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TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

October 7, 2011

TO: Internal File

THRU: April Abate, Hydrologist and Team Lead *aac 10/11/11*

FROM: James Owen, Engineer *JO*

RE: Suspend Subsidence & Spring Quality Monitoring, Hiawatha Coal Company, Hiawatha Mine, C/007/0011, Task #3927

SUMMARY:

After completing the review of the 2010 Annual Report for Hiawatha Company's Hiawatha Mine, the Division of Oil Gas & Mining determined that in order for the Permittee to remove a commitment to perform annual subsidence studies from its Mining and Reclamation Plan (MRP), it would need to provide an analysis demonstrating that no subsidence is occurring. It was requested that the Permittee compile information from the subsidence survey data collected over the past 10 years. The Permittee was allowed to select 5 of the most accurate years of data collected within the 10 year period to perform the analysis on to be submitted to the Division.

On September 27, 2011, the Division received an application for an amendment to the Permittee's MRP. The application included the requested analysis and was submitted for the purpose of suspending subsidence monitoring requirements.

This memo addresses compliance with the engineering (R645-301-500) section of the Utah Coal Mining Rules.

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TECHNICAL ANALYSIS:

OPERATION PLAN

SUBSIDENCE CONTROL PLAN

Regulatory Reference: 30 CFR 784.20, 817.121, 817.122; R645-301-521, -301-525, -301-724.

Analysis:

The applicant states that no underground mining is taking place or is scheduled to take place for several years which would result in subsidence. The applicant included a new appendix (V-17) to be added to the MRP. The appendix includes an analysis which demonstrates that no significant subsidence has taken place since 2000.

For the purpose of demonstrating that no subsidence is occurring, and to allow for the removal of the commitment within the MRP to perform annual subsidence studies, a 10 year (2000-2009) subsidence analysis was conducted. In accordance with the Division's request, the analysis focused on five of the most accurate years of data collected from within the 10 year period. **The five years selected for analysis were 2000, 2002, 2005, 2006 and 2008. Raw subsidence data for all 5 years was included in the Appendix.**

- **2000 and 2002 Subsidence**

In 2000 and 2002, subsidence data was collected and reported using aerial survey methods (elevation reading from photography). For both years, 112 different subsidence monitoring stations (300 to 412) were measured. The change in subsidence for both 2000 and 2002 were compared to baseline data from 1988. The accuracy of the readings was based on ground control and photo-scale. A margin of error within aerial survey data is found to be acceptable for course scale analyses such as subsidence monitoring

A side-by-side comparison of select points within the 2000 and 2002 data was done to allow for single point analysis. Notable is the fact that certain points demonstrate a decrease in elevation one year and an increase in the other year. Point 343 was shown to uplift 0.67 feet in 2000 and was then shown to subside 1.84 feet in 2002. Point 365 was shown to uplift by 0.20 feet in 2000 and then shown to subside 1.98 feet in 2002. The opposite case is also present. For example, point 336 was shown to subside 0.22 feet in 2000, and then was shown to uplift by 0.18 feet in 2002. These discrepancies demonstrate that the subsidence measured is either; based on constant up and downward motions of small scale subsidence and uplift (unlikely at this stage for residual

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subsidence) within a margin of error, or that the data is erroneous. To supplement the aerial surveying conducted in 2000, all areas were walked in August of 2000 during the control survey. No significant changes to the surface or new fracturing were noted.

- **2005 Subsidence**

In 2005, subsidence data was collected and measured using a Leica GPS surveying system on the State Plane NAD 86 Coordinate System. Fifteen different subsidence monitoring station were measured. For all 15 points, the greatest decreased was measured as -2.31 ft. and the greatest increase was +1.13ft. For single point analysis, Point 399 was chosen for elevation comparison between 2000, 2002, and 2005. The point was shown to subside by 0.01 and 0.10 feet in 2000 and 2002 respectively, and then was shown to uplift by 1.54 feet in 2005.

- **2006 & 2008 Subsidence**

In 2006 & 2008, subsidence data was collected and measured using a Leica GPS surveying system on the State Plane NAD 86 Coordinate System. As part of the 2006 report, 6 subsidence control stations were compared to the baseline data for the points. Data collected in 2006 was compared to data collected in 2004. The greatest decrease in elevation was shown to be 0.49ft, while the greatest increase was shown to be 0.44 feet. This information allowed an updated accuracy estimate to be place in the range of 0.93-1.00 feet. Another 8 points were monitored for subsidence. No points demonstrated an increase or decrease of more than 0.5 feet. This demonstrates that no significant subsidