# PIÑON RIDGE MILL DECOMMISSIONING AND RECLAMATION COST ESTIMATE

Submitted and Prepared By


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## 1.0 INTRODUCTION

This decommissioning and reclamation cost estimate for the Piñon Ridge Mill was prepared by Energy Fuels Resources Corporation (Energy Fuels) with the assistance of KGL Associates, Inc. (KGL). The bonding period of the cost estimate is for the first five years of mill operation. For this period, closure costs have been estimated for the build out of the facility which includes the mill, ore pad, Tailings Cell A, 40 acres of evaporation ponds, and access roads within the restricted area. It also includes reclamation of the soil stockpile area west of the restricted area and the monitoring systems located both within and outside of the restricted area. The cost estimate does not include reclamation of the main access road, administration building, guard house, truck scales, and well field, which will be retained for the post-milling land use. Figure 1 shows the areas that are to be reclaimed as part of closure activities.

The cost estimate was prepared for the Colorado Department of Public Health and Environment (CDPHE) and provides information needed by that agency to establish a closure and reclamation bond amount for the facility (6 CCR 1007-1, 18.8.3.4). The bond is intended to provide the state with the necessary funds for site closure and reclamation should Energy Fuels not be able to perform the work. To meet that objective, the estimate was prepared based on a third-party contractor reclaiming the site under the supervision of a project management company. This approach is consistent with state regulations that require "The applicant's cost estimates must take into account total costs that would be incurred if an independent contractor were hired to perform the closure and stabilization work" (6 CCR 1007-1, Part 14.31.1).

The management structure of the decommissioning and reclamation project has three major components; (1) the State of Colorado, (2) a project management company (the state's representative), and (3) a construction contractor. The state oversees overall direction of the project. The project management company oversees all aspects of the progression of the project, from initial planning through final closure and is responsible for preparing the reclamation plan, bid documents, engineering plans, and report submittals. The construction management company is also responsible for insuring that the contractor is in compliance with environmental requirements and the radiation program and the industrial hygiene program. The construction contractor performs the actual construction activities under the direction of the project management company. Sub-contracted work may also be performed based on the capabilities of the construction contractor

### *1.1 Decommissioning Activities*

The reclamation cost estimate accounts for costs associated with the following major decommissioning activities and ancillary categories:

- Decontamination of the Mill Facilities
- Dewatering of the Tailings Impoundment
- Placement of an Interim Impoundment Cover
- Decommissioning and Demolition of the Mill Facilities and Ore Pad
- Decommissioning and Demolition of the Evaporation Ponds

- Construction of the Impoundment Radon Barrier and Other Cover Layers
- Site Grading and Re-contouring
- Site Topsoil Placement and Re-vegetation
- Third Party Primary and Sub-Contractor Support and Overhead
- Radiation and Industrial Hygiene Programs (including Site Contamination Characterization, and Final Status Survey)
- Post-Closure Monitoring
- Decommissioning of Monitoring Systems
- DOE Long Term Care (Monitoring and Maintenance)
- State Administration Fees

These activities are described in detail in Section 3.

### *1.2 Estimated Bond Amount*

The estimated bond amount for reclamation and closure of the Piñon Ridge Mill totals $11,898,480 including $1,634,520 for project management, $8,824,700 for construction activities, and $1,439,260 for other activities including the construction performance bond, post-closure monitoring, decommissioning of monitoring systems, DOE long term care, and state administration fees. Table 1 presents a summary of these estimated costs by activity. Section 2 describes the assumptions and methods used to calculate the bond estimate while Section 3.0 provides a more detailed description of each line item in the estimate.

