beyond the damaged area. Prior to placing a patch, a bead of granular bentonite or bentonite paste at the minimum rate of 500 g per lineal meter shall be placed around the damaged area.

### 11.3.1.5 Bio-Intrusion Barrier Placement

The Bio-Intrusion Barrier shall be placed over the Radon Barrier as indicated in the closure cover design (refer to Kleinfelder, 2010). Native soil shall be added to nominal three-inch (3-inch) cobble material to achieve a final compacted layer with overlapping cobbles within a soil matrix. Mixing proportions and methods will be determined by the Task Manager (TM) and included in the Construction Specifications.

The Bio-Intrusion Barrier shall be placed in maximum 8-inch loose lifts, and compacted per a method specification to achieve the required consistency.

### 11.3.1.6 Capillary Break Placement

The Capillary Break layer shall be placed over the Bio-Intrusion Barrier layer, as indicated in the closure cover design (refer to Kleinfelder, 2010). Capillary Break material shall be placed to a relative density of approximately 50 percent, or about 115 to 120 pounds per cubic foot (pcf) dry unit weight.

### 11.3.1.7 Erosion Barrier Placement

The Erosion Barrier shall be placed over the Capillary Break layer as indicated in the closure cover design (refer to Kleinfelder, 2010). The Erosion Barrier shall consist of native soil. To limit placement compaction, the Erosion Barrier material (up to 4.0 ft thickness) shall be placed in one lift compacted to eighty-five



(85) percent of the maximum dry density (as determined by the standard Proctor test) at plus or minus two percent of optimum moisture content (ASTM D698). Rock mulch shall either be mixed in-place into the upper 0.5 ft of the Erosion Barrier layer after placement, or mixed off-site and placed in a 0.5 ft lift, with approximately 20 percent of the upper layer consisting of rock.

The finished cover will be sloped at a grade of two percent (2%) away from the center of each cell toward the cell perimeter as shown in the Drawings.

The Erosion Barrier shall be vegetated as outlined in Section 13.0.

### ***11.3.2 Settlement Monitoring Points***

Immediately after the Interim Cover materials are placed, settlement points will be installed as described in Section 10.3.7 to provide a means for measuring the settlement of tailings after placement of the Interim Cover and during and after placement of the Tailings Cell Closure Cover. After completion of settlement monitoring, the settlement points will be abandoned in place per Section 10.3.7.

### ***11.3.3 Radon Flux Measurements***

After completion of the Radon Barrier layer, and prior to placement of the remaining closure cover layers, a radon flux survey shall be conducted over the tailings area according to the procedures outlined in Section 6.3.1 at a grid spacing of 30 feet (10 meters). The radon flux measurements shall be provided to the CDPHE.



## 12.0 EROSION PROTECTION PLACEMENT

### 12.1 General

#### 12.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with erosion protection placement in accordance with the Drawings and these Specifications. Erosion protection placement consists of covering the berm slopes and lining designated parts of drainage channels with erosion protection, as indicated in the Drawings. The work shall consist of the following:

- Placing Rock Blanket material on Tailings Cell sideslopes;
- Placement of CDOT Type I Bedding and CDOT Type II Bedding as the filter layer beneath Riprap; and
- Placement of Riprap protection as required on Tailings Cell sideslopes and in surface water control channels.

Borrow sources, size, layer thickness, areal extent and gradation requirements will vary across the site according to the Drawings and these Specifications.

#### 12.1.2 Related Work

- Section 11.0 - Tailings Cell Closure Cover;
- Section 15.0 - Construction Quality Assurance
- Section 16.0 - Health and Safety

## 12.2 Materials

The following sections of these Specifications indicate the design nominal stone size ( $D_{50}$ ) for each of the erosion protection layers. These materials shall conform to the following criteria:

- A minimum of 50 percent by weight of the material shall be greater than the design  $D_{50}$ ;
- The material shall be well-graded as quantified by USCS and shall meet the requirements of these Specifications; and
- Rock to be used for Riprap, Rock Blanket, Toe Protection, CDOT Type I Bedding and CDOT Type II Bedding shall have a minimum rock durability rating as specified in Section 12.3.

When oversizing of the rock is required, based on durability rating discussed in Section 12.3, the rock shall be oversized by applying an oversizing factor that is the difference between the tested durability and the required durability rating, expressed as a percentage to be increased. For example, if the rock durability rating is 65, but must have a durability of 80, the rock would require oversizing by at least 15 percent:  $80 - 65 = 15$ .

At least five days before placing any erosion control material, particle size analysis of the rock shall be developed and approved for each rock gradation. The Contractor shall provide the Owner with samples of



rock material for each application for Quality Assurance gradation checks at the frequencies described in Section 15.0.

### **12.2.1 Riprap**

Riprap shall have a nominal stone size ( $D_{50}$ ) of 9 inches or 18 inches, as indicated in the Drawings. Riprap shall meet the requirements of Colorado Department of Transportation (CDOT) Section 506 of the Standard Specifications for Road and Bridge Construction, latest Edition, and the durability criteria Specified in Section 12.3.

### **12.2.2 Rock Blanket**

Rock Blanket shall have a nominal stone size ( $D_{50}$ ) of 2.5 inches for placement on outslopes of 10H:1V or flatter, and shall have a nominal stone size ( $D_{50}$ ) of 3.5 inches for placement on outslopes of 5H:1V or flatter, and shall meet the requirements of CDOT Section 506 of the Standard Specifications for Road and Bridge Construction, latest Edition, and the durability criteria Specified in Section 12.3.

### **12.2.3 Toe Protection**

Toe Protection used for erosion protection of run-out rock aprons shall have a nominal stone size ( $D_{50}$ ) of 8 inches and meet the requirements of CDOT Section 506 of the Standard Specifications for Road and Bridge Construction, latest Edition, and the durability criteria Specified in Section 12.3.

### **12.2.4 CDOT Type I Bedding and CDOT Type II Bedding**

CDOT Type I Bedding and CDOT Type II Bedding shall consist of materials meeting CDOT Section 703.03 of the Standard Specifications for Road and Bridge Construction, latest Edition, for these materials.

Erosion protection components for the tailings cover are summarized in the following table:



**Table 2: Erosion Protection Components**

Erosion Protection Element	Material Size	Layer Thickness
Vegetated Soil Top Cover, 0.02 Slope	Minimum $D_{50}$ = 0.5 inches for rock-mulch size	Rock mulch in top 0.5 feet
10H:1V Rock Cover Outslopes	$D_{50}$ = 2.5 inches	12-inch minimum thickness Filter layer required
5H:1V Rock Cover Side Slope <sup>1</sup>	$D_{50}$ = 3.5 inches	12-inch minimum thickness Filter layer required
Riprap Rundown Channels	$D_{50}$ = 18 inches	36-inch minimum thickness Filter layer required
Cell Berm Toe Protection	$D_{50}$ = 8.0 inches	24-inch minimum thickness Filter layer required

<sup>1</sup>Sideslope between Cells A and B and between Cells B and C.

### 12.3 Execution

Laboratory test results and a durability rating for each rock borrow area shall be developed before use of the rock material. Durability tests shall consist of the following:

- Absorption and Specific Gravity – ASTM C97 and ASTM C127
- Sodium Sulfate Soundness – ASTM C88
- LA Abrasion at 100 cycles – ASTM C131 or ASTM C535

The results of the above testing shall be used to determine a rock durability rating in accordance with Table D1 of the NRC’s Staff Technical Position (STP) “Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites,” August 1990. The following criteria shall be used to determine acceptable uses of rock borrow based on the rock durability rating:

- Rock having a durability rating greater than or equal to 80 may be used as Riprap, Toe Protection, Rock Blanket, CDOT Type I Bedding or CDOT Type II Bedding.
- Rock having a durability rating less than 80 and greater than or equal to 65 may be placed in surface water control ditches (i.e. “critical areas”) as Riprap or filter materials (i.e. CDOT Type I Bedding or CDOT Type II Bedding) only after being oversized in accordance with the criteria in Section 12.2 of these Specifications.
- Rock having a durability rating less than 80 and greater than or equal to 50 may be used on the sideslopes as Rock Blanket (i.e. “non-critical areas”) only after being oversized in accordance with the criteria in Section 12.2 of these Specifications.
- Rock having a durability rating of less than 65 may not be used for Riprap, CDOT Type I Bedding or CDOT Type II Bedding.
- Rock having a durability rating of less than 50 may not be used for any application.



