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DIV. OF OIL, GAS & MINING

August 25, 2005

Coal Regulatory Program
 Attn.: Mary Ann Wright, Associate Director of Mining
 Division of Oil, Gas and Mining
 1594 West North Temple, Suite 1210
 Box 145801
 Salt Lake City, Utah 84114-5801

RE: Review of Recently Submitted PacifiCorp Draft Reports, Canyon Fuel Company,
 Skyline Mine, C/007/005

*Incoming
 C/007/0005
 Copy to Kaylett,
 Dana, Susan, Mark,
 Pam, [unclear]
 Jim*

Dear Ms. Wright:

Canyon Fuel Company, LLC., Skyline Mines (CFC) and its consultants have recently reviewed the two draft reports prepared by PacifiCorp's consultants concerning Electric Lake and issues related to its alleged water loss. These two draft reports were delivered by PacifiCorp to Mr. Michael R. Styler, Executive Director of the Utah Department of Natural Resources, in July of this year. One draft report, "Preliminary Draft Summary of Results from Groundwater Tracing Investigations at Electric Lake, Utah, June 22, 2005" was prepared by Tom Aley and the other, "Analysis of Groundwater Flow from Electric Lake towards the Skyline Mine, May 2005", was prepared by Dr. Kip Solomon. CFC believes a response is necessary due to the numerous allegations put forth in these two draft reports and the sensitive nature of this issue. PacifiCorp continues to promote, both publicly and privately, its theory the majority of the water entering the Skyline Mine is from Electric Lake, disregarding all other possible causes responsible for the lake losses. The draft reports contain numerous inaccurate assumptions and conclusions based upon these inaccuracies. In this letter we have chosen to identify only a few of these inaccuracies and invalid conclusions. If PacifiCorp persists in pursuing its theory and ultimately produces final reports, we would appreciate the opportunity to make more formal submittals.

Draft Reports

CFC and its consultants have a great deal of concern responding to the concepts and claims put forth under the label of "draft" or "preliminary draft" reports. It is difficult to determine if the authors of the reports are certain of the validity of the results presented in "draft" reports or are just presenting ideas they are considering. If these are just some of their tentative ideas, how can PacifiCorp expect the Division to make any type of determination based on "draft" reports? These "draft" reports appear to be part of

another attempt by PacifiCorp and its consultants to assert that the alleged loss of Electric Lake Water is tied directly to the Skyline Mine while ignoring all other potential possibilities that might explain the situation.

Aley Report

The report, "Preliminary Draft Summary of Results from Groundwater Tracing Investigations at Electric Lake, Utah, June 22, 2005", prepared by Mr. Tom Aley of Ozark Underground Laboratory, Inc. contains interesting preliminary draft assumptions and conclusions. However, we have several questions regarding the validity of this work.

Dye Results

The preliminary draft Aley report indicates the acceptable emission wavelength for fluorescein in elutant (i.e., dye stripped from the activated charcoal sampler) is 513.6 to 517.9 nm, and for eosine elutant is 535.2 to 541.8 nm. However, in Appendix A, *Procedures and Criteria, Analysis of Fluorescein, Eosine, Rhodamine WT, Sulfurhodamine B, and Pyranine Dyes in Water and Charcoal Samplers*, Table 3 of his report, the normal acceptable emission wavelength range for fluorescein in elutant is listed as 514.0 nm to 518.1 nm. (We have assumed Aley used the RF-5301 spectrophotofluorophotometer for his analyses presented in this report. This is the machine he used to analyze CFC blind samples.) The peak wavelength of 8 of the 12 samples identified as dye detections in Table 1 of the preliminary draft Aley report are less than the 514.0 nm minimum fluorescein dye wavelength as identified in Appendix A. Additionally, the centers of the fluorescein peak of the remainder of the reported fluorescein dye detections are at the bottom end of Aley's reported acceptable wavelength range. Has the acceptable dye detections range been modified to allow most of the samples to be classified as detections? CFC blind samples analyzed by both Aley and an independent laboratory for Electric Lake Dam outlet water have wavelengths well within the acceptable emission wavelength for fluorescein dye.

The preliminary draft Aley report indicates that both fluorescein and eosine were detected in JC-1 well water samples collected in mid June 2003, (p. 3). However, blind samples obtained by CFC and analyzed by Aley for the same sampling period were reported as non-detections for either dye.

It is interesting to note that on page 12 of the *Groundwater Tracing Handbook* provided to clients of Aley's Ozark Underground Laboratory (2002), it indicates that "In some coal mine settings (particularly those with high sulfur coals) there is sometimes appreciable natural fluorescence in or near the acceptable emission wavelength range of fluorescein dye."