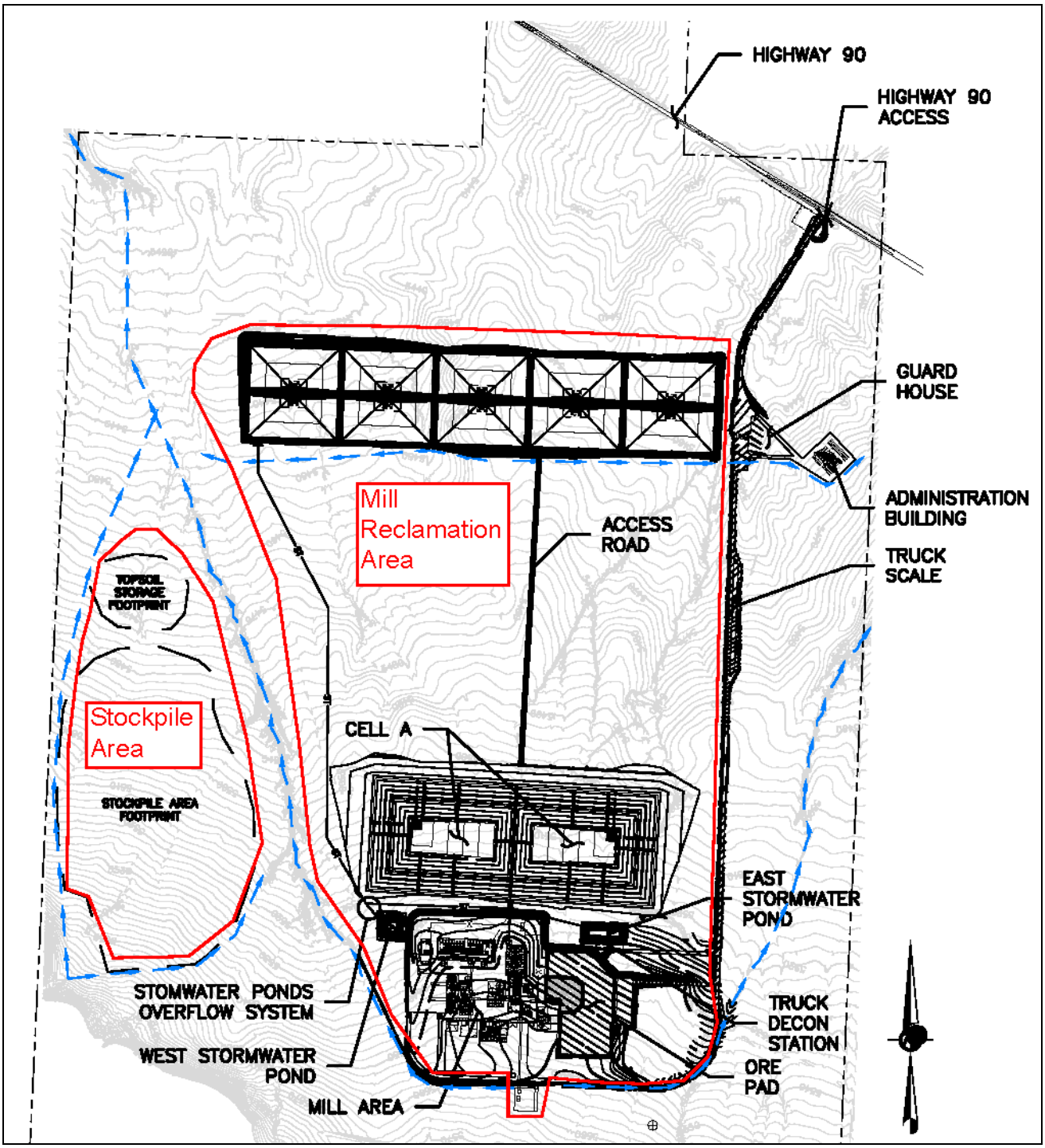



**Figure 1 Piñon Ridge Mill Footprint (after Kleinfelder, 2008)**

**Table 1 Cost Estimate Summary**

| Item Number | Category | Cost Estimate ($) |
|---|---|---|
| | **Project Management (Owner's Representative)** | |
| 1) | Project Management, Engineering And Overhead | 720,410 |
| 2) | Characterize Site Contamination Limits | 334,260 |
| 3a) | Radiation & Ind. Hygiene Programs - Personnel | 315,900 |
| 3b) | Rad. & Ind. Hyg. Programs - Sample Analysis | 263,950 |
| | PM Subtotal | 1,634,520 |
| | **Construction Contractor** | |
| 4) | Contractor Mobilization / Demobilization | 128,880 |
| 5) | Decontamination of Facility | 90,000 |
| 6) | Dewater Tailings | 163,350 |
| 7) | Re-Grade Tailings | 18,450 |
| 8) | Mill Site Demolition | |
| 8a) | Dismantle Facilities For Disposal | 900,000 |
| 8b) | Facilities Disposal in Impoundment | 255,130 |
| 8c) | Ore Pad Disposal in Impoundment | 21,960 |
| 8d) | Strip and Place Mill Facility Soils in Impoundment | 18,490 |
| 8e) | Strip and Place Other Site Soils in Impoundment | 17,640 |
| 8f) | Strip and Place Evaporation Pond Materials | 649,220 |
| 9) | Construct Interim Fill Cover | 144,000 |
| 10) | Grout Seal Leak Impoundment Leak Detection | 14,270 |
| 11) | Construct Tailings Impoundment Cover: | |
| 11a) | Radon Barrier | 548,100 |
| 11b) | Capillary Break Layer | 1,597,740 |
| 11c) | Capillary Break Filter Layer | 798,870 |
| 11d) | Bio-Intrusion Layer | 354,740 |
| 11e) | Erosion Barrier | 120,510 |
| 11f) | Erosion Barrier Rock Mulch Layer | 798,870 |
| 11g) | Rock Blanket | 789,400 |
| 11h) | Embankment Toe Protection | 394,620 |
| 11i) | Drainage Channel Filter Layer | 7,820 |
| 11j) | Drainage Channel Rip Rap | 23,160 |
| 12) | Perform Site Grading: | |
| 12a) | Mill And Ore Pad | 20,250 |
| 12b) | Roads | 405 |
| 12c) | General | 90 |
| 13) | Place Topsoil: All Remaining Areas | 93,510 |
| 14) | Seed and Re-vegetate: | |
| 14a) | Impoundment | 70,380 |
| 14b) | All Remaining Areas | 146,970 |
| 15) | Construction Contractor Support | 637,875 |
| | Construction Contract Subtotal | 8,824,700 |
| | **Subtotal: Project Management and Construction Contractor** | **10,459,220** |
| 16) | Performance Bond (1%) | 104,590 |
| 17) | Post Closure Monitoring and Maintenance | 233,090 |
| 18) | Decommissioning of Monitoring Systems | 59,130 |
| 19) | DOE Long Term Care | 827,590 |
| 20) | State Administration Fee | 214,860 |
| | **Total:** | **11,898,480** |

## 2.0 ESTIMATION METHODS AND ASSUMPTIONS

CDPHE requires that the reclamation bond estimate be based on the projected maximum cost for closure and reclamation during the licensing period. Normally, this would occur at the end of the 5-year licensing period when facilities will have expanded to their maximum extent. In this case, however, Energy Fuels also evaluated conditions during the first year of operation when extensive backfilling would be required in Tailings Cell A as part of closure. Accordingly, two reclamation scenarios were evaluated. The first scenario involved mill operation for a very short period (less than one year) followed by subsequent backfilling to grade of Tailings Cell A with on-site soil. The second scenario involved longer term mill operation such that Tailings Cell A was filled with process waste (five years or more). A fully engineered Tailings Closure Cover would then be constructed over Tailings Cell A. As discussed in more detail below, the second scenario proved to be more costly and was selected for detailed cost analysis.

The Energy Fuels Resources Corp. engineering group prepared a draft cost estimate for the second scenario based on its knowledge of similar projects. This estimate was then reviewed by KGL Associates, Inc. (KGL) for accuracy and completeness. KGL is a construction company experienced in completing uranium mill decommissioning projects similar to the proposed closure plan for the Piñon Ridge Mill. The draft estimate was then finalized based on comments and a bid price received from KGL. The bid by KGL, as well as its corporate background information are presented in Attachments A and B, respectively.

### *2.1 Reclamation Scenarios*

Reclamation Scenarios 1 and 2 are similar in most respects. In both scenarios, the mill facility and ore pad are fully built, one-half of the evaporation ponds (i.e., 40 acres) are constructed and Tailings Cell A is constructed (Figure 1). These items form the basis of the reclamation cost estimate. At the time of reclamation and closure, all of the mill facility, ore pad and evaporation pond materials are placed within Tailings Cell A, within a disposal vault on top of the tailings material.

In Scenario 1, the mill is operated for less than one year. It is assumed that significant quantities of processed waste were sent to the tailings cell to preclude simple removal. However, insufficient volume of waste in the cell requires Tailings Cell A to be backfilled with on-site soil to grade. Because of the great thickness of the backfill (64 feet), construction of a final, engineered Tailings Closure Cover would not be required. This assumption is based in part on the belief that the great thickness of fill provides protection from potential radon releases that would otherwise be induced by anticipated surface erosion.

In Scenario 2, it was assumed that long-term mill operations (five years or longer) have occurred and that Tailings Cell A is filled to its design limit. A fully engineered Tailings Closure Cover, consistent with the design presented in the Tailings Cell Closure Design Report (Kleinfelder 2009a) , is constructed over the top of Tailings Cell A.

The primary difference between the two scenarios is that Scenario 1 requires the haulage and placement of approximately 1.2 million cubic yards of soil fill while Scenario 2 requires the

installation of the engineered Tailings Closure Cover. Costs for these specific items are compared in Attachment C. Even with the inclusion of an additional $500,000 for revising the closure design, Scenario 1 is lower in cost than Scenario 2. Therefore, Scenario 2 was selected for detailed cost analysis.

### *2.2 Project Approach*

Project tasks were developed for the reclamation and closure estimate based on experience in decommissioning similar projects and a chronological approach to implementing the closure and reclamation plans presented in the Tailings Cell Closure Design Report (Kleinfelder 2009a), Mill Decommissioning Plan (Kleinfelder 2009b) and Specifications for Closure and Reclamation of Mill Facilities (Golder 2009). These tasks are detailed in Section 3 of this estimate. Take-off quantities were derived from the mill construction plans provided by CH2M Hill (2009) and the aforementioned Kleinfelder reports using AutoCAD methods. The demolition quantities from the mill construction plans are detailed in Attachment D.

Total costs for each task were then estimated based on the time and resources to complete the work. Current (i.e., 2009) unit prices for labor and equipment were obtained from several Denver-area construction companies (USA Environment and Ames Construction).Time estimates were developed for each activity based on previous experience and standard reference handbooks (i.e., Caterpillar Performance Handbook and Means Building Construction Cost Data). Costs were then calculated by multiplying the unit prices by the estimated time needed to complete the activity.

KGL reviewed the draft estimate for accuracy and completeness and provided revised unit rates and times for some of the tasks. The estimate was then revised to match KGL's bid presented in Attachment A. As stated in KGL's cover letter, "The Exhibits represent actual bids for similar haul distances and materials, actual quotes for similar tasks, and calculated costs using current equipment, labor, and materials costs." The final unit prices used for labor and equipment in the estimate are presented in Attachments E and F, respectively. Material costs are provided directly in the detailed Cost Estimate Work Sheet found in Attachment G.

### *2.3 Reclamation Crew, Equipment and Schedule*

In developing this estimate, Energy Fuels assumed that the project would be done by a relatively small crew over a longer period of time rather than a larger crew over a shorter time period. This assumption was based on the fact that some tasks, such as dewatering of the tailings, could not be done in a short time period regardless of the level of effort expanded.

