2 November 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: RESPONSES TO SPECIFIC COMMENTS INCLUDED IN CDPHE RFI #4**
**PIÑON RIDGE PROJECT, MONTROSE COUNTY, COLORADO**

Dear Bob:

Golder Associates Inc. (Golder) has prepared this letter to provide responses to comments from the Colorado Department of Public Health and Environment (CDPHE) in the Request for Information (RFI) #4 as provided in the letter from Steve Tarlton dated 21 September 2010. This letter addresses specific comments included as Attachment 1 to RFI #4 prepared by Mr. Clay Trumpolt, and the comment from Mr. Larry Bruskin included as Attachment 2 to RFI #4.

## 1.0 RESPONSES TO COMMENTS – RFI #4 (ATTACHMENT 1)

The comments contained in Attachment 1 to RFI #4 pertain to the letter titled "Tailings and evaporation pond delivery and return piping conceptual plan, Piñon Ridge Project, Montrose County, Colorado" prepared by Golder, dated 6 August 2010. The comments for which Golder was requested to prepare a response are duplicated, with the response following.

### Comment No. 2

*There is insufficient detail in the figures. Please provide a plan view of the two tailings cells showing the relationship of the tailings slurry delivery pipe, the supernatant tailings water return pipeline, and the raffinate water delivery piping systems. Please label the systems. Include information on the location and number of spigots, all valve locations and types, and other pertinent information.*

### Response to Comment No. 2

Figure 4 has been developed to illustrate the initial delivery and return piping plan for Tailings Cell A (as current), with Tailings Cell B (in the future). This figure, as well as the others included with the Golder (2010a) letter, is included in Attachment A. The figure illustrates the concept for the following components:

- Tailings delivery line from the mill (4-inch diameter solid HDPE pipeline);
- Tailings distribution lines around the perimeter of the cell (3-inch diameter solid HDPE pipeline);
- Supernatant tailings water return piping from the tailings cell back to the mill (6-inch diameter solid HDPE pipeline);
- Approximate location of spigots (2-inch diameter spigot, with perforated HDPE pipe extending into cell), based on the tailings deposition modeling presented in the Tailings Cell Design Report (Golder, 2008); and
- Currently proposed valve locations for major pipe junctions.


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The supernatant tailings water return piping will collect water from both the tailings underdrain system (above the liner), as well as from the tailings decant pool developed above the tailings surface.

At present, the design of the tailings delivery and return piping is concept-level, to be developed to construction-level detail during the detailed design phase of the project.

## Comment No. 3

*Please provide information in the form of a plan view of the evaporation ponds showing the location of the two piping lines. Provide the same level of detail as per comment 2 above.*

## Response No. 3

Figure 5 has been developed to illustrate the delivery and return piping plan for the Evaporation Ponds, with Phase 1 of the ponds shown as current, and Phase 2 shown as future. This figure is included in Attachment A to this letter. This plan view shows the following:

- Raffinate water delivery piping extending from the process circuit (4-inch diameter solid HDPE pipeline);
- Raffinate water return piping extending from the ponds to the tailings cell for recycling to the return water tank or for dust suppression (4-inch diameter solid HDPE pipeline); and
- Approximate location of mister system piping.

The raffinate water delivery piping will be used both as a feed line to the ponds and a feed line to the mister system. The raffinate water will be allowed to overtop weirs constructed between the cells thereby distributing water through the system. Also, the use of submersible pumps is anticipated to distribute the total raffinate volume equally among the available cells and provide alternative feed for the mister system for improved evaporation.

At present, the design of the tailings delivery and return piping is concept-level, to be developed to construction-level detail during the detailed design phase of the project.