In addition to performing rock durability testing prior to use, rock durability testing shall be conducted periodically during construction. Details of testing frequencies and requirements are presented in Section 15.0.

## 12.4 Placement

### 12.4.1 Riprap

Riprap shall be placed at the locations and to the depths and grades shown on the Drawings. The Riprap shall be placed in a manner to ensure that the larger rock fragments are uniformly distributed and the smaller rock fragments serve to fill the spaces between the larger rock fragments to achieve a densely-placed, uniform layer of Riprap of the specified thickness. Hand placement will be required only to the extent necessary to ensure the results indicated. Riprap shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.

Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.

### 12.4.2 Rock Blanket

Rock Blanket materials will be placed on the outslopes and side slopes of the tailings cover, as indicated in the Drawings. Rock Blanket materials shall be placed to a minimum thickness of 12 inches, overlying a bedding layer consisting of CDOT Type I or Type II Bedding materials (refer to the Drawings). Care shall be taken while placing the Rock Blanket to prevent segregation of materials. The thickness of the Rock Blanket shall be verified by construction control, staking, and probing, as described in Section 15.0. If the Rock Blanket thickness measures less than the minimum, additional rock shall be spread until measurements verify the appropriate thickness has been placed. Rock Blanket shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.

Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.

### 12.4.3 Toe Protection

Toe Protection materials shall be provided as indicated in the design drawings. Toe Protection shall be placed to a nominal thickness of 24 inches, overlying the Filter Layer. Toe Protection shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.

Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.



***12.4.4 CDOT Type I Bedding and CDOT Type II Bedding***

CDOT Type I Bedding and CDOT Type II Bedding shall be placed as the filter layer beneath Riprap. The CDOT Type I Bedding shall be placed above the CDOT Type II Bedding, and in contact with the Riprap. Each layer shall be placed in one lift and tracked in place. Placement shall be in a manner which prevents segregation of the material. CDOT Type I Bedding and CDOT Type II Bedding shall be placed in accordance with Section 506 of the CDOT Specifications for Road and Bridge Construction, latest edition.

Material which does not meet the requirements described in Section 12.2 shall be either reworked or removed and replaced as necessary to meet these Specifications.



## 13.0 VEGETATION

### 13.1 General

#### 13.1.1 Scope of Work

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with revegetation in accordance with the Construction Drawings and these Specifications. Revegetation efforts shall be directed at all areas disturbed by construction and not covered with erosion protection and shall include, but not be limited to, any areas from which windblown tailings have been removed, the regraded mill and evaporation pond areas, the tailings cover, and all other areas from which mill facilities and/or affected soils were removed.

#### 13.1.2 Related Work

- Section 2.0 - Clearing and Grubbing
- Section 6.0 - Affected Soil Excavation and Placement
- Section 11.0 - Tailings Cell Closure Cover
- Section 16.0 - Health and Safety

### 13.2 Products

Mulch and seed mixture shall be approved by the Owner prior to application based on the criteria specified in Section 13.2.1 and Section 13.2.2.

#### 13.2.1 Seed Mixture Specifications and Planting Locations

Two similar seed mixtures have been developed to revegetate disturbed areas associated with the Piñon Ridge Project. These seed mixtures are composed of native species that are adapted to the project area soils and climatic conditions and do not require supplemental irrigation for germination and establishment.

Seeding rates are based on Pure Live Seed (PLS) and for drill seeding methods. If broadcast or hydroseeding is used, the seeding rate should be doubled. All seed shall be fresh, clean, new crop seed and will be tested for purity, germination, and for weeds. The seed will be free of noxious weeds, and the quantity of total weed seed will be low or within the limits allowed by Colorado seed laws and labeling. All seed will be used within one year from testing date. Seed species will be from genetically appropriate seed sources/seed zones (i.e., collected from ecological conditions approximating those of the project location). Seed will be furnished in original bags showing seed testing analysis including percentage of PLS, year of production, net weight, date, origin and location of packaging. Seed which has become moldy or otherwise damaged in transit or storage shall not be accepted. Modification of seed mixtures, if necessary for any reason, will be done in consultation with a qualified vegetation specialist.



### 13.2.1.1 Seed Mixture 1

Seed Mixture 1 (Shallow Rooted), presented in Table 3, will be used to revegetate the closure cover on the tailings cells and the surrounding areas within 200 ft of the toes of the reclaimed embankments. Seed Mixture 1 will also be used to revegetate topsoil and subsoil stockpiles since these soils will be used in large part for building the closure covers over the tailings cells.

### 13.2.1.2 Seed Mixture 2

Seed Mixture 2, presented in Table 4, will be used to revegetate areas disturbed during initial construction, during facility operation, and during closure operations. This seed mix will be used for all areas of the site except for the tailings cells and soil stockpiles. This seed mixture may also be used for interim stabilization purposes. Seed Mixture 2 is similar to Seed Mixture 1, but includes five additional deeper-rooted shrub species to improve habitat quality.

### **13.2.2 Mulch**

Mulch shall be small-grain hay or straw in a dry condition. Mulch shall be free of weeds and foreign matter detrimental to plant life.



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

**Table 3: Proposed Seed Mixture 1 – Shallow Rooted**

Common name ( <i>Scientific Name – Kartesz</i> )	Variety <sup>1</sup>	Seeding Rate (lbs/Acre – PLS) <sup>2</sup>
Needle and Thread ( <i>Stipa comata</i> )		1.8
Indian Ricegrass ( <i>Oryzopsis hymenoides</i> )		1.8
Thickspike Wheatgrass ( <i>Elymus lanceolatus</i> )	Critana	1.8
Slender Wheatgrass ( <i>Elymus trachycaulus</i> )	Pryor	0.5
Sandberg Bluegrass ( <i>Poa Secunda</i> )	Sandberg	0.9
Bottlebrush Squirreltail ( <i>Elymus elmoides</i> )		0.9
Blue Grama ( <i>Bouteloua gracilis</i> )	Alma	0.9
Galleta ( <i>Hilaria jamesii</i> )	Viva	0.9
<b>Forbs</b>		
Blue Flax ( <i>Linum lewisii</i> )	Appar	0.5
Utah Sweetvetch ( <i>Hedysarum boreale</i> )	Timp or native	1.0
Palmer Penstemon ( <i>Penstemon palmerii</i> )		1.0
<b>Total PLS/Acre:</b>		<b>12.0 lbs/Acre</b>

<sup>1</sup> Where variety is not specified, use native genetically appropriate seed source/ seed zone for all species to be planted.

<sup>2</sup> Double rate if broadcast seeded.



# PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

**Table 4: Proposed Seed Mixture 2 – Deep Rooted**

Common name ( <i>Scientific Name – Kartesz</i> )	Variety <sup>1</sup>	Seeding Rate (lbs/Acre – PLS) <sup>2</sup>
Needle and Thread ( <i>Stipa comata</i> )		1.8
Indian Ricegrass ( <i>Oryzopsis hymenoides</i> )		1.8
Thickspike Wheatgrass ( <i>Elymus lanceolatus</i> )	Critana	1.8
Sandberg Bluegrass ( <i>Poa Secunda</i> )	Sandberg	0.9
Bottlebrush Squirreltail ( <i>Elymus elmoides</i> )		0.9
Blue Grama ( <i>Bouteloua graceilis</i> )	Alma	0.9
Galleta ( <i>Hilaria jamesii</i> )	Viva	0.9
<b>Forbs</b>		
Blue Flax ( <i>Linum lewisii</i> )	Appar	0.5
Palmer Penstemon ( <i>Penstemon palmerii</i> )		1.0
Scarlet Globemallow ( <i>Sphaeralcea coccinea</i> )		1.0
Utah Sweetvetch ( <i>Hedysarum boreale</i> )	Timp or native	1.0
<b>Shrubs</b>		
Fourwing Saltbush ( <i>Atriplex canescens</i> )		2.0
Gardner's Saltbush ( <i>Atriplex gardneri</i> )		2.0
Wyoming Sage ( <i>Artemisia tridentate spp wyomingensis</i> ) <sup>3</sup>		0.25
Black Sage ( <i>Artemisia nova</i> ) <sup>3</sup>		0.25
Winterfat ( <i>Krascheninnikovia lanata</i> ) <sup>4</sup>		0.5
<b>Total PLS/Acre:</b>		<b>17.5 lbs/Acre</b>

<sup>1</sup> Where variety is not specified, use native genetically appropriate seed source/ seed zone for all species to be planted.