Aley reports arrival times for dye from two separate dye injections studies performed at Electric Lake, the second study following the first by 329 days. The calculated arrival time for dye (fluorescein) in the first study was 65 days; in the second study the arrival

time was 318 days. Mr. Aley states that a difference in gradient could account for the different arrival times. However, the gradient between the lake and JC-1 was about 0.044 for the first test, and varied only slightly during the second test but averaged about 0.040. Consequently, the gradient can be used to explain a difference of only about 10 percent in arrival time, but not a difference of 500 percent, as was measured.

We are also concerned with Mr. Aley's assertion (laid out at length in his description of the "bench test") that movement of the dye is retarded by chemical reaction with the rock substrate. If that is the case, then the arrival time for the second test should have been shorter than for the first. Dye molecules from the first injection would have occupied adsorption sites along the fractures, allowing dye from the second injection to travel with decreased retardation.

Bench Test

The bench test performed by Mr. Aley has at its foundation the assumption that surface waters migrate through and come in extended contact with freshly broken or pulverized rock material. Intervening between the alleged fracture recharge areas in Electric Lake and the nearest Skyline Mine workings is more than a mile of unsubsidized rock strata. Mining-induced fracturing or pulverizing of rock in this interval has not been observed, nor is there any reasonably plausible mechanism whereby mining-related activities over a mile distant could have created such damage.

Unlike the freshly broken and pulverized rocks utilized in Mr. Aley's bench test, the rock surfaces exposed along the natural faults and fracture systems near Electric Lake likely have a much lower adsorption potential. When rocks are fractured and pulverized, fresh, unweathered rock surfaces are created which likely have appreciably more adsorption potential than do the ancient rock surfaces along fractures of tectonic origin that have existed for thousands or millions of years.

Aley attempts to explain the very low reported dye concentrations in the charcoal samples with the results of the bench scale test he performed on dye and crushed rock. In the hard rock mining and environmental industry, where bench scale testing of adsorption and desorption has a long history, the results and meaning of such testing is questionable. A critical problem is scaling from the bench test to the field scale. The preliminary draft Aley report makes the unwarranted assumption the scaling issue is not a problem and the results of a single, poorly documented bench test represent field scale conditions near JC-1 and Electric Lake. With regard to Aley's bench test, he fails to describe the results of monolithic vs. mixed rock types, the effects of various initial dye concentrations, the effects of dye and rock water ratios, adsorption and desorption interactions between dyes, the effects of solute chemistry of the water used to mix the dye, the effects of initial rock water content, the effects of time and flushing volumes, etc. Aley also fails to cite peer-reviewed literature on the topic of dye adsorption and desorption. Thus, while we find this experiment interesting, it is not a compelling argument for appreciable dye loss by rock-water interaction.

Solomon Report

Dr. Kip Solomon addresses several issues, including ground water flow rates and tritium concentrations, in his report stamped as "Draft" and titled "Analysis of Groundwater Flow from Electric Lake towards the Skyline Mine, May 2005". As with the Aley report, we have significant questions regarding Solomon's assumptions and conclusions.

Solomon's Model

In Solomon's draft report, he suggests that Electric Lake is losing 5,000 gpm (a PacifiCorp employee recently stated publicly the lake was losing 13 cfs or about 6,000 gpm) through fractures in the lake bottom, and that all of that water is flowing into the pumping well, JC-1. (It is important to note that all Dr. Solomon's arguments are based on the tritium concentrations in JC-1. He casually states that the well water is representative of the water flowing into the mine, but a glance at the tritium concentrations in his Figure 1 shows that it certainly is not.) In Dr. Solomon's conceptual model "old" water is also currently entering the pumping well, and is the source of relatively low tritium concentrations in the mixture. According to Solomon's model, however, the old water originates only in the walls of fractures connected to a surface source; old molecules in the pores of the wallrocks are kicked out into an advecting stream by young water molecules diffusing into the rock. Dr. Solomon finds "not viable" an "Alternative Model" wherein old water entering the mine represents storage depletion in thick, regionally extensive sandstones which are also connected to the mine by a network of fractures.

Dr. Solomon finds the Alternative Model not viable based on the results of CRAFLUSH modeling. His model results show tritium concentrations (in JC-1) increasing in time toward a maximum equal to a surface water value that will be attained in about 10 years. However, the model results that appear to dispute the Alternative Model are entirely dependent on input parameters for which there are no measurements, and in some cases, not even good guesses. For instance, Dr. Solomon assumes that fractures are 0.8 mm-wide and are spaced 1.0 meters apart. But as good or better fits to the measured data can be obtained by instead assuming:

(a) a slightly smaller spacing (0.3 m) and slightly wider fracture aperture (1.3 mm wide), and all other input the same,

or by simply assuming

(b) fractures spaced 0.17 m apart, and all other input data the same.