## Comment No. 5

*Please provide a short narrative of how the spigots would be operated for the first tailings cell under normal operating conditions.*

## Response No. 5

The following excerpts have been extracted from Golder (2008) which presents a general summary of how tailings deposition is anticipated for the first tailings cell under normal operating conditions:

> "At start-up of tailings deposition within each tailings cell (or sub-cell), the operations plan should provide for deposition to commence in the vicinity of the underdrain sump. The purpose of initiating deposition in this manner is to provide coarse-grained underflow material over the underdrain sump system, in contact with the underdrain filter materials… the underdrain filter materials were designed for filter compatibility with each other and with the anticipated tailings steam; however, additional protection to the underdrain sump system would be provided by initial placement of the coarse-grained tailings materials over the system preventing clogging due to fine-grained tailings slimes. After initial placement of coarse-grained tailings in this area, then deposition would proceed to maintain the tailings pool area(s) over the underdrain sump(s).
>
> When the tailings cell is constructed with two internal cells, as is the case with Tailings Cell A…, tailings should be placed within each of the sub-cells immediately after commencement of deposition in order to provide additional buttressing of the liner system. It is recommended to cover the floor of each of the sub-cells with tailings prior to discharging to a single sub-cell.

Operations personnel may opt to discharge to both sub-cells simultaneously, which is considered appropriate, pending that initial deposition proceed as discussed."

Tailings deposition within Tailings Cell A, generally as discussed in Golder (2008), assumes the following five simplified phases:

- Phase 1 – Deposition commences within sub-cell A1 (or A2) in the vicinity of the underdrain sump to provide approximately 10 feet of tailings deposition over the sump area. This phase of deposition is illustrated conceptually in Figure 1, showing four (4) spigot points. This phase of deposition provides coarse-grained underflow tailings over the underdrain sump to enhance the long-term effectiveness of the tailings underdrain system;

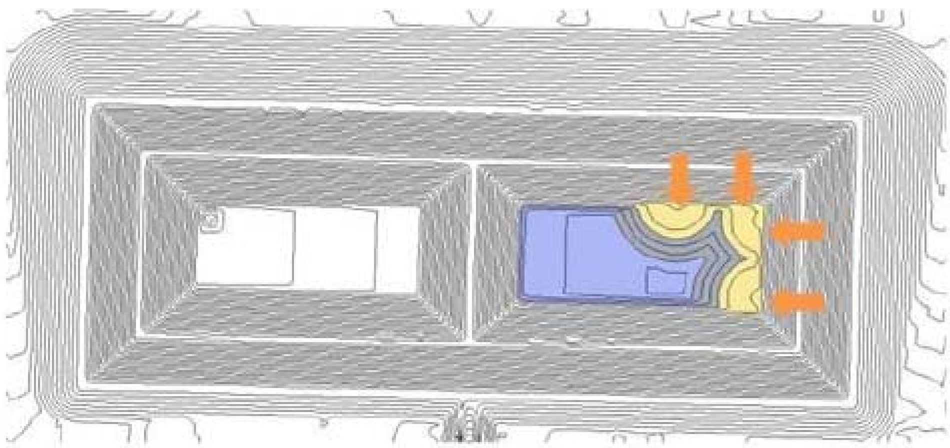

**Figure 1: Phase 1 tailings deposition.**

- Phase 2 – Commence deposition within the other sub-cell in the vicinity of the underdrain sump (as per Figure 1), again providing approximately 10 feet of coarse-grained underflow tailings over the underdrain sump area;
- Phase 3 – Continued deposition within the remainder of the first sub-cell, maintaining the pool in the underdrain sump area, until full. This phase is illustrated in Figure 2;