<sup>2</sup> Double rate if broadcast seeded.

<sup>3</sup> Sagebrush if drill seed should be seeded through a separate drill box to permit very shallow seeding (i.e., <1/8 inch) and proper seed placement for plant establishment. Best seeding results comes from surface broadcast seeding that is pressed into the soil to provide for a good soil-seed contact. Sagebrush seed can also be broadcasted directly onto snow or broadcast seeding followed by a cultipacker or drag chain.

<sup>4</sup> Seeding rate in mixture is recommended as 0.5 lbs/acre if drilled and 1.0 if broadcasted. When drill seeded, seed at depths <1/4 inch. Winterfat may also be broadcast on snow.



## 13.3 Execution

### 13.3.1 General

Revegetation shall be conducted as specified on the mill area, and any other areas as specified in Section 13.1.1. Salvaged topsoil, where available, shall be spread at locations designated by the Owner in 4- to 6-inch loose lifts. Seeding shall be performed only in the autumn months (i.e., from September through November).

### 13.3.2 Soil Preparation

The soil to be revegetated shall be prepared by first cultivating to a minimum depth of six inches. Fertilizer shall be added, if required, to the soil at an application rate to be determined after soil analyses are conducted by the Owner and shall be worked into the upper six inches of soil by disking along the contours to the extent practical. This application shall not precede seeding by more than one day.

### 13.3.3 Seeding

Seeding shall be conducted by drill or broadcast seeding the specified seed mixture at the specified application rates along the contours or opposite the direction of the prevailing wind. Broadcast seeding may be allowed upon approval by the Owner using an application rate equal to twice the rate specified for drill seeding. Seeding shall not be performed immediately following a heavy rain, during windy periods, or when the ground is determined to be too dry (particularly if broadcast seeding is considered), as determined by the Owner. Drill seeding shall use a roller attachment or its equivalent attached behind the drill to inhibit movement of seeds previously sown. No seeding shall be performed in areas in excess of that which can be mulched the same day.

### 13.3.4 Mulching

Mulch shall be applied to seeded areas at the application rate of two tons per acre. Mulch will be crimped into the surface utilizing a crimper designed for this purpose or other equipment that achieves satisfactory results.

### 13.3.5 Restoration

Planted areas damaged during execution of the site work shall be restored. The areas which fail to show a "catch" or uniform stand with bare spots larger than 10 feet by 10 feet within one growing season shall be reseeded by the Contractor during the next planting season with the specified seed mixture and methodology.



## 14.0 FENCING

### 14.1 General

#### 14.1.1 *Scope of Work*

Unless otherwise specified by the Owner, the Contractor shall furnish all labor, materials and required equipment and shall perform all operations in connection with the construction of fencing in accordance with the Drawings and these Specifications. The work shall consist of installation of a chain link fence to minimize unauthorized access to the reclaimed tailings area and repair or replacement of the existing barbed wire fence around the Piñon Ridge Project Area, where necessary.

Work associated with the chain link fence shall include excavation of post foundation holes to a minimum depth of 30 inches into the subgrade and installation of the posts in concrete foundations. The overall height of the chain link fence shall be approximately 8 feet high, using 96-inch wide chain link fabric. The fabric shall be composed of individual wire pickets which are helically wound and interwoven in the form of a continuous chain link fabric, having a 2-inch mesh,  $\pm 1/16$  inch between parallel wires. The top selvage shall be twisted and barbed, and the bottom selvage shall be knuckled. The fence shall be constructed at the location indicated on the Drawings. Work associated with the barbed wire fence shall include installation of steel T-posts and four strands of wire (top and bottom wires smooth; inner wires barbed), where necessary, to form a complete fence around the Piñon Ridge Project area, as indicated on the Drawings.

#### 14.1.2 *Related Work*

- Section 16.0 - Health and Safety

### 14.2 Products

Submittals for the following products shall be provided to the Owner for approval prior to use. Contractor shall provide product data including manufacturer's technical data (galvanized wire), test data (strength), and specifications sufficient to allow evaluation by the Owner. Submittals shall include shop drawings showing at a minimum brace sections, gate details, and any details pertinent to the long-term effectiveness of the fences.

#### 14.2.1 *Chain Link Fence*

Chain link fencing shall consist of galvanized steel posts (Line, Pull, Corner and End Posts) embedded in concrete foundation, post caps, and chain link fence fabric. In addition, the chain link fence consists of the rails, compression braces, tension rods, stretcher bards, ties, etc., required to connect the chain link fence fabric to the posts and provide chain link fence stability.

All standard mill tolerances as described in ASTM specifications applicable to framework and fabric shall apply.



### 14.2.1.1 Chain Link Fence Fabric

The chain link fence fabric shall be nine-gauge after coating and shall have a minimum tensile strength of 80,000 pounds per square inch (psi). The fabric shall be zinc coated and shall meet the requirements of ASTM A392. The weight of the zinc coating per square foot (psf) of uncoated wire surface shall be not less than two ounces as specified for Class 2 galvanizing, or the fabric shall be aluminum-coated steel fence fabric. Coating shall be Class 2, with a minimum coating weight of 0.35 ounce of aluminum (psf) of uncoated surface. Fabric shall meet all the test requirements of ASTM A491. The fabric shall be composed of individual wire pickets which are helically wound and interwoven in the form of a continuous chain link fabric, having a 2-inch mesh,  $\pm 1/16$  inch between parallel wires. The top selvage shall be twisted and barbed, and the bottom selvage shall be knuckled.

### 14.2.1.2 Line Posts

Line posts shall be 2-inch by 2.25-inch "H" column, or 2-3/8-inch outside diameter (O.D.) Schedule 40 pipe, or 2.25-inch by 1.70-inch rolled form posts. Posts shall be hot-dipped galvanized after cutting with 2-ounce zinc (psf) in accordance with ASTM A123. Line posts shall be of sufficient length to extend 36 inches below grade into concrete footings.

### 14.2.1.3 End, Pull and Corner Posts

End, pull, and corner posts shall be carbon steel standard pipe sections of 2-7/8-inch O.D. Schedule 40 pipe or 3.5-inch by 3.5-inch rolled form posts. Pipe shall be hot-dipped galvanized with 2-ounce zinc per square foot (ASTM A123) and shall be of sufficient length to extend 36 inches below grade into concrete footings.

### 14.2.1.4 Top Rails

Top rails shall be standard 1-5/8-inch O.D. Schedule 40 pipe or 1-5/8-inch by 1-1/4-inch rolled form hot-dipped galvanized with 2-ounce zinc psf (ASTM A123). Pipe rails shall be furnished in random lengths and shall be joined with heavy steel outside galvanized couplings at least 7 inches in length.

### 14.2.1.5 Compression Braces and Tension Rods

Compression braces for all truss or branch panels shall be 1-5/8-inch O.D. Schedule 40 pipe or 1-5/8-inch by 1-1/4-inch rolled form as described for top rails. Tension members shall be 3/8 inch diameter steel rods with heavy steel post bands and tension adjusting threaded rod and nut, all galvanized (ASTM A153).

### 14.2.1.6 Post Tops (Post Caps)

Post tops shall be one-piece malleable iron or pressed steel designed to exclude all moisture and hot-dipped galvanized with 1.2 ounces zinc psf (ASTM A153).



### 14.2.1.7      Stretcher Bars

Stretcher bars shall be of 1/4-inch by 3/4-inch flat hot-dipped galvanized steel. All terminal post bands shall be a minimum of 1/8 inch by 1 inch wide and secured with a 3/8-inch carriage bolt. Stretch bar bands shall be spaced not to exceed 14-inch intervals.

### **14.2.2 Barbed Wire Fence**

The four-strand barbed wire fence shall consist of 12-1/2 gauge galvanized steel wire with zinc coating (top and bottom wires smooth), which shall meet the requirements of ASTM A121, and standard steel T-posts and corner posts.

### **14.2.3 Chain Link Gates**

The chain link gate frames shall consist of the Gate Frame (corner bars and diagonal rods) and the fabric used for chain link fence. Fabric for the gates shall be of the same gauge as for the link fence. The following accessories shall be furnished for each gate and galvanized in accordance with ASTM A153.