Energy Fuels assumed that there will typically be about 7 equipment operators per day performing the reclamation work. Adding the supervisory and radiation program personnel, it is anticipated that the typical daily workforce will be about 10 people. Daily crew size can range from 2 operators to 15 operators, depending on the amount of scheduled work.

Table 2 lists a generalized equipment fleet to be used for demolition and on-site excavation and materials movement. Table 3 lists a generalized equipment fleet to be used for the construction of the Tailings Closure Cover. Details can be found in Attachment G. Operator

wages are separate from the equipment costs. Wages for equipment operators are approximately $18.75 per hour. The burden (employee insurance and employer taxes) is 35%. It is assumed that the equipment is rented.

**Table 2 Excavation and Demolition - Equipment Fleet**

| Equipment | Cost |
|---|---|
| Trucks (CAT 740) | $85.12 / Hr |
| Excavator (CAT 365) | $128.13 / Hr |
| Dozer (CAT D6) | $ 65.88 / Hr |
| Motor Grader | $ 62.76 / Hr |
| Scrapers (CAT 613) | $ 33.64 / Hr |

**Table 3 Tailings Closure Cover Construction - Equipment Fleet**

| Equipment | Cost |
|---|---|
| Trucks (Over-The Road) | $ 20.00 / Ton – Material Delivered |
| Compactor (CAT 563 C) | $ 31.88 / Hr |
| Scraper (CAT 631) | $ 156.58 / Hr |
| Water Truck | $ 49.81 / Hr |
| Dozer (CAT D6) | $ 65.88 / Hr |

Excavation and demolition activities include the use of thumb and shear attachments with the excavators. Consumables such as fuel, oil and gas (FOG) are included as cost items. An excavator is used predominantly for materials movement, excavation and truck loading. For this cost estimate, it is assumed that no items to be reclaimed on the site are salvageable and all materials are placed in the tailings vault. This approach is consistence with Nuclear Regulatory Commission guidance provided in NUREG-1757, Volume 3.

Soil stripping and bulk filling is achieved with the use of CAT 613 scrapers along with a motor grader. Movement of native soil for the Tailings Closure Cover will be primarily with scrapers. Placement of imported materials for the Tailings Closure Cover, such as sand and rock, will be accomplished with a CAT D6 dozer. Materials are imported and dumped in place by ”over-the-road” tractor-trailer units. This service is provided by the company supplying those materials. Site grading is to be performed with a CAT 14 motor-grader. Topsoil placement is to be performed with the same equipment as the excavation and demolition fleet.

Along with the reclamation cost estimate, a representative schedule of the reclamation activities is included. Project duration (Figure 2) is estimated at 2 years, eight and ½ months (855 days) based on a work schedule of 10 hours per day, 6 days per week. The schedule includes one year for dewatering of the tailings impoundment. This schedule is for direct

reclamation activities and does not include the post-closure monitoring period or the DOE Long-Term care period.