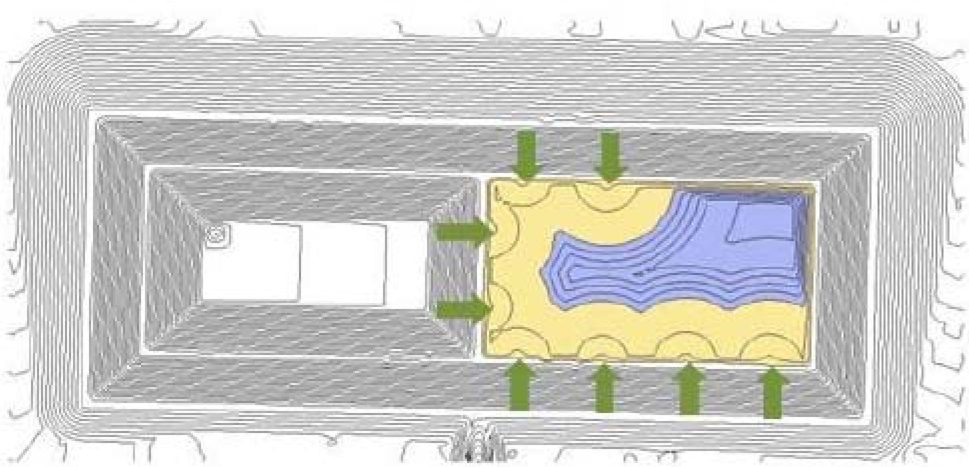

**Figure 2: Phase 3 tailings deposition.**

- Phase 4 – Continued deposition within the remainder of the second sub-cell, as per Phase 3 above (refer to Figure 3); and

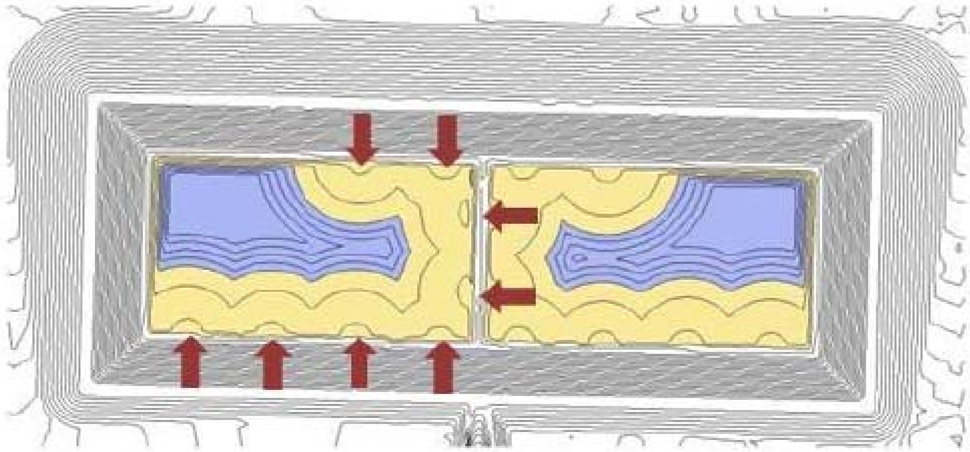

**Figure 3: Phase 4 tailings deposition.**

- Phase 5 – Once both sub-cells are filled, tailings deposition will proceed along the perimeter of the entire tailings cell in stages (i.e., discharge from 3 or more consecutive spigots at a time, rotating around the cell), until the tailings cell is full (refer to Figure 4).

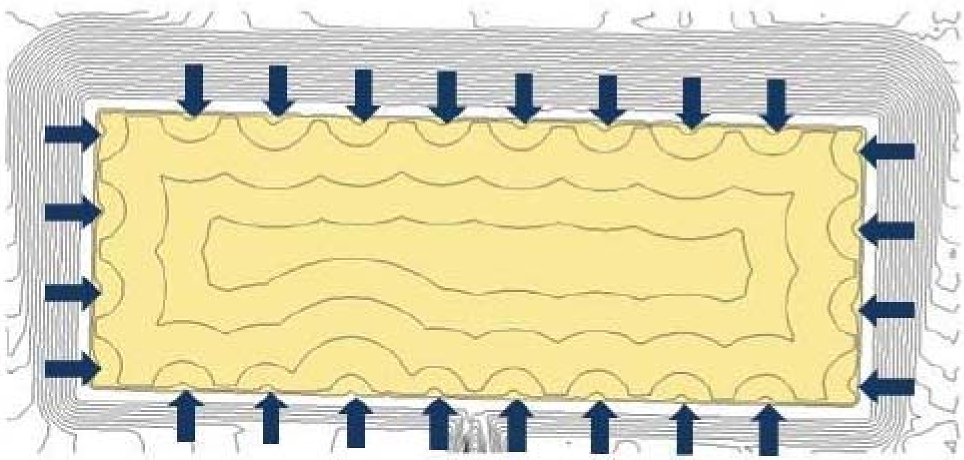

**Figure 4: Phase 5 tailings deposition.**

The perimeter discharge of Phase 5 would leave a depression in the center of the cell resulting from the tailings beach slopes and perimeter discharge arrangement. Although not modeled, a sixth and final phase of deposition would involve extending the tailings discharge pipes to the center of the cell to more efficiently use the available tailings storage space, and develop grades that support closure cover construction.

Detailed design of the tailings delivery system will be performed during the detailed design phase of the project. The Operations Plan for the tailings cells will also be further refined to provide specific instructions to the operators.

## Comment No. 9

*What method will be employed to connect the HDPE pipe sections?*

### Response No. 9

High-density polyethylene (HDPE) pipe sections will be connected using butt-heat-fusion welding in accordance with Manufacturer's guidelines. Section 02710.0 of the Technical Specifications addresses installation of HDPE pipelines, including pressure testing of pressurized pipelines.

### Comment No. 12

*When lining the trenches with HDPE, the number of seams should be minimized by running the long dimension of the roll down the length of the trench. How will the HDPE liner in the lined trench be fitted to the rectangular trench?*

### Response No. 12

The standard roll width for geomembrane is 22.5 feet. Based on the dimensions provided in Detail 3 on Figure 3 (contained in Attachment A), the lined pipe trench would result in a geomembrane width of approximately 20 feet (in section). Though running the geomembrane the long dimension of the roll down the length of the trench would limit the number of seams, it may also result in a significant amount of geomembrane wastage. As part of the submittal process prior to construction, the installer will provide a geomembrane deployment plan. The plan may include modified dimensions of the anchor trenches or channel cross-section to accommodate the full roll width without cutting, or it may include installation of the geomembrane perpendicular to the trench.

Detail 3 on Figure 3 has been revised from a vertical excavation to include side slopes at 2.5H:1V (horizontal:vertical), as long-term stability of the vertical cut into the native subgrade may be a concern.

### Comment No. 13

*Will thrust blocks be required at tee junctions for the HDPE pipelines?*

### Response No. 13

It is possible that thrust blocks will be required at pipe elbows or other pipe junctions. This level of detail will be evaluated during detailed design of the piping system.

### Comment No. 14

*Please provide typical detail of HDPE pipeline 90-degree bends and tee junctions showing HDPE joints.*

### Response No. 14

Detail 4 on Figure 3 (included in Attachment A) shows a schematic of the tailings pipe junction from the mill to Tailings Cell A. This detail shows pipe elbows and other fittings, as needed, in this location.

At present, the design of the tailings delivery and return piping is concept-level, to be developed to construction-level detail during the detailed design phase of the project.

## 2.0 RESPONSES TO COMMENTS – RFI #4 (ATTACHMENT 2)

Attachment 2 to RFI #4 contains one comment relating to liquefaction analyses, as follows:

### Comment

*Consistent with Section 2.4 of NUREG-1620, Revision 2, the liquefaction potential of the subsurface, tailings pile, and embankment materials must be evaluated. Although Appendix E of the Phase 2 Geotechnical Investigation (Volume 4) evaluates liquefaction with respect to the overburden soils, the subsurface material and actual tailings materials were not discussed. The evaluation should consider operational conditions (e.g., saturated tailings) as well as post-closure conditions. NUREG-1620 suggests that the evaluation be based on results from laboratory and/or field tests, with interpretation of* *the test data consistent with current practice. If global liquefaction is identified, mitigation measures or redesign of potentially impacted structures should be proposed in order to provide reasonable assurance that the liquefaction potential has been eliminated or mitigated. If minor or local liquefaction is identified, the license applicant should ensure that its effect is accounted for in the analysis of both differential and total settlement, and is shown not to compromise the performance of the final cover components. Please provide an updated evaluation of the items discussed herein.*

### Response

Considering deep groundwater conditions and the proposed construction practices, i.e. compaction of subsurface materials, the only component of the Tailings Cells potentially susceptible to liquefaction is the tailings material itself. The tailings are deposited hydraulically via spigots and will naturally consolidate as the additional tailings are deposited on top. In addition, a significant portion of the tailings may be submerged throughout the deposition process resulting in a relatively loose soil structure prone to compression (volume reduction) during shearing. Consequently, the generated excess pore pressures may become equal to or larger than the vertical effective stress resulting in a loss of stability, i.e. the tailings materials may liquefy.

To conservatively evaluate seismic stability and liquefaction potential of the Tailings Cells, the shear resistance of the tailings materials was set to 10 percent of the effective vertical stress in the appended stability (Attachment B) and liquefaction analyses (Attachment C). The cyclic stress resulting from the design strong motion event (Kleinfelder, 2008) was calculated based on current industry practice (Youd et al., 2001) as outlined in Attachment C. For conservatism, liquefaction analyses were conducted under the following assumptions:

- Phreatic surface is at the top of the tailings surface. Consequently, no strength increase due to soil suction or desiccation of tailings was considered.
- The thickness of the tailings closure cover was set to 12.7 feet, even for the deepest sections of the impoundment.
- Excess pore pressures were assumed to fully develop during the seismic event, i.e. no magnitude scaling was considered for the relatively small design earthquake magnitude of $M_w$=4.8.

The attached analyses (see Attachment C) indicate that localized liquefaction of the tailings materials may occur during operation of the Tailings Cell; however, liquefaction is not likely to occur after placement of the closure cover. In the unlikely event of tailings liquefaction after closure cover construction, seismic-induced settlements of approximately 26 inches may result in a cover slope reduction of 1.0 percent. Noting that the consolidation settlement may result in a cover slope reduction of approximately 0.6 percent (Golder, 2010), the overall cover grades will remain positive even if the tailings were to liquefy.

## 3.0 OTHER COMMENTS

In addition to addressing liquefaction of the tailings materials, follow up discussions between Mr. Larry Bruskin and Mr. Frank Filas of EFRC indicated that CDPHE requested additional information on the stability of the re-designed closure cover, as well as the potential for cover damage due to tailings settlement.

The redesigned closure cover stability is evaluated in Attachment B indicating relatively high factors of safety under both static and seismic conditions. Minimum factors of safety of 4.7 and 1.4 were calculated for static and seismic (pseudo-static) conditions, respectively, as compared to the design safety factors of 1.5 for static conditions and 1.1 for seismic conditions.

The potential for cover damage due to tailings settlement was evaluated by Golder (2010b), indicating relatively small deformations which are not likely to significantly influence the overall cover performance.

In this evaluation, a maximum slope reduction of approximately 0.6 percent was estimated due to tailings settlement.

## 4.0 CLOSING

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.

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 – Tailings Cell and Evaporation Pond Delivery and Return Piping Concept Figures
B – Tailings Cell Stability Analyses
C – Tailings Cell Liquefaction Analyses

GG/KFM/rjg

## 5.0 REFERENCES

Golder Associates Inc. (Golder). 2008. "*Tailings Cell Design Report, Piñon Ridge Project, Montrose County, Colorado*," Prepared for Energy Fuels Resources Corporation. October 2008.

Golder Associates Inc. (Golder). 2010a. "*Tailings and evaporation pond delivery and return piping conceptual plan, Piñon Ridge Project, Montrose County, Colorado*," Letter to Mr. Robert R. Monok. 6 August 2010.

Golder Associates Inc. (Golder). 2010b. "*Tailings Cell Foundation and Closure Cover System Settlement Analysis Addendum - Piñon Ridge Project, Montrose County, Colorado*" – letter prepared for Energy Fuels Resources Corporation, Golder project No. 073-81694.022.1, April 9, 2010.

Kleinfelder, Inc. (Kleinfelder). 2008. "*Design Ground Motions at Piñon Uranium Mill, Colorado*." Memorandum to Golder, 14 January 2008.

Youd, T.L., I.M. Idriss, R.D. Andrus, I. Arango, G. Castro, J.T. Christian, R. Dobry, W.D. Liam Finn, L. F. Harder Jr., M.E. Hynes, K. Ishihara, J. P. Koester, S. S. C. Liao, W. F. Marcuson III, G. R. Martin, J. K. Mitchell, Y. Moriwaki, M. S. Power, P.K. Robertson, R. B. Seed, K. H. Stokoe II. 2001. "*Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils"*, *J. Geotechnical and Geoenvironmental Engineering,* Vol. 127, No. 10, ASCE.

## ATTACHMENT A

## TAILINGS CELL AND EVAPORATION POND DELIVERY AND RETURN PIPING CONCEPT FIGURES