#### 14.2.3.1      Gate Frame

Gate Frame corner bars shall be fabricated from carbon steel standard pipe of nominal 2-inch square (1.90 inch) with a nominal weight of 2.72 pounds per foot and galvanized with 2-ounce zinc psf (ASTM A123). Diagonal rods shall have two 3/8-inch galvanized adjustable truss rods providing double diagonal trussing. Gate Frame components (corner bars and diagonal rods) shall be welded together and hot-dipped galvanized after fabrication. All welded joints shall be continuous, reasonably smooth, and cleaned of slag and spatter after fabrication, prior to galvanizing. Alternatively, the Gate Frame components may be connected using fittings. Fittings shall be of malleable iron or pressed steel having means for attaching diagonal bracing members.

#### 14.2.3.2      Gate Posts

The gate posts shall be carbon steel standard tube of 3.5 inch by 3.5 inch rolled from section galvanized as specified for other posts, having a minimum weight of 5.85 pounds per square foot.

#### 14.2.3.3      Gate Hinges

Gate hinges shall be of malleable iron providing for a full 180 degrees swing, with bottom hinge to be ball and socket type. Gate hinges shall be bolted or welded to the Gate Frame corner bars and Gate Posts.

#### 14.2.3.4      Drop Rod, Latches, Padlocks and Catches

Chain Link Gates shall be equipped with a plunger-type drop rod assembly, securely bolted to the frame. Latches for single gates shall have two fork latches mounted on the center plunger rod with means for padlocking available from either side of the gate, Hold-back catches shall be provided for each leaf of



vehicular gates, employing a semi-automatic hold-back catch to be anchored at least 12 inches into a 12-inch diameter by minimum 24-inch deep concrete footing.

#### **14.2.4 Hardware Wire Cloth (Wire Cloth)**

Hardware wire cloth shall consist of welded galvanized steel wire fabric galvanized by the hot-dip process per ASTM A740. The maximum wire gage is specified as a function of the mesh size in the following table:

**Table 5: Hardware Wire Cloth Wire Gage**

<b>Mesh Size</b>	<b>Max. Wire Gage</b>
1/8-inch x 1/8-inch	23
1/2-inch x 1/2-inch	19
3/4-inch x 3/4-inch	16

#### **14.2.5 Concrete Foundations**

Concrete used in the installation shall conform to:

- Portland Cement, Type I: ASTM C150;
- Aggregates: Fine and coarse, ASTM C33; and
- Water: Clean, potable and free of oil, strong acids, salt or organic matter.

### **14.3 Execution**

#### **14.3.1 Fence Installation**

Fence and gates shall be installed as directed by the Owner and specified herein. Work shall be constructed, monitored, and tested in accordance with these specifications. Any work found unsatisfactory or any work disturbed by subsequent operations before acceptance is granted shall be corrected by the Contractor.

#### **14.3.2 Chain Link Fence Installation**

Fabric ties shall be fastened to line posts with galvanized, preformed, six-gauge fabric bands spaced approximately 14 inches apart, and to top rail, braces, and tension wire at not more than 24-inch spacing. Fabric bands for top rail, braces, and tension wire shall not be less than nine gauge, galvanized, preformed steel wire. Maximum spacing for posts shall be 10 feet from center to center.

A malleable iron center rest designed to receive the plunger rod of the gate shall be furnished and anchored at least 12 inches into a 12-inch by 24-inch diameter concrete footing. The top of the gate frame shall align with the top of the fence fabric or the top rail.



A horizontal pipe brace shall be installed at the top rail midway between top and bottom of the fabric with a truss rod extending from midpoint of the line post diagonally to the bottom of the terminal post.

All posts shall extend at least 24 inches into concrete. Post holes are to be at least four inches deeper than the posts. All post foundations, other than gate posts which may be larger as indicated herein, shall be 12 inches in diameter.

All posts shall be set accurately to established lines and grades and plumbed in all directions. Concrete shall be required to produce a 28 day compressive strength of not less than 2,500 psi. All concrete footings shall be poured up to a smooth finish grade and slightly crowned to shed water. Excess concrete or any other construction debris shall be removed from the site.

The finished fence shall be plumb, taut, true-to-line, and complete in every detail. All work shall be performed by experienced personnel.

Wire Cloth shall be installed around the entire perimeter of the Tailings Cells. Wire Cloth shall extend from two feet below the base to three feet above the base of the barbed wire or the chain link fence to preclude access by small, ground-dwelling wildlife.

Bottom of the Wire Cloth shall be placed in the narrow trench excavated approximately 30 inches below the ground surface and backfilled after placing the Wire Cloth. The bottom of the Wire Cloth in the vicinity of the post foundation (24 inches from each side of the concrete foundation) may be secured by backfilling the trench with concrete or using the coarse gravel backfill (the backfill material  $D_{50}$  equal to at least 2 inches or greater).

The top of the Wire Cloth shall be secured to the Chain Link Fence Fabric using hog rings.

### ***14.3.3 Barbed Wire Fence Installation***

Repair and extend, where directed, the existing barbed wire perimeter fencing around the property boundary. Fence shall be no taller than 42 inches, constructed with four strands of wire (top and bottom smooth wire; inner two wires barbed), with at least 12-inch spacing between the top two wires. Bottom wire would be at least 16 to 18 inches off the ground.

Work associated with the barbed wire fence shall include installation of steel T-posts and four strands of barbed wire, as indicated on the drawings.

Barbed wire strands shall be fastened to T-posts and corner posts with wire that shall not be less than nine-gauge, galvanized, preformed steel wire. Maximum spacing for posts shall be 15 feet from center to center. All T-posts shall extend at least 18 inches into the ground.

The finished fence shall be plumb, taut, true-to-line, and complete in every detail.



## 15.0 CONSTRUCTION QUALITY ASSURANCE

### 15.1 General

This section addresses the construction quality assurance (CQA) procedures for the demolition and earthwork (soils) components of the decommissioning and reclamation activities. This program has been developed to assure that the construction of the soil components and placement of demolition debris and soil/cement slurry are in compliance with the project Specifications, and to demonstrate that the regulatory requirements for construction are achieved.

The objective of this plan is to assure that proper materials, construction techniques, and procedures are followed by the Contractor and that the intent of the design is met. This plan also provides the means for resolution of problems that may occur during construction.

The additional objective of this plan is to assure that the demolition activities are performed in accordance with the current industry practices and applicable regulatory safety requirements. This plan addresses quality assurance (QA), not quality control (QC). This CQA Plan is independent of the QC programs conducted by the Contractor. The intent of the CQA Plan is to provide verification and testing to demonstrate that the Contractor has met its obligations in the supply and installation of earthwork (soils) materials and demolition backfill according to the design, project Specifications, and contractual and regulatory requirements. QC is provided by the Contractor and refers to those actions taken by the Contractor to ensure that materials and workmanship meet the requirements of the design Drawings and Specifications.

#### 15.1.1 Environmental Submittals

As required by the preliminary "Mill Decommission Plan (Kleinfelder 2009b)" submitted with the License Application for the Piñon Ridge Mill, a detailed decommissioning plan will be prepared by the Owner prior to the start of decommissioning activities. The detailed plan will include permits, work plans (including identification of Radiation Work Permits needed), waste-handling plans, health and safety operating protocols, environmental monitoring and control programs, quality assurance plan, and requirements for the as-built completion reports. Decommissioning shall not begin until CDPHE approves the decommissioning plan.

The Contractor shall be required to submit documentation of the qualifications of its superintendent and others who supervise critical tasks as specified by the Owner, including the person responsible for safety. The surveyor's proof of licensure shall also be submitted to the Owner.



## **15.1.2 Cleanup Verification Plan**

The Owner shall submit a Cleanup Verification Plan to the CDPHE for approval at least 90 days prior to the start of affected soil excavation. This plan shall be consistent with the guidelines presented in NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination", and shall describe the gamma survey and sampling procedures to be implemented prior to, during, and after reclamation of the site.

## **15.1.3 In-Place Radiological Testing of Surface Tailings**

The Owner shall provide the CDPHE with a radiological sampling and testing report for the Tailings Cell Top prior to construction of the Radon Barrier as described in Section 15.3.3.

## **15.1.4 Settlement Monitoring Report**

The Owner shall provide the CDPHE with a tailings settlement monitoring report prior to construction of the Tailings Cell Closure Cover as described in Section 15.3.2.

## **15.1.5 Radon Barrier Prequalification**

The Owner shall provide the CDPHE with a Radon Barrier prequalification report prior to construction of the Radon Barrier closure cover layer as described in Section 15.3.4. This report may be submitted separately or as part of the report for the radiological testing of surface tailings described in Sections 15.3.3.

## **15.1.6 Tailings Cell Closure Cover Quality Control Report**

The Owner shall provide a summary report to the CDPHE of the quality control test results performed during construction of the Tailings Cell Closure Cover after construction of the cover is completed. The summary shall include a grid map providing points of reference for test locations and a complete set of records of field and laboratory quality control (QC) data.

## **15.1.7 Radon Flux Measurements**

The Owner shall submit the results of radon flux measurements from the Tailings Cell to the CDPHE. The measurements shall be taken after construction of the Radon Barrier Layer in accordance with Section 15.3.4 of these Specifications.

## **15.2 Products**

Not applicable.



## 15.3 Execution

### 15.3.1 Verification of Demolition Activities

All construction demolition activities shall be recorded on a Demolition Field Form including the following information:

- Type and location of debris;
- Approximate volume of soil debris or dimensions of the structural member;
- Decommissioning method (e.g., cutting, excavation);
- Relevant radiation readings and release forms required for off-site disposal or re-use; and

For on-site disposal, the form should indicate the deposition lift thickness, amount of soil/cement slurry required to fill the voids and amount of soil required to achieve compaction and grading requirements in accordance with Section 5.0 of these Specifications.

All Demolition Field Forms shall be signed and dated by the QAC and reviewed and signed by DPM or the authorized representative.

### 15.3.2 Settlement Monitoring

To monitor settlement of the tailings, settlement monitoring points shall be installed during or immediately after placement of the Interim Cover over the regraded tailings at the locations and coordinates indicated on the Drawings. Settlement elevation readings shall be recorded after placement of the Interim Cover and throughout placement of the Radon Barrier and final cover. Survey frequencies are specified in Section 10.3.7. Placement of the Radon Barrier layer shall not begin until 90 percent of the initial consolidation due to Interim Cover placement has occurred. The Owner shall determine when 90 percent of consolidation has been achieved, as approved by the CDPHE, through evaluation of the settlement survey results.

The settlement monitoring points shall be monitored during and after placement of the Radon Barrier and final cover as described in Section 11.3.2. Unless surveying indicates significant subsidence after construction of the final cover, the settlement monitoring points shall be removed as described in Section 10.3.7 of these Specifications.

The Contractor shall be responsible for surveying of the settlement monitoring points during placement of the closure covers layers, and shall provide the Owner with the survey results on a periodic basis. The Owner shall be responsible for surveying of the settlement monitoring points prior to and after cover placement operations and for maintaining charts plotting the magnitude of settlement versus logarithm of time. Time zero for each phase of cover construction shall correspond to the start date of loading around the settlement monitoring points.



The Owner shall provide CDPHE with a report providing the settlement monitoring data after 90 percent of initial consolidation has been achieved from placement of the Interim Cover. Placement of the Radon Barrier layer shall not be initiated until approved by CDPHE. The Owner shall also provide a report providing the settlement monitoring data after 90 percent of final consolidation has been achieved from placement of the Radon Barrier and final cover. The settlement monitoring points shall not be removed until approved by CDPHE.

### ***15.3.3 Testing of In-Place Tailings and Interim Cover***

After regrading of the surface tailings and placement of the Interim Cover, the surface and near surface tailings shall be sampled and analyzed to verify their radiological properties. A uniform grid with 16 sampling locations shall be established on top of the Interim Cover.

The sampling depth shall vary with eight samples collected from 0 to 18 inches below the tailings surface and eight samples collected from 30 to 48 inches below the tailings surface. In-situ samples shall be collected for analysis and testing to allow for determination of in-place physical parameters. The depth of the Interim Cover material at the 16 sampling locations shall also be measured and recorded during sampling and eight in-situ samples of Interim Cover shall be collected for analysis and testing. If shallow trenches are used to collect tailings and Interim Cover samples, the excavation shall be filled and compacted in 6 inch lifts until reaching the lines and grades existing prior to the sampling. Trench excavations shall be filled and compacted in accordance with the Interim Cover specifications in Section 15.3.5. If a hand operated hollow stem auger is used to collect tailings and Interim Cover samples, the excavations shall be backfilled with tailings cuttings and interim cover (in that order) and compacted by hand.

Each of the tailings samples shall be classified using the USCS and analyzed for grain size distribution (ASTM D 422), in-place density and moisture content (ASTM D 1556), specific gravity (ASTM C 127 and/or ASTM D 854), Ra-226 concentration (EPA Method 903.0); and emanation fraction. In addition, the 8 samples of Interim Cover shall be tested to determine their radon diffusion coefficient at a dry density corresponding to the average measured in-place density and a moisture content corresponding to the estimated long-term moisture content using CDPHE-approved empirical methods (i.e. the radon diffusion coefficient will be determined on the Interim Cover samples recompacted to their average field density).

The results of the sampling and testing program shall be reported to the CDPHE for its review prior to starting the construction of the Radon Barrier.

### ***15.3.4 Radon Barrier Placement, Compaction and Testing***

The quality control and testing procedures described in this section are applicable to material used to construct the Radon Barrier layer. Inspection and testing described herein of all Radon Barrier materials



shall be conducted by the Owner to ensure that specified materials are placed and compacted as designated on the Drawings and in these Specifications.

### 15.3.4.1 Material Prequalification

On-site soils excavated and stockpiled during initial construction of the mill and subsequent expansions will be used for construction of the Radon Barrier. Materials used to construct the Radon Barrier layer shall be tested by the Owner prior to their use to verify that the material has geotechnical parameters consistent with those used in the design model. These soils shall also be analyzed to verify that their Ra-226 concentrations are within background levels for the mill and tailings area. Once the Radon Barrier borrow area is prequalified, i.e. once the Ra-226 concentrations are determined to be within acceptable limits, gradation testing, USCS classification, and Atterberg Limits determination shall continue during placement at the frequencies specified in Section 15.3.5 of this document.

Sample location and depth for prequalification testing shall be based on a uniform grid system designed to represent the borrow area in terms of both areal extent and depth (i.e., each sample will represent an approximately equal volume of soil). A minimum of 20 samples shall be collected, classified according to the USCS, and tested for gradation (ASTM D422) and Atterberg Limits (ASTM D423 and ASTM D424). In addition, a representative sample shall be collected for each 50,000 cubic yards of material and analyzed for Ra-226 concentrations (EPA Method 903.0), and tested to determine their specific gravities (ASTM D854), Standard Proctor curves (ASTM D698), radon emanation fractions and diffusion coefficients. The diffusion tests shall be conducted using a pre-defined moisture content by weight specified by the Owner.

The geotechnical test results, emanation fractions and diffusion coefficients shall be compared to the design values used in the radon flux model to verify the adequacy of the proposed borrow material. The Ra-226 concentrations shall be compared to the background levels recorded in the mill and tailings vicinity to verify that they are within nominal background ranges, i.e. at or below Ra-226 concentrations measured prior to mill construction.

Soils which do not have comparable or superior cover characteristics to the test values used in the model or which are above acceptable Ra-226 concentrations shall not be used for Radon Barrier layer construction. Alternately, if sufficient borrow material is not available to meet the design criteria, the Owner may propose a thicker cover design based on representative parameters for the proposed additional borrow material.

The sampling and analytical results from the proposed additional borrow area shall be submitted as a report to the CDPHE. This report may be submitted separately or as part of the verification report for the surface tailings described in Section 15.3.3 of these Specifications. The radon attenuation cover shall not be constructed until the CDPHE has approved the Radon Barrier layer borrow source.



#### 15.3.4.2 Radon Barrier General Classification Testing

Gradation and Atterberg Limit testing of Radon Barrier materials shall be conducted during construction at the testing frequencies specified in Section 15.3.5 of this document.

#### 15.3.4.3 Radon Barrier Compaction Testing

Compaction testing of Radon Barrier materials shall be conducted during construction at the testing frequencies specified in Section 15.3.5 of this document.

#### 15.3.4.4 Radon Flux Measurement

After construction of the Radon Barrier layer, but before placement of the Bio-Intrusion Barrier, Capillary Break and Erosion Barrier/Vegetative Cover layers, the radon flux from the Radon Barrier layer surface shall be measured. Measurement of the radon flux shall be performed in accordance with the requirements of 40 CFR Part 61, Method 115 and 10 CFR Part 40, Appendix A Criterion 6. A minimum of 100 measurements at rectangular grid locations over the completed Radon Barrier surface shall be made, using large-area activated charcoal canisters (see EPA 520/5-85-0029 and 520/5-90-032). The measurements shall continue on a monthly basis until determining that radon flux has reached a steady-state condition. The mean radon flux from the Tailings Cell shall be calculated and shall be reported to the CDPHE along with the locations and results of the individual flux measurements in accordance with 10 CFR Part 40, Appendix A Criterion 6 (4).

### **15.3.5 Earthworks and Geosynthetic Liner Quality Assurance**

Construction of the earthwork components and the geosynthetic liner of the Decommissioning Plan shall be in accordance with these Specifications and Drawings. A CQA monitoring and testing program shall be implemented by the Owner to ensure construction compliance by the Contractor. The CQA testing program shall consist of construction testing and materials testing. During construction, the QAC shall sample and test the construction materials to verify that they meet the Specifications. All testing shall either be conducted on-site, or at a laboratory approved by the DPM.

#### 15.3.5.1 Construction Testing

The QAC shall conduct testing in concurrence with the construction activities. Soil tests to be performed by QAC, and the testing frequency, for each material type are listed in Table 6. Geosynthetic Liner shall have properties shown in Table 7. During manufacturing of the Geosynthetic Liner or after delivery on-site, QAC will coordinate sampling and forwarding of samples to the approved laboratory for testing to ensure conformance with the Specifications. Samples will be taken across the entire width of the roll. Unless otherwise stated, samples will be three (3) feet long by the width of the roll. QAC will mark the machine direction on the samples with an arrow. Unless otherwise stated, samples shall be taken at a frequency of



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

no less than one per one hundred thousand (100,000) square feet. As a minimum, the tests will be performed to verify conformance to the Specifications with minimum values specified in Table 7.

The testing frequencies specified shall be increased when the QAC determines that construction conditions (such as adverse weather, equipment breakdown, improperly ballasted compactor, excessive lift thickness, improper soil type, improper moisture conditioning and compaction) warrant additional tests. Additional tests will be approved by the TM and directed by the QAC. Quality Control (QC) testing is the responsibility of the Contractor, with the required testing and minimum testing frequencies corresponding to the earthwork QAC testing program summarized in Table 6. Similarly, the required QC testing, including manufacturer's quality control (MQC), and minimum testing frequencies for the Geosynthetic Liner installation are summarized in Table 7.



**Table 6: Soil Construction Minimum Testing Frequencies<sup>1</sup>**

Test and ASTM Designation <sup>1</sup>	Interim Cover, Radon Barrier, Erosion Barrier (cy)	Capillary Break (cy)	Bio-Intrusion Barrier, Riprap, Rock Blanket, CDOT Type I Bedding, CDOT Type II Bedding, Toe Protection (cy)
Compaction (ASTM D698)	50,000	N/A	Note 4
Compaction (ASTM D1557)	N/A	50,000	N/A
Particle Size <sup>2</sup> (ASTM C117, C136, D1140)	50,000	50,000	10,000
Atterberg Limits (ASTM D4318)	50,000	N/A	10,000
Moisture Content <sup>3</sup> (ASTM D2216, D4643, D6938)	2,000	2,000	Note 4
Sand Cone (ASTM D1556) and Nuclear Density <sup>3</sup> (ASTM D6938)	2,000	2,000	Note 4

<sup>1</sup> Test shall be performed at the specified frequency, or one per material type, whichever is greater.

<sup>2</sup> Use the USCS description and identification (ASTM D2488).

<sup>3</sup> In-place moisture content and in-place density using D6938 acceptable only after accuracy established by D2216 and D1556 methods with the correlation coefficient of 0.9 or greater.

<sup>4</sup> Will be placed in accordance with an approved method specification.

Soil compaction requirements for the Interim Cover material are 90 percent or greater of the maximum dry density and within minus 2 to plus 3 percent of optimum moisture as determined by the Standard Proctor method (ASTM D698).



**Table 7: Geosynthetic Liner Minimum Testing Frequencies**

Test and ASTM Designation			Test Frequency (sq.ft.)	Required Values
Bentonite (ASTM D5890)	Swell	Index <sup>1</sup>	1 per 50 tons	24 mL/2g min.
Bentonite (ASTM D5891)	Fluid	Loss <sup>1</sup>	1 per 50 tons	18 mL max.
Bentonite (ASTM D5993)	Mass/Area <sup>2</sup>		40,000 ft <sup>2</sup>	0.75 lb/ft <sup>2</sup> min
GCL (ASTM D6768)	Grab	Strength <sup>3</sup>	200,000 ft <sup>2</sup>	45 lbs/in MARV
GCL (ASTM D6496)	Peel	Strength <sup>3</sup>	40,000 ft <sup>2</sup>	3.5 lb/in min
GCL Index Flux <sup>4</sup> (ASTM D5887)			Periodic	1 x 10 <sup>-9</sup> m <sup>3</sup> /m <sup>2</sup> /sec max
GCL Hydraulic Conductivity <sup>4</sup> (ASTM D5887)			Periodic	5 x 10 <sup>-10</sup> cm/sec max
GCL Hydrated Shear Strength <sup>5</sup> (ASTM D5321, ASTM D6243)	Internal		Periodic	500 psf typical

<sup>1</sup> Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

<sup>2</sup> Bentonite mass/area reported at 0 percent moisture content.

<sup>3</sup> All tensile strength testing is performed in the machine direction using ASTM D 6768. Upon request, tensile results can be reported per modified ASTM D 4632 using 4 inch grips.

<sup>4</sup> Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 92 gal/acre/day. This flux value is equivalent to a permeability of 5x10<sup>-10</sup> cm/sec for typical GCL thickness. ASTM D5887 testing is performed only on a periodic basis because the membrane is essentially impermeable.

<sup>5</sup> Peak value measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

The Standard Proctor test (ASTM D698) shall be used to determine the maximum density for Radon Barrier compaction. The compacted material shall be placed at a density equal to or greater than 95 percent of the maximum density and at a moisture content between minus 1 percent and plus 3 percent of optimum moisture content as determined using the Standard Proctor test.

### 15.3.5.2 Construction Monitoring

The QAC will monitor the installation of earthwork and geosynthetic components to verify that the construction is in accordance with the Specifications. The QAC shall identify inadequate construction methodologies or materials that may adversely impact the performance of the closure construction. The



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

QAC will record visual observations throughout the construction process to ensure that the materials are placed to the minimum dimensions as shown on the Drawings.

The QAC shall observe and document foundation preparation, confirming that foundations are free of soft, organic and otherwise deleterious materials (such as debris, branches, vegetation, ice or frozen materials) as well as sufficiently dewatered for handling construction equipment. Dewatering activities will be performed by the Owner, and will begin well in advance of cover placement in the Tailings Cells. During placement of soil materials, the QAC shall:

- Verify the use of appropriate fills;
- Monitor and document placement, including soil type, particle size, loose lift thickness, moisture conditioning process, compaction equipment and methods used to attain compaction including number of passes, uniformity of compaction coverage, compacted lift thickness, bonding of lifts and in-place moisture content and dry density is in compliance with the Specifications;
- Monitor surface preparation to verify that the surface is properly prepared;
- Monitor the placement of fill materials to ensure that the Contractor exercises care in the vicinity of pipes, and that underlying geosynthetics are not damaged; and
- Monitor equipment being used to place the fill materials to verify that the Contractor places the material in accordance with the Specifications.

QAC monitoring of Geosynthetic Liner placement shall include the following:

- Verify that the subgrade is free of deleterious materials prior to deployment, that anchoring is achieved as specified (if applicable), and deployment procedures are performed in compliance with the Specifications;
- Verify sufficient overlap and that the specified seam procedures were followed in compliance with the Specifications;
- Verify that all repairs are performed in compliance with the Specifications;
- Observe and document that the final lift of the Radon Barrier material is placed on top of the Geosynthetic Liner in such a manner as to ensure that the Geosynthetic Liner and underlying Interim Cover materials are not damaged; and
- In addition, the QAC shall verify that prior, during and after construction, the rolls of Geosynthetic Liner material are handled and stored in accordance with the manufacturer's recommendations.