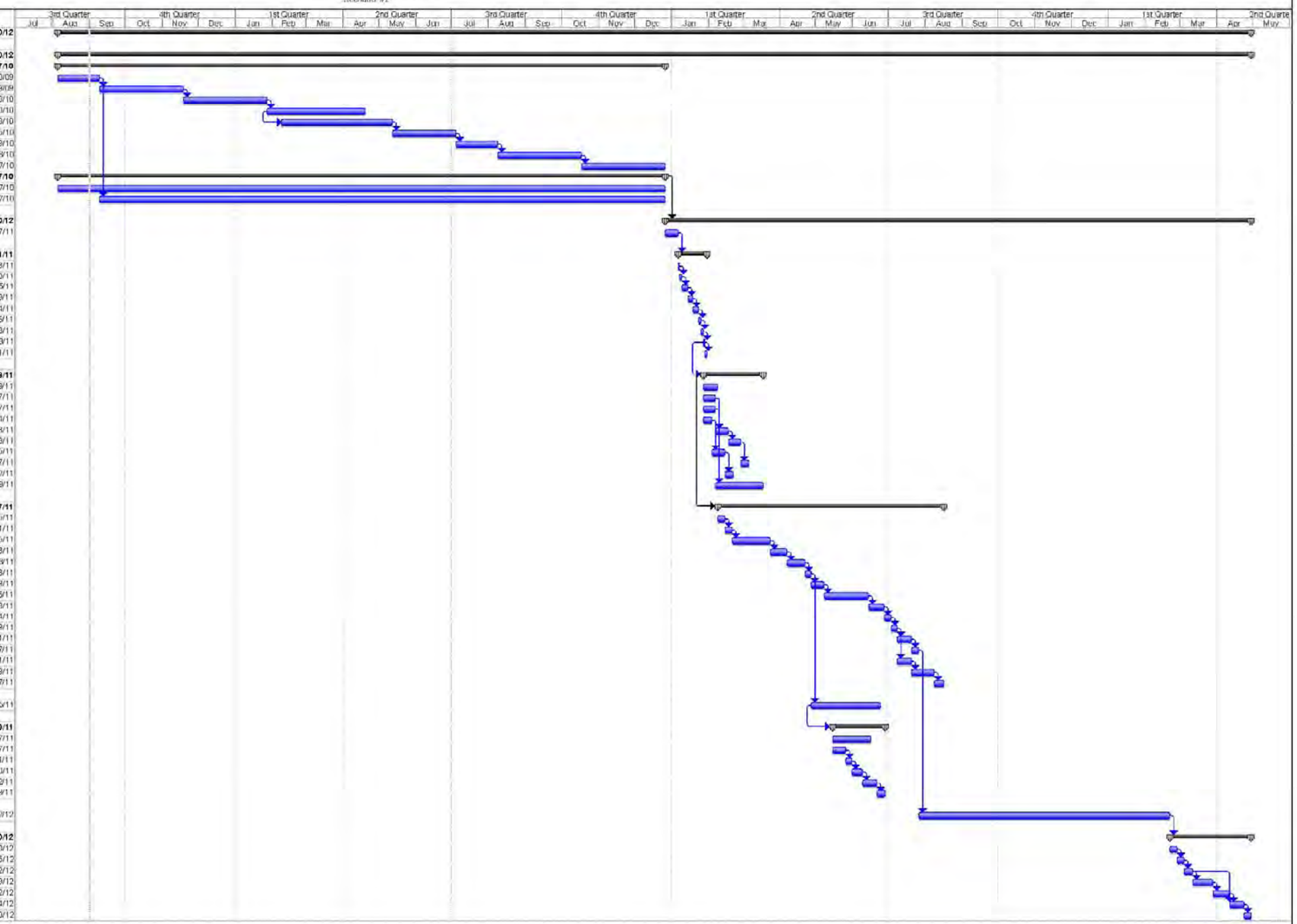
ENERGY FUELS RESOURCES

PINON RIDGE MILL CLOSURE

Closure after 5 or More Years of Operation

Scenario #2

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Pinon Mill Decommissioning** | **885 days** | **Thu 8/6/09** | **Mon 4/30/12** |
| 2 | | | | |
| 3 | **Pre-Closure Activities** | **855 days** | **Thu 8/6/09** | **Mon 4/30/12** |
| 4 | **Regulatory Coordination and Planning** | **435 days** | **Thu 8/6/09** | **Mon 12/27/10** |
| 5 | Agency Coordination | 30 days | Thu 8/6/09 | Thu 9/10/09 |
| 6 | Prepare Remedial Investigation Work Plan | 60 days | Thu 9/10/09 | Thu 11/19/09 |
| 7 | Agency Review | 60 days | Thu 11/19/09 | Thu 1/28/10 |
| 8 | Remedial Investigation | 70 days | Thu 1/28/10 | Tue 4/20/10 |
| 9 | RI Analytical | 60 days | Tue 2/9/10 | Thu 5/13/10 |
| 10 | Prepare RI Report | 45 days | Thu 5/13/10 | Mon 7/5/10 |
| 11 | Agency Review | 30 days | Mon 7/5/10 | Mon 8/9/10 |
| 12 | Prepare Remedial Action Work Plan | 60 days | Mon 8/9/10 | Mon 10/18/10 |
| 13 | Agency Review | 60 days | Mon 10/18/10 | Mon 12/27/10 |
| 14 | **Site Monitoring** | **435 days** | **Thu 8/6/09** | **Mon 12/27/10** |
| 15 | Site Monitoring, Maintenance, & Security | 435 days | Thu 8/6/09 | Mon 12/27/10 |
| 16 | Operate Dewatering System | 435 days | Thu 8/6/09 | Mon 12/27/10 |
| 17 | | | | |
| 18 | **Remedial Action** | **420 days** | **Mon 12/27/10** | **Mon 4/30/12** |
| 19 | Mobilize Staff, Crew, Equipment, and Support Facilities | 10 days | Mon 12/27/10 | Fri 1/7/11 |
| 20 | | | | |
| 21 | **Facility Decontamination** | **20 days** | **Fri 1/7/11** | **Mon 1/31/11** |
| 22 | Area 100: Ore Handling and Grinding Area Decontamination | 1 day | Fri 1/7/11 | Sat 1/8/11 |
| 23 | Area 200: Leaching Tank Decontamination | 1 day | Sat 1/8/11 | Mon 1/10/11 |
| 24 | Area 300: CCD Thickner Area Decontamination | 5 days | Mon 1/10/11 | Sat 1/15/11 |
| 25 | Area 400 Uranium Solvent Extraction Train Decontamination | 3 days | Sat 1/15/11 | Wed 1/19/11 |
| 26 | Area 500 Uranium Precipitation Decontamination | 4 days | Wed 1/19/11 | Mon 1/24/11 |
| 27 | Area 600: Vanadium Solvent Extraction / Oxidation Decontamination | 2 days | Mon 1/24/11 | Wed 1/26/11 |
| 28 | Area 700 Vanadium Precipitation Facility Decontamination | 2 days | Wed 1/26/11 | Fri 1/28/11 |
| 29 | Area 800: Reagents Unloading Bldg. & Warehouse Decontamination | 1 day | Fri 1/28/11 | Sat 1/29/11 |
| 30 | General Facility Universal Waste Removal & Disposal | 1 day | Sat 1/29/11 | Mon 1/31/11 |
| 31 | | | | |
| 32 | **Facility Demolition** | **43 days** | **Fri 1/28/11** | **Sat 3/19/11** |
| 33 | De-energize Electrical Systems | 10 days | Fri 1/28/11 | Wed 2/9/11 |
| 34 | Area 100 Demolition | 9 days | Fri 1/28/11 | Mon 2/7/11 |
| 35 | Area 200 Demolition | 9 days | Fri 1/28/11 | Mon 2/7/11 |
| 36 | Area 300 Demolition | 6 days | Fri 1/28/11 | Fri 2/4/11 |
| 37 | Area 400 Demolition | 10 days | Mon 2/7/11 | Fri 2/18/11 |
| 38 | Area 500 Demolition | 6 days | Fri 2/10/11 | Mon 2/28/11 |
| 39 | Area 600 Demolition | 9 days | Fri 2/4/11 | Tue 2/15/11 |
| 40 | Area 700 Demolition | 6 days | Mon 2/28/11 | Mon 3/7/11 |
| 41 | Area 800 Demolition | 6 days | Tue 2/15/11 | Tue 2/22/11 |
| 42 | Area 900 Demolition | 35 days | Mon 2/7/11 | Sat 3/19/11 |
| 43 | | | | |
| 44 | **Tailings Cell A Closure** | **162 days** | **Wed 2/9/11** | **Wed 8/17/11** |
| 45 | Mobilize Equipment | 5 days | Wed 2/9/11 | Tue 2/15/11 |
| 46 | Grade Tailings | 5 days | Tue 2/15/11 | Mon 2/21/11 |
| 47 | Strip And Place Evaporation Pond Soils in Cell A | 28 days | Mon 2/21/11 | Fri 3/25/11 |
| 48 | Place Ore Pad Materials in Cell A | 12 days | Fri 3/25/11 | Fri 4/8/11 |
| 49 | Place Mill Facility Soils in Cell A | 13 days | Fri 4/8/11 | Sat 4/23/11 |
| 50 | Strip And Place Other On-Site soils in Cell A | 4 days | Sat 4/23/11 | Thu 4/28/11 |
| 51 | Construct Interim Fill 90% Cover | 9 days | Thu 4/28/11 | Mon 5/9/11 |
| 52 | Construct 90% Radon Barrier Cover | 32 days | Mon 5/9/11 | Wed 6/15/11 |
| 53 | Construct 90% Capillary Break | 11 days | Wed 6/15/11 | Tue 6/28/11 |
| 54 | Construct 90% Filter Layer | 5 days | Tue 6/28/11 | Mon 7/4/11 |
| 55 | Construct 90% Bio-Intrusion Layer | 5 days | Mon 7/4/11 | Sat 7/9/11 |
| 56 | Construct 90% Erosion Barrier | 10 days | Sat 7/9/11 | Thu 7/21/11 |
| 57 | Place Interim Cover Soil Above Temporary Open Space | 5 days | Thu 7/21/11 | Wed 7/27/11 |
| 58 | Construct Rock Blanket Cover | 10 days | Sat 7/9/11 | Thu 7/21/11 |
| 59 | Construct Embankment Toe Protection | 16 days | Thu 7/21/11 | Tue 8/9/11 |
| 60 | Construct Tailings Cover Drainage Channels | 7 days | Tue 8/9/11 | Wed 8/17/11 |
| 61 | | | | |
| 62 | **Final Status Surveys** | 50 days | Thu 4/28/11 | Sat 6/25/11 |
| 63 | | | | |
| 64 | **Site Reclamation** | **38 days** | **Mon 5/16/11** | **Wed 6/29/11** |
| 65 | Backfill Evaporation Ponds that have been Closed | 28 days | Mon 5/16/11 | Fri 6/17/11 |
| 66 | Grade Mill & Ore Pad | 10 days | Mon 5/16/11 | Fri 5/27/11 |
| 67 | Grade Haul Roads | 4 days | Fri 5/27/11 | Wed 6/1/11 |
| 68 | General Site Grading | 8 days | Wed 6/1/11 | Fri 6/10/11 |
| 69 | Re-Topsoil Cell A | 10 days | Fri 6/10/11 | Wed 6/22/11 |
| 70 | Initial Seeding (All-AC) | 5 days | Wed 6/22/11 | Wed 6/29/11 |
| 71 | | | | |
| 72 | **Post Settlement Dewatering & Site Monitoring** | 180 days | Wed 7/27/11 | Wed 2/22/12 |
| 73 | | | | |
| 74 | **Final Closure Following Complete Dewatering of Cell A** | **58 days** | **Wed 2/22/12** | **Mon 4/30/12** |
| 75 | Grout Subdrain | 5 days | Wed 2/22/12 | Tue 2/28/12 |
| 76 | Remove Conveyance Pipeline from Cell A to Evaporation Pond | 5 days | Tue 2/28/12 | Mon 3/5/12 |
| 77 | Remove Final Evaporation Pond | 6 days | Mon 3/5/12 | Mon 3/12/12 |
| 78 | Final Status Survey of Evaporation Pond Site | 15 days | Mon 3/12/12 | Thu 3/29/12 |
| 79 | Complete Cap | 12 days | Thu 3/29/12 | Thu 4/12/12 |
| 80 | Backfill Evaporation Pond | 10 days | Thu 4/12/12 | Tue 4/24/12 |
| 81 | Final Seeding | 5 days | Tue 4/24/12 | Mon 4/30/12 |




Project: Energy Resources-Pinon Mill D
Date: Tue 9/1/09

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Page 1

**Figure 2 Representative Project Schedule**

## 3.0 PROJECT TASKS AND DETAILED COST ESTIMATE

Each of the project tasks are described below. The line item number of each task correlates with the Work Breakdown Structure (WBS) Code on the detailed estimator's worksheet presented in Attachment G and Item Number in the Cost Summary by Task table presented in Attachment H. Table 1 also shows these line-items.