Figure 1, prepared by CFC's consultants and attached to this letter, illustrates the results of CRAFLUSH scenarios (a) and (b) compared to Solomon's results. The RMS (root mean square residual error) for the two scenarios are 0.314 and 0.246, compared to 0.307 for Solomon's results. The results for scenarios (a) and (b) show the discharge

tritium concentration approached its maximum level after only 3 to 4 years. The maximum level in Figure 1, however, is maintained at only a fraction of the surface value (3 TU rather than 10 TU) because it is being diluted by old water at a rate of two to one from a source other than surface-connected fractures (i.e., from storage in the regional sandstones). These results fully support the Alternative Model.

Storage depletion in the regional sandstones is very well documented by the drawdown that has been measured in monitoring wells throughout the area since the mine inflows began. Water levels in wells screened in the upper sandstones underlying the coal seam mined at Skyline have declined by as much as 300 feet, while water levels in monitoring wells more than two miles away have declined by as much as 90 feet. The entire drawdown cone represents an enormous contribution of water from storage that is completely ignored in Dr. Solomon's conceptual model.

Dr. Solomon refers to a starting date of 1999 for both significant flow on the fractures and large-scale water losses from Electric Lake. In addition to the fact that Electric Lake water balances were not kept before, during, or after 1999, it is important to remember that mine inflows in 1999 occurred only along the 14-Left and 16-Left Faults. The traces of those faults do not cross under Electric Lake, but remain 3,000 ft and 5,000 ft, respectively, north from the northern high-water limit of the lake. Those two inflows together discharged 3,000 gpm initially, and still discharge together about 600 gpm after 6 years. Those facts do not support Dr. Solomon's draft conclusion.

Dr. Solomon also infers that the fractures themselves are mining induced. The fractures that are at the heart of the dye and tritium studies, the Diagonal and Connelville Faults, were not induced by mining, but are regional structures that were mapped before any mining had taken place in the Skyline Mine area. Where they cross under Electric Lake, they are nearly a mile and a half from the nearest corner of the mine. Additionally, fracturing of the overlying strata related to longwall mining at the Skyline Mine is restricted to an area defined by the angle-of-draw of subsidence. The angle-of-draw at the Skyline Mine is typically between 15 and 22 degrees from vertical. If the strata above the coal seam mined is 700 feet thick and the angle-of-draw is assumed to be 22 degrees, then the area of subsidence extends approximately 283 feet horizontally beyond the edges of the longwall panels. Mining-induced subsidence has not taken place within the area delineated by the highwater limit of Electric Lake.

Solomon's Fluid Flow Rates

On page 8 of his report, Dr. Solomon uses the cubic law to calculate the total length of fractures that would have to be exposed beneath Electric Lake to allow PacifiCorp's entire alleged misplaced flow (5,000 gpm) to flow down the Diagonal Fault to JC-1. He assumes two aperture widths, but favors the smaller aperture (0.25 mm), and with it calculates a requirement of 365 fractures, each 0.25 mm wide and 200 m long (the width of the lake). We think that this number is unreasonably high, especially given that each fracture would have to be spaced one meter from its neighbor in order to match Dr. Solomon's model results.

Furthermore, Dr. Solomon errs in his calculation of gradient between the lake and the pumping well. He uses a ratio of 305/700, which is the approximate water table height above well screen divided by the approximate depth to the well screen in the vicinity of JC-1. However, the cubic law requires input of the hydraulic gradient between the point of inflow on the fracture and the point of outflow. In this case, Electric Lake is the alleged inflow point, and it is located about 7,000 ft from JC-1 along the strike of the Diagonal Fault. Consequently, the gradient that should be used in the cubic law calculation is 0.043 rather than 0.44, and the number of fractures that would be required is 3,700 rather than 365.

Dr. Solomon asserts that water from Electric Lake migrates through hundreds of closely-spaced, small-aperture fractures toward the Skyline Mine. However, this condition is not consistent with the observed Star Point Sandstone groundwater discharge mechanisms in the Skyline Mine. If groundwater were moving rapidly downward through a broad network of small-aperture fractures, it would be anticipated that groundwater would drip diffusely into the mine workings from the mine roof over a broad area. However, the large Star Point Sandstone groundwater inflows that have been encountered in the Skyline Mine have emanated from discrete discharge locations along significant faults and the vast majority of the water has discharged from the mine floor.

Canyon Fuel Company, LLC Skyline Mine feels obligated to express our concerns to you regarding these draft reports submitted to Mr. Styler by PacifiCorp. Again, we are concerned these draft reports should be closely scrutinized for accuracy and valid conclusions. Additionally, we believe drawing any conclusions on the cause(s) of the loss of Electric Lake water based solely on the information presented in these two draft reports would be premature and unsound. As mentioned above, if PacifiCorp persists in pursuing its theory and ultimately produces final reports, we would appreciate the opportunity to review those final reports and make more formal submittals.

If you have any questions, please give me a call at (435) 448-2619.

Sincerely,



Wess Sorensen
General Manager
Canyon Fuel Company, LLC – Skyline Mine

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FIGURE 1
Comparison of CRAFLUSH Model Results