### **15.3.6 Tailings Cell Construction Documentation**

Documentation by the QAC shall consist of daily record-keeping, construction problem resolutions, design and Specification changes, photographic records of decommissioning and closure construction activities, weekly progress reports, chain of custody forms for test sample tracking, and a CQA Report.

#### **15.3.6.1 Daily Record Keeping**

Daily records kept by the QAC shall consist of field notes, observation and testing data sheets, summary of meetings with the Contractor, and reporting of construction problems and resolutions. The QAC shall submit this information on a regular basis to the DPM for review.



## 15.3.6.2 Soils Observation and Testing Forms

The QAC will document soils observations on forms that generally include the following information:

- Date, project name, location, and weather data, including high and low daily temperatures and precipitation (if any);
- A site plan showing work areas and test locations;
- Descriptions of ongoing construction detailing work areas and equipment used by the Contractor;
- Summary of test results and samples obtained, with locations and elevations;
- Resolutions of deficient test results;
- Test equipment calibrations, if necessary;
- Summary of meetings held; and
- Signature or initials of the QAC.

## 15.3.6.3 Geosynthetic Liner Placement Observation and Testing Forms

The QAC will document Geosynthetic Liner observations on forms that generally include the following information:

- Date, project name, location, and weather data, including high and low daily temperatures and precipitation (if any);
- Descriptions of ongoing construction detailing work areas and equipment used by the Contractor;
- Numbering system identifying test or sample number;
- Location and identification of repairs and date of repair (if applicable);
- Measurements for geomembrane panels or seams;
- Location of tests and test results;
- Identification of testing technicians and time of tests;
- Summary of meetings held; and
- Signature or initials of the QAC.

## 15.3.6.4 Photo Documentation

The QAC shall photograph the various phases of decommissioning and closure construction. Photographs shall be identified by location, time, date, and name of the QAC taking the photograph.

## 15.3.6.5 Design and Specification Changes

During closure construction, the need to address design and Specification changes, modifications or clarifications may arise. In such cases, the QAC shall notify the TM, who shall notify the DPM. Design and Specification changes shall be approved, signed and sealed by a Professional Engineer (P.E.) licensed in the State of Colorado. Design and Specification changes shall only be made with written agreement from the Owner and DPM, and may require review and/or approval by CDPHE.



### 15.3.6.6 Weekly Progress Reports

The QAC shall prepare weekly progress reports summarizing decommissioning, closure construction and CQA activities. This report shall be submitted to the DPM, and shall include the following:

- Date, project name and location;
- Summary of decommissioning activities;
- Summary of construction-related activities;
- Summary of samples taken and test results;
- Summary of deficiencies and/or defects and resolutions; and
- Signature of the QAC.

### 15.3.6.7 CQA Report

At the completion of the decommissioning and closure construction, the QAC shall submit a CQA Report to the DPM. This report shall confirm that the work was performed in accordance with the approved Decommissioning Plan, and will contain the following information:

- Summary of decommissioning and closure construction activities;
- Photographic documentation;
- Test data sheets;
- Geosynthetic Liner QA and QC documents; Earthwork CQA test results, including date, test locations and resolutions of deficient test results;
- CQA observation of Contractor's QC activities;
- Copies of surveyors' certificates;
- Fill temperature monitoring results; Staff schedule summary;
- A description of significant construction problems and resolution for these problems;
- Changes to the Drawings or Specifications, and the justification for these changes;
- Record Drawings;
- A statement that the decommissioning and closure construction was completed in compliance with the Drawings and Specifications, signed and sealed by the QAC; and
- As-built drawings signed and sealed by a Professional Engineer (P.E.) licensed in the State of Colorado.



## 16.0 HEALTH AND SAFETY

### 16.1 General

This section defines the working conditions and monitoring designed to protect the health and safety of workers. The safety equipment, monitoring devices and frequencies, action levels, and training programs are intended to comply with EFRC's "Material License Application," dated 2009.

Standard operating protocols, including most of the radiological and non-radiological health and safety training and procedures developed for mill operations, will be used for decommissioning. These protocols are included in the Piñon Ridge Mill Health and Safety Plan (EFRC 2009).

An environmental monitoring and control program will be in place for the decommissioning activities, which will comply with the regulatory requirements in 10 CFR Part 20 to protect workers, the public and the environment from ionizing radiation during decommissioning and reclamation activities.

#### 16.1.1 Scope of Work

This section addresses health and safety requirements and activities for work performed by the Contractor. These requirements include:

- Pre- and post-work physical examinations for all on-site personnel unless specifically waived by the project industrial hygienist and Radiation Safety Officer (RSO);
- Adherence to 10 CFR Parts 19 and 20;
- Site orientation meeting;
- Training in proper implementation of protective measures for worker health and safety during the project including Radiation Work Permits (RWPs); and
- Adherence to the Health and Safety Plan.

The Contractor shall comply with the Mine Safety and Health Administration (MSHA) and CDPHE regulations. The Owner shall provide the Contractor and subcontractors with a copy of the Health and Safety Plan.

Analytical testing related to radiological contamination surveys and radiological monitoring shall be performed by the Owner. Site conditions are expected to vary. The RSO, with approval of the DPM, may authorize deviations from the schedule of reclamation activities after evaluating the potential hazards of changing the sequence.

#### 16.1.2 Related Work

All sections included in these Specifications.



## 16.2 Safety Equipment

### 16.2.1 Personal Protective Equipment

Personal protective equipment shall consist of a hard hat, gloves (rubber, where appropriate), work clothes or coveralls, particulate Level C half-mask cartridge or full face respirators, safety glasses, and work boots.

### 16.2.2 Exposure Monitoring

Each of the Contractor's employees shall be required to wear a dosimeter badge to measure external radiation exposure. A low-volume air sampler shall be used in the general work area during non-routine work tasks in accordance with the Occupational General Air Particulate Survey procedure (EFRC, 2009) unless otherwise directed by the RSO. The filter paper from the air sampler shall be collected and analyzed for uranium. At least one employee shall also be outfitted by the Contractor with a breathing zone sampler to measure airborne uranium in accordance with the Occupational Breathing Zone Monitoring procedure (EFRC, 2009) and one sample shall be obtained per day for each location where work is being performed. The breathing zone samplers will run continuously during each shift with the filter paper being collected daily and analyzed for uranium.

## 16.3 Execution

### 16.3.1 Responsible Personnel

The Contractor shall designate key project personnel and provide each person's resume for review by the DPM. A line of authority shall be established between the RSO and the Contractor's supervisory personnel.

### 16.3.2 Hazard Analysis

The potential hazards associated with the site activities include chemical, physical, and radiological hazards. The chemical hazards involve potential exposure to affected soils and uranium tailings with the associated process chemicals used in the milling of ore.

The physical hazards associated with construction activities primarily involve working with and around heavy equipment, including elevated noise levels, diesel fume, overhead and buried utility lines, moving parts on equipment, and potential equipment rollover or other accidents. Demolition activities include additional physical hazards such as dust from construction debris, elevated tripping and falling hazards, hazards associated with unstable (unsecured, rolling or falling) structural members and hazards associated with the demolition of high-pressure hydraulic lines and electrical installations.

The radiological hazards include exposure to external radiation (gamma), and internal radiation, including alpha and beta radiation associated with inhalation and ingestion of airborne contamination. The Contractor



shall specify the measures to be taken to mitigate or minimize these hazards and any other hazards anticipated during site activities.

### 16.3.3 Radiological Safety

The radiation safety program consists of the following elements:

- 1) Written and practiced "as low as is reasonably achievable" (ALARA) philosophy is shared in responsibility by the Owner, the RSO, and all workers.
- 2) The RSO has the authority to suspend, postpone, or modify any work activity that is potentially hazardous to workers or, a violation of CDPHE rules or license conditions.
- 3) The RSO is delegated the authority to enforce regulations and administrative policy that affects any aspect of the radiological safety program.
- 4) The RSO develops and administers the ALARA program and is active in review and approval of plans for new equipment, process changes, or changes in operating procedures to ensure that the plans do not adversely affect the protection program against uranium and its decay products.
- 5) Radiation Work Plans are required for non-routine activities.
- 6) Daily inspections are conducted by the RSO or his designee.
- 7) Weekly inspections are conducted and documented by the radiation personnel.
- 8) Monthly reports shall be submitted by the RSO to the Vice President of Governmental and Regulatory Affairs of EFRC.
- 9) Technically qualified personnel are employed and key personnel receive continued training.
- 10) A comprehensive radiation safety training program is implemented.
- 11) An extensive surveying and monitoring program is conducted by the radiation and environmental personnel.
- 12) Respiratory protection for employees is used as necessary.
- 13) Bioassay program(s) for employees are performed.
- 14) Facilities and equipment are properly designed to ensure adequate protection for the employees and environment.
- 15) Proper facility layout maintains employee exposures ALARA.
- 16) Access is restricted for areas of potential exposure to airborne radioactivity.
- 17) Dusting of tailings areas is minimized.
- 18) Fume hoods are present in analytical areas.
- 19) Written analytical procedures are available to personnel.
- 20) Written procedures for instrument operation, sample collection, instrument calibration, and documentation are available.
- 21) Records and filing relating to the radiation safety program are maintained.