**Line Item Description:**

### 1) Project Management, Engineering and Overhead

This line item involves the management of the project by a company that serves as the representative of the State of Colorado. This company oversees the entire project from initial planning through closure. The company prepares the reclamation plan, administers the contract, manages the construction contractor and sub-contractors, ensures environmental compliance and prepares all reports to the state. The company is responsible for the radiation program and industrial hygiene program. Costs in this line item include on-site and off-site management, office staff and overheads and engineering services. Engineering contingency has been incorporated into this line item.

Exclusive of the costs of line item 1 are the costs for conducting the radiation and industrial hygiene programs. While considered as part of the project management costs, these have been considered in items 3a and 3b.

### 2) Site Characterization / Identify Limits of Contamination

Soil contamination will be characterized and identified for subsequent clean-up. A 10 meter grid will be established over the following areas: the mill facility, the ore storage pad, the evaporation ponds, outslopes of Tailings Cell A, and surrounding areas that have the potential to possess wind-blown contaminated materials. Radiological surveys will be performed in conjunction with physical soil sampling. Soil samples will be analyzed for gross Alpha, $U_{nat}$, $Ra_{226}$, $Th_{230}$, and $Pb_{210}$. Personnel for this stage include a radiation safety technician (RST) and appropriate equipment. Soil samples are obtained through the work of a subcontractor under direction of the RST. Soil sampling will be performed on areas that are identified to exceed 5 pCi/g of $Ra_{226}$ above background, based on site gamma surveys.

### 3) Radiation Program and Industrial Hygiene

The radiation and industrial hygiene programs are to be conducted by the project management company. This company will also provide radiation and industrial hygiene services for the construction contracting company. Staffing will consist of one RSO ($45.00 / Hr), one RST ($30.00 / Hr) and one secretary / clerk ($12.23 / Hr). Costs for the radiation program personnel are presented in Attachment G, line item 3a. Wages shown in Attachment G, line item 3a are reduced for benefits (35% burden, 10% profit margin). These ancillary costs are included in line item 1, Project Management, Engineering and Overhead. Personnel costs were estimated for the project life of 2.7 years. Line item 3b of Attachment G presents

the sampling costs associated with the radiation program, the industrial hygiene program and environmental compliance. Sampling costs were estimated for a project life of 2.7 years.

The project management group is responsible for preparing the remedial action report, performing the site characterization study and conducting the final status survey report. The cost for labor and sampling associated with these tasks has been accounted for in line items 3a and 3b.

During the final status survey, which occurs after clean-up of contaminated soil, soil sampling will be performed on areas identified in the site characterization study (Item 2) as exceeding 5 pCi/g $Ra_{226}$ background levels as well as other areas suspected to have been contaminated during reclamation. Soil samples will be taken randomly over 10% of the total grid area established in line item 2. Project sampling costs are presented in Attachment G, line item 3b.

**4) Contractor Mobilization / Demobilization**

This item considers the cost of mobilization of contractor equipment and support facilities. It is assumed that the mill office building, which is outside of the licensed boundary area, is uncontaminated and available for use.

**5) Facility Residue Flushing & Preparation for Decommissioning**

Mill facility decontamination is to be performed prior to demolition activities. Primary activities include flushing of piping, tanks and vessels. In addition, general washing of all interior surfaces of the mill facility is to be performed to control dust and reduce exposure to residual contamination of the workforce.

Other activities include clean-up and disposal of contaminated sludge, solid wastes and water. All unused reagents are to be returned to the appropriate vendors for disposal or re-use. Contaminated reagents will be neutralized and disposed of in Tailings cell A.

Equipment:

1 CAT IT-38
1 Water Truck with cannon (4,000 gal)
1 Skid Steer
1 Fork Lift
1 Scissor Lift
4 Operators
2 Technicians

**6) Tailings Dewatering**

Dewatering of Tailings Cell A involves daily pumping and maintenance of pumps and pipelines. This phase of reclamation is assumed to be completed within one year to attain sufficient solidification of the tailings material. It is assumed that the tailings material has a high content of slimes and possesses a low permeability coefficient. Item 6 is performed concurrently with item 5.

### 7) Re-grade Tailings Material in Cell A

Prior to placement of debris from the mill demolition activity into the cell, preparation of the tailings surface is necessary for ease of operations. This work is to be performed by the use of a CAT D6 dozer. The area to be re-graded is approximately 30 acres.

### 8) Facilities Demolition and Disposal

Line items 8a through 8f cover the demolition of the mill facilities and the subsequent disposal of those facilities in Tailings Cell A. Materials are to be disposed of in Cell A, rather than in Cell C as shown in the Decommissioning Plan (Kleinfelder 2009b), based on the five-year bonding period used in this estimate. Items 8a (Dismantling of Mill) and 8b (Transport, Place and Compact Mill Debris) are considered to be concurrent operations. For costing purposes, these two activities have been separated. Electrical service disconnect is performed by an electrical subcontractor. Mill debris quantities were taken from CH2M Hill (2009).

#### 8a) Dismantling of Facilities

This item involves the physical demolition and dismantling of the mill structures (Areas 100 through 900). Attachment D lists the interior mill equipment items to be disposed.

Equipment:

2 CAT 365 Hydraulic Excavator with thumb
1 CAT 365 Hydraulic Excavator with 10K Hammer or Shear
1 Water truck with cannon (4,000 gallon capacity)
1 Skid Steer Unit
2 Service Trucks
6 Operators
2 Technicians

#### 8b) Disposal of Facilities (In Cell A) – Concurrent with 8a above

This activity is concurrent with item 8a above. Disposal of mill debris in the tailings cell involves dumping of the debris from the trucks with subsequent wheel compaction and backfill in the disposal vault. After the debris is initially compacted, a soil / cement slurry is sluiced into the material to fill voids and decrease further settlement.

The disposal vault is an area where the mill debris is confined, above the tailings material. Mill debris is to be placed in lifts of 5 feet or less. It is estimated that the volume of mill debris and fill will occupy a volume of 100,000 cubic yards. Initial compaction efforts are expected to produce a volume of material containing 10% void space. This void space will then be filled with the soil / cement slurry. The soil / cement slurry will possess 5% cement by weight, resulting in a material strength (UCS) of approximately 100 psi.

Equipment:

2 – 740 D haul trucks
1 CAT D6 dozer with ripper

1 CAT 330 Hydraulic Excavator with thumb
1 CAT 563 C Compactor
1 Concrete Pump Unit
1 Concrete Mobile Mixer
6 Operators

**8c) Disposal of Ore Pad Materials (In Cell A)**

Reclamation of the ore storage pad involves removing all structural fill and concrete associated with the ore pad, but not the underlying soil, which is addressed under item 8e below. This material will be placed above the tailings material but below the radon barrier layer in Tailings Cell A. Table 4 presents the materials to be removed. The equipment fleet is the same as item 8b above. The quantity of materials to be disposed of is 14,520 cubic yards.