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

The Contractor shall specify minimum equipment requirements for the levels of protection to be maintained on-site, in accordance with the RSO's program. The Contractor shall provide equipment for its employees. Personal protection equipment (PPE) equipment shall meet or exceed the levels specified in the Health and Safety Plan. The Contractor shall conduct a medical monitoring program to meet or exceed requirements stipulated by the Piñon Ridge Mill Health and Safety Plan (EFRC 2009).

A bioassay program to periodically evaluate the urinary levels of uranium in accordance with the Piñon Ridge Mill Health and Safety Plan (EFRC 2009) shall also be required. The Construction Health and Safety Plan shall specify that all site visitors shall be required to demonstrate compliance with these requirements before being allowed on-site in any active work area.

### **16.3.4 Exposure Monitoring**

#### **16.3.4.1 Radiation Exposure**

Radiation monitoring will be provided for all employees, including contract employees, assisting in reclamation.

Primary monitoring of external radiation exposure of employees shall be provided by a commercial badge service company utilizing dosimeter badges measuring beta and gamma radiation. All employees assigned to work in the restricted area shall wear such a badge. The badges shall be worn and corrective actions taken in accordance with the Personal Radiation monitoring procedure (EFRC 2009).

Area air monitoring will be conducted in accordance with Occupational General Air Particulate Survey procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

Breathing zone air monitoring will be conducted in accordance with the Occupational Breathing Zone Monitoring procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

Urinalysis bioassays will be conducted in accordance with the Bioassay procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

Radon and Radon daughters shall be sampled in accordance with the Radon-222/Radon-220 Decay Product Surveys procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.

#### **16.3.4.2 Radiological Contamination Survey Program**

Radiological contamination surveys shall be conducted in the lunch rooms, change rooms, and offices at in accordance with the Alpha Beta Gamma Contamination Surveys procedure (EFRC 2009) on a schedule determined by the RSO and consistent with the procedure.



Release of equipment or materials from the restricted area shall be performed in accordance with the Release of Equipment to Unrestricted Areas procedure (EFRC 2009).

Policy statements shall be issued regarding housekeeping and cleanup requirements.

### ***16.3.5 Emergency Procedures***

The Contractor shall designate a local facility for treatment of work injuries. The name and address of this facility shall be provided to the Owner and posted at the job site.

Appropriate routes to the treatment center and methods of emergency contact shall also be specified by the Contractor in the designation and posting.

A list of emergency phone numbers shall be maintained on-site.

### ***16.3.6 Site Control and Decontamination***

Release procedures for personnel shall include a radioactive activity scan of skin and clothing prior to leaving the site each day in accordance with the Personnel Release Surveys procedure (EFRC 2009).

All personnel, clothing, equipment, materials and vehicles coming in contact with tailings shall be decontaminated in an area designated by the Owner prior to removal from the restricted area in accordance with the Decontamination procedure (EFRC 2009) and surveyed in accordance with the appropriate procedure.

### ***16.3.7 General Site Health and Safety and Work Rules***

The Contractor shall delineate its standard operating rules as they apply to job safety. Incorporation of the Owner's rules shall also be required.

### ***16.3.8 Health and Safety Training***

The Contractor's employees shall receive site-specific radiation safety training by the Owner's RSO. The Contractor shall also schedule periodic on-site training meetings.

All visitors and regulatory personnel who require access to the active work area/restricted area shall be expected to demonstrate compliance with these requirements.

Radiation protection training shall be conducted for all employees, including contract employees, assisting in reclamation.

All new employees shall be instructed by means of an established course in the inherent risk of exposure to radiation and the fundamentals of protection against exposure to uranium and its decay products in accordance with the Radiological Health and Safety Training procedure (EFRC 2009). Each female



## PIÑON RIDGE PROJECT - SPECIFICATIONS FOR RECLAMATION OF MILL FACILITIES

employee of reproductive age shall be given additional training in accordance with the Pregnant Women procedure (EFRC 2009).

The radiation safety training program shall include the following topics:

- 1) Fundamental radiation chemistry - primarily terms and definitions related to radiation.
- 1) What radiation is and where it comes from.
- 2) Types of radiation exposure.
- 3) Health effects.
- 4) ALARA definition and measures to maintain ALARA exposures.
- 5) Radiation protection regulations (10 CFR Parts 19 and 20).
- 6) Site-specific radiation types.
- 7) Site-specific radiation hazards.
- 8) Fundamentals of health protection.
- 9) Personal hygiene.
- 10) Facility-provided protection.
- 11) Health protection measurements and instrumentation.

A written test with questions directly relevant to the principles of radiation safety and health protection covered in the training shall be given to each worker. The test results shall be reviewed and wrong answers shall be discussed to make sure the worker understands the correct answer. The test results shall be maintained in each employee's file.

Retraining shall be conducted at least annually covering radiation safety regulations, problems, and operating procedures. Employees shall be encouraged to make suggestions relating to work assignments that could make their job safer and/or their exposure levels lower.

Hazard training and task training shall be conducted by the Contractor to instruct new employees on the job. This training shall be documented.

Individual instruction or advice shall be given by the RSO upon issuance of a Radiation Monitoring Request Form.

All visitors and contractors shall be instructed in industrial and/or radiation safety requirements relating to their project-specific function. All visitors touring the restricted area shall be escorted by someone properly trained and knowledgeable about the hazards of the site.



## 17.0 REFERENCES

- CH2M Hill, 2009. *Basic Engineering Report, Piñon Ridge Project, Colorado*. Report prepared for Energy Fuels Resources. 4 February 2009.
- Colorado Department of Transportation (CDOT). 2008. State Highway Access Permit. CDOT Permit No. 508015. Permittee: Stephen Antony, Energy Fuels Resources Corporation. 21 May 2008.
- Energy Fuels Resources Corporation (EFRC). 2009. Piñon Ridge Mill Health and Safety Plan, Lakewood, Colorado.
- Environmental Restoration Group (ERG). 2009. Baseline Radiological Investigation Report, Piñon Ridge Uranium Mill, Montrose County, Colorado.
- Golder Associates Inc. (Golder). 2008a. Technical Specifications, Piñon Ridge Project, Montrose County, Colorado. Revision A – Issued for Permitting. Prepared for Energy Fuels Resources Corporation. September. Project No. 073-81694.0009.
- Golder Associates Inc. (Golder). 2008b. Ore Pad Design Report, Piñon Ridge Project, Montrose County, Colorado. Prepared for Energy Fuels Resources Corporation. October. Project No. 073-81694.0005.
- Golder Associates Inc. (Golder). 2008c. Tailings Cell Design Report, Piñon Ridge Project, Montrose County, Colorado. Prepared for Energy Fuels Resources Corporation. October. Project No. 073-81694.0003.
- Golder Associates Inc. (Golder). 2008d. Evaporation Pond Design Report, Piñon Ridge Project, Montrose County, Colorado. Prepared for Energy Fuels Resources Corporation. October. Project No. 073-81694.0004.
- Kleinfelder. 2009a. Piñon Ridge Project – Tailings Cell Cover and Site Closure Grading Plans, Montrose County, Colorado. February 13, 2009.
- Kleinfelder. 2009b. Mill Decommissioning Plan – Energy Fuels Resources Corporation – Uranium Mill Licensing Support, Montrose County, Colorado, April 9, 2009.
- Kleinfelder. 2010. Tailings Cell Closure Design Report, Energy Fuels Corporation, Piñon Ridge Project, Montrose County, Colorado. September 10, 2010.