**Table 4 Ore Pad Materials to be Disposed**

| Item No. | Item | Unit | Quantity |
|---|---|---|---|
| 1. | Bentomat ST | SF | 261,010 |
| 2. | Roadbase Material | CY | 7,400 |
| 3. | Stormwater Pond- 60 mil HDPE | SF | 28,725 |
| 4. | Retaining Wall | SF | 3,700 |
| 5. | Wall Backfill | CY | 2,740 |
| 6. | Shotcrete Facing w/reinforcing | SF | 3,700 |
| 7. | Concrete | CY | 1,615 |

**8d) Mill Facility Soil Stripping (To Cell A)**

Contaminated soil below the mill facility is to be stripped and placed in Tailings Cell A, either mixed with the mill debris or placed on top of the tailings material, below the radon barrier layer. For costing purposes, excavation to an average depth of 6 inches is assumed. The purpose of this is to remove contamination that may have penetrated into the soils below the facility. Equipment used in this activity includes 2 CAT 740 D Trucks, 1 CAT 365 Excavator, 1 CAT D6 Dozer, 1 CAT 536 C Compactor and 1 CAT 14 motor grader. The quantity of soil to be stripped is 12,227 cubic yards.

**8e) Stripping of Ore Pad and Other Soils (To Cell A)**

Soils beneath the ore pad, as well as other areas identified as contaminated, will be stripped and placed into Tailing Cell A. An average stripping depth of 6 inches is assumed. Much of the “other” soil is the “wind-blown” material identified in item 2 (site characterization study). The equipment fleet used in this task is the same as in item 8d above. The quantity of soils to be stripped is 11,657 cubic yards.

**8f) Evaporation Pond Soil Stripping and Backfilling**

This task is composed of two sub-tasks, removing the evaporation pond materials and contaminated soil, and backfilling of the pond area to approximate original contour (for drainage). Table 5 presents the material to be disposed of in Cell A. Contaminated soils underlying the evaporation pond area are assumed to average 6 inches in depth. The

quantity of material to be disposed of is 85,000 cubic yards. This consists of 41,700 cubic yards of potentially contaminated sub-liner soil and 43,300 cubic yards of evaporation sediments and demolition related construction materials. Evaporation pond sediments were inadvertently not included in the KGL bid; accordingly, Energy Fuels added the cost for this item to KGL's estimate

Equipment used to remove the materials for disposal:

1 CAT 988 Wheel Loader
6 740 D Ejector Trucks
1 Water Truck with cannon (4,000 gal)
1 CAT 14 Motor-Grader
1 CAT 536 C Compactor
2 CAT D8 Dozers
11 Operators

**Table 5 Evaporation Pond Construction Materials to be Disposed**

| Item No. | Item | Unit | Quantity |
|---|---|---|---|
| 1. | GCL | SF | 2,050,840 |
| 2. | HDPE | SF | 2,050,840 |
| 3. | Primary 60 mil HDPE | SF | 2,050,840 |
| 4. | Secondary 60 mil HDPE | SF | 2,050,840 |
| 5. | Double Anchor Trench | SF | 18,000 |
| 6. | Rubsheet | SF | 314,930 |
| 7. | Leak Detection 10" Dia. HDPE | SF | 1,500 |
| 8. | Leak Detection Fill | CY | 2,500 |
| 9. | HDPE Stiffener Sheet | CY | 3,240 |
| 10. | Bird Netting | SF | 2,270,000 |
| 11. | Wood Poles | EA | 195 |
| 12. | Stainless Steel Cable- 7/32" | LF | 106,843 |

Backfilling of the evaporation pond area will be with native soil previously stockpiled from the mill construction phase. The purpose of backfilling is to re-establish proper drainage. Pond residues will be dried and mixed with soil for subsequent disposal in Tailing Cell A. The quantity of backfill soil is 227,541 cubic yards.

Equipment used in this activity:

1 CAT 988 Wheel Loader
6 740 D Ejector Trucks
1 Water Truck with cannon (4,000 gal)
1 CAT 14 Motor-Grader
2 CAT D8 Dozers
11 Operators

**Tailings Cell Closure (Items 9 through 11)**

Reclamation task items 9 through 11 involve the construction of the Tailings Closure Cover. The Tailings Closure Cover was designed by Kleinfelder (2009a). The Tailings Closure Cover layers (items 9 and 11a through j) are shown in Figure 3. Figure 4 shows a larger scale

drawing of the Tailings Closure Cover design and the relationship of the rock blanket to the Tailings Closure Cover.

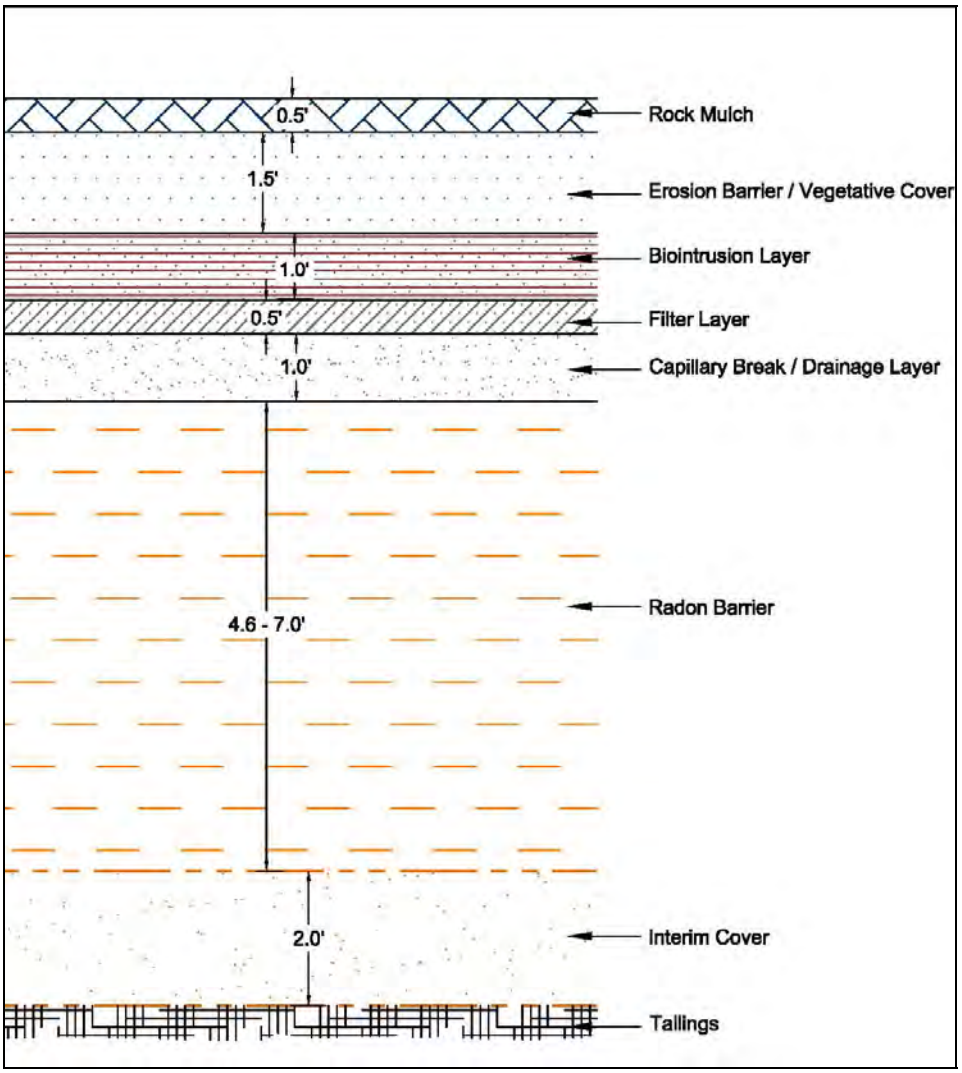



**Figure 3 Tailings Closure Cover Design – Typical (after Kleinfelder, 2009a)**

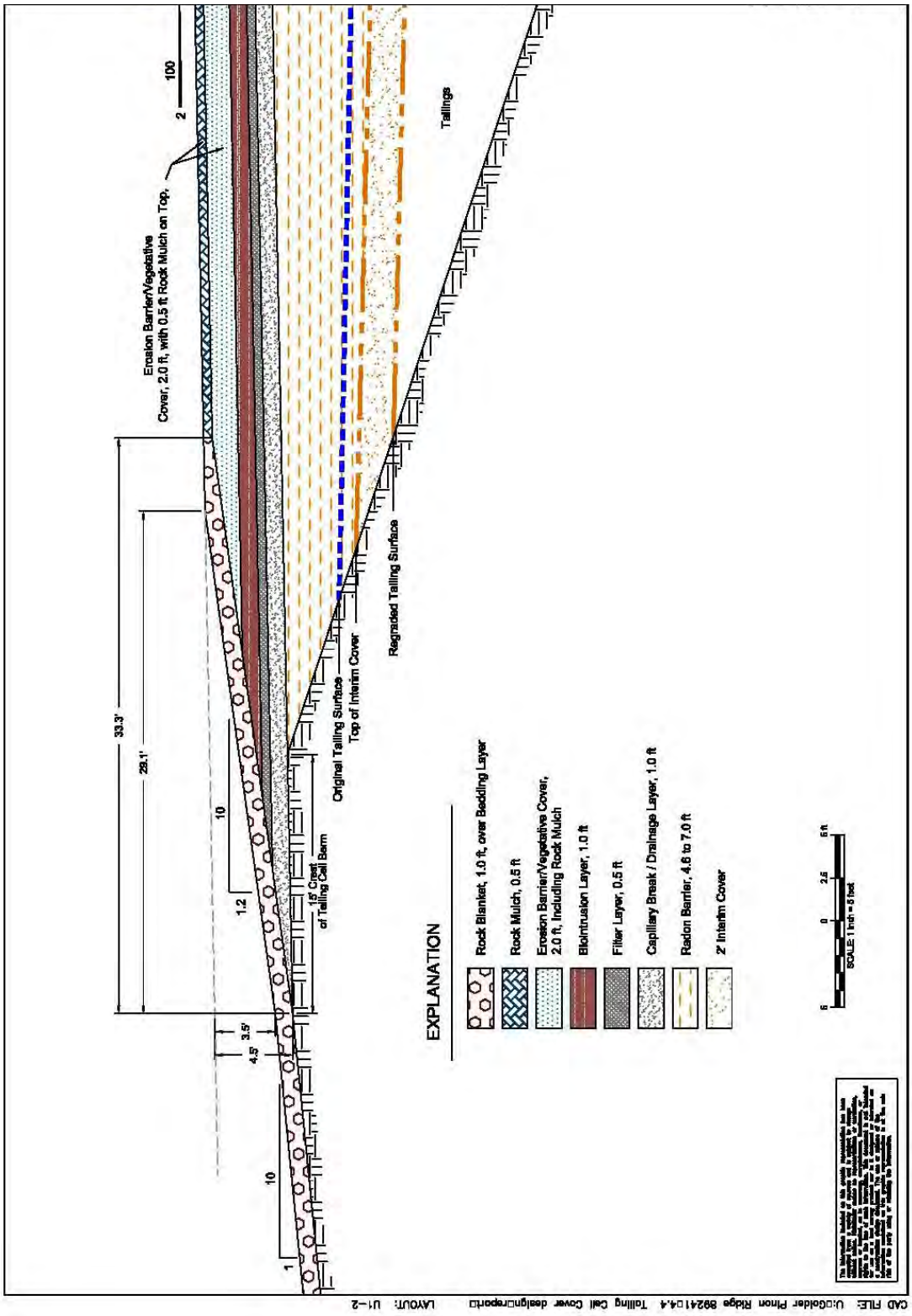



**Figure 4 Tailings Closure Cover Design – Large Scale (after Kleinfelder, 2009a)**

### 9) Construct Interim Fill Cover for Tailings

The interim fill cover is placed on top of the mill debris disposal vault and tailings beyond the limits of the vault. It is a buffer between the vault and the radon barrier layer. The function of the interim fill is to provide immediate protection from windborne release of tailings after cessation of cell operation. This layer consists of the placement of 2.0 feet of uncontaminated native soil, placed in lifts over the re-graded tailings material. This material is to be compacted to a minimum of 85% maximum dry density (Standard Proctor, ASTM D-698). The quantity of fill to be placed is 94,560 cubic yards. Most of the work is to be performed with CAT 631 scrapers along with low ground pressure equipped CAT D6 dozers.

### 10) Grouting of Leak Detection System and Under-drain

After the tailings have undergone dewatering, the dewatering pumps and apparatus are to be removed. The “Leak Detection System” (LDS) and under-drain piping are to be filled with a cement and bentonite grout. The grout is delivered, with on-site labor used to place the grout. The quantity of grout needed to fill these systems is 35 cubic yards. There is a total of 1,740 linear feet of 10 inch diameter drain pipe.

### 11) Construct Tailings Closure Cover

Items 11a through 11j involve construction of the Tailings Closure Cover system. Figures 3 and 4 show the details of the cover construction.

#### 11a) Radon Barrier

This layer provides the primary barrier to the release of radon from the cell. It consists of 4.6 to 7.0 feet of compacted native soil. Design is based on the “RADON” modelling code. It will be placed in 8 inch lifts. Compaction will be 95% of maximum dry density (Standard Proctor) and within 2% of optimum moisture content. The volume of soil fill is 362,640 cubic yards.

Equipment:

- 4 CAT 631 Scrapers
- 1 Water Truck (4,000 gal)
- 1 CAT 14 Motor-Grader
- 1 CAT 536 C Compactor
- 2 CAT D8 Dozers
- 8 Operators

#### 11b) Capillary Break

Provides the primary barrier against the infiltration of water to the cell and provides a lateral pathway for drainage of moisture. The layer consists of 1.0 foot of granular soil (sand and gravel) satisfying a $d_{15}/d_{85}$ filter particle size ratio with the filter layer (below). This material is to be imported from off-site materials. Compaction is to be 50% relative density (115 to 120 pcf). The quantity of granular soil to be placed is 74,368 tons (53,120 cubic yards).

Equipment:

1 Water Truck (4,000 gal)
1 CAT 536 C Compactor
3 CAT 14 Motor-Grader
3 CAT D6 Dozers
7 Operators

**11c) Capillary Break Filter**

This layer prevents downward migration of fine soil particles into the capillary layer. It consists of 0.5 foot of granular soil (sand) meeting the $d_{15}/d_{85}$ particle size ratio with the bio-intrusion layer (below). Compaction is to be 90% of maximum dry density (Standard Proctor). The quantity of filter material (sand) is 37,184 tons (26,560 cubic yards).

Equipment:

1 Water Truck (4,000 gal)
1 CAT 536 C Compactor
3 CAT 14 Motor-Grader
3 CAT D6 Dozers
7 Operators

**11d) Bio Intrusion Layer**

This layer provides a barrier against burrowing animals. It consists of 1.0 foot of native soil mixed with 3" nominal rock (cobbles). Compaction is to be "85% Standard Proctor or approximately 100 pcf dry density" (Kleinfelder, 2009a). The quantity of 3" rock is 14,837 tons. The volume of soil fill is 53,120 cubic yards.

Equipment:

2 CAT 966 Wheel Loader
3 740 D Ejector Trucks
1 Water Truck (4,000 gal)
1 CAT 536 C Compactor
1 CAT 14 Motor-Grader
1 CAT D6 Dozers
8 Operators

**11e) Erosion Barrier Layer**

Along with the rock mulch layer (see below), this soil layer protects against erosion due to wind and water. It consists of 1.5 feet of native soil. Compaction is to be 85% of maximum dry density (Standard Proctor). Soil fill volume is 79,680 cubic yards.

Equipment:

1 CAT 966 Wheel Loader
8 740 D Ejector Trucks
1 Water Truck (4,000 gal)
1 CAT 536 C Compactor
1 CAT 14 Motor-Grader

2 CAT D6 Dozers

13 Operators

### 11f) Erosion Layer Rock Mulch

This 0.5 foot thick topsoil / rock matrix layer consists of topsoil mixed with a $d_{50}$ of 0.5 inch durable rock. The quantity of 3" rock is 39,485 tons and the volume of soil fill is 26,560 cubic yards.

Equipment:

1 Water Truck (4,000 gal)

1 CAT 536 C Compactor

1 CAT 14 Motor Grader

1 CAT D6 Dozers

2 Operators

### 11g) Rock Blanket Cover

This cover layer consists of 1.0 foot of graded durable rock with a $d_{50}$ of 2.5 inches. The quantity of 3" rock is 84,992 tons (27,538 cubic yards). The rock blanket cover layer is to be placed on top of the "rock blanket filter", item 11h listed below.

Equipment:

1 Water Truck (4,000 gal)

1 CAT D6 Dozers

2 Operators

### 11h) Rock Blanket Filter

The filter layer consists of 0.5 foot of sand / gravel bedding meeting a $d_{15}/d_{85}$ particle size ratio with the underlying native soil. The quantity of sand is 19,312 tons. The rock blanket filter layer underlies the "rock blanket cover" layer, item 11g above.

Equipment:

1 CAT D4 Dozer

1 CAT 966 Wheel Loader

2 Operators

### 11i) Drainage Channel Filter

The filter consists of 4" of CDOT Type I bedding material overlying 6" of CDOT Type II bedding material. The quantity of CDOT Type I bedding is 243 tons. The quantity of CDOT Type II bedding is 121 tons.

Equipment:

1 CAT D4 Dozer

1 CAT 966 Wheel Loader

2 Operators

### 11j) Drainage Channel Rip-Rap

The Rip-Rap consists of 3 feet of durable rip-rap material ($d_{50}$ of 18”). The quantity of rip rap is 1,078 tons of rock.

Equipment:

1 CAT 318 Excavator
1 CAT 966 Wheel Loader
2 Operators

## 12) Site Grading

Site grading involves contouring the reclaimed site for drainage. Areas to be graded include the mill and ore pad locations, roads within the licensed boundary area and general areas such as the soil stockpile area and mill support structures. Equipment utilized in this activity consists of a CAT 14 motor-grader and water truck.

The following areas are to be graded:
12a Mill and Ore Pad, 58 acres
12b Roads, 1 acre
12c General Site, 3 acres

## 13) Topsoil Placement

All disturbed areas will be prepared for seeding and vegetation by placement of 6” of topsoil (or other suitable growth media). The primary areas to receive topsoil are the mill facility, the ore pad area and the evaporation pond area. Topsoil for Tailings Cell A was previously included in Item 11f above (i.e., erosion layer rock mulch). Topsoil will be supplied from exiting on-site stockpiles. During mill construction, all topsoil is to be placed in a stockpile to the west of the tailings ponds (Figure 1). KGL’s estimate inadvertently included topsoil for Tailings Cell A under this category. Energy Fuels subtracted this item from KGL’s bid since it is included with the rock mulch above.

Topsoil is to be placed on all remaining areas (61,820 CY)

Equipment used in this activity:

1 CAT 966 Wheel Loader
3 740 D Ejector Trucks
1 Water Truck (4,000 gal)
1 CAT 14 Motor-Grader
2 CAT D6 Dozers
8 Operators

## 14) Seeding and Re-vegetation

After placement of topsoil, the site will be seeded by a subcontractor using hydro-seeding application methods.

The following areas are to be seeded and re-vegetated:
14a Tailings, 34 acres
14b All Other Areas, 71 acres

### 15) Construction Contractor Support Personnel

Contractor support consists of a supervisor, assistant supervisor and an administrator. Sub-contracted work under the direction of the construction contractor will include project surveying, geotechnical testing and geotechnical analysis. Offices will be set up in the existing on-site office structure, which is located outside of the licensed boundary area and assumed to be free of mill related contamination.

### 16) Performance Bond

A performance bond of 1.0% is provided for in this line item. This line item is found in Table 1 and also in Attachments G and H.

### 17) Post-Closure Monitoring and Maintenance

After completion of reclamation, the site will continue to be monitored until revegetation is deemed to be successful. For bonding purposes, this period of time is assumed to be for a three year period. Costs for this line item include labor, site repair, and sample analysis (Attachment G). Labor consists of one man, full time, for three years. Sampling includes groundwater, surface water, air and radon. Site repair consists of the use of a CAT D4 dozer for 3 days each year to address erosion, and for re-seeding (approximately 0.5 acres per year).

### 18) Decommissioning of Monitoring Systems

Once the monitoring period has been completed and the site has been accepted for long-term care by the DOE, the groundwater monitoring wells will be properly abandoned and the air monitoring systems will be removed. Decommissioning of the monitoring systems involves abandoning subsurface water monitoring wells and demolishing the air monitoring stations. Site reclamation includes topsoil placement and seeding. There are sixteen subsurface water monitoring wells (9 existing, 7 proposed) totalling 3,660 linear feet. Using a cost of $15.00 per foot, abandonment of the wells will cost $ 54,900. The cost per foot is based on a recent bid for abandoning observation wells. The following list shows the tasks involved. Abandonment requires well closure by a licensed water well driller.

Tasks involved in the abandonment of the monitoring wells:

a) Hire licensed water well driller
b) Pull casing
c) Removal of well piping
d) Tremmie placement of bentonite grout
e) Placement of concrete plug
f) Top-soil placement and seeding well sites.

Reclamation of the air monitoring stations involves removal and disposal of two tower units, two “Conex” mounted stations and three platform mounted stations. Costs include demolition of the structures and disposal. Demolition costs ($0.10 / CF) are based on the 2009 RS Means estimate line “17-02-0126”. Disposal costs ($ 3.71 / CY) are also based on the 2009 RS Means Estimator – “Trucking to an Offsite Facility”. Tower 1 has dimensions of 100 by 6

by 6 feet. Tower 2 has dimensions of 30 by 6 by 6 feet. Each of the three platforms has dimensions of 12 by 6 by 10 feet. The two Conex boxes have dimensions of 8 by 9 by 25 feet. Because these items are to be disposed of offsite, no effort is made to compact the material other than to cut the towers and platforms into manageable pieces (20 foot lengths).

**19) DOE Long Term Care**

This item is added as a lump-sum, to cover the costs of long-term site monitoring. The value to be used is $ 250,000 in 1978 dollars (R.H. 3.9.5.10.4). Using the inflation calculator provided by the U.S. Department of Labor, this lump sum value is $ 827,584 in 2009 dollars.

**20) State Administration Fee**

A state administration fee for project oversight is required. The State of Colorado charges an administrative fee of 1% of the total contract amount. One state employee will oversee the project with approximately 20% of their yearly time dedicated to this function. Annual salary is assumed to be $112,000. Travel costs are included at 10 percent of salary. Additionally, the state adds 26% of this cost for department overhead and 20% for state indirect overhead. The cost is as follows:

| **Annual Cost** | | |
|---|---|---|
| Labor | $ | 22,400 |
| Travel | $ | 2,240 |
| Subtotal | $ | 24,640 |
| Dept Overhead | $ | 6,406 |
| CDPHE Indirect | $ | 4,928 |
| Total | $ | 35,974 |
| | | |
| 2.71 Years Labor: | $ | 97,490 |
| 1% Contract Admin. | $ | 117,370 |
| Total: | $ | 214,860 |

## 4.0 REFERENCES

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Kleinfelder, 2009b, Mill Decommissioning Plan, Energy Fuels Resource Corporation, Uranium Mill Licensing Support, Piñon Ridge Mill, Montrose County, Colorado: prepared for Energy Fuels Resources Corporation, October, 2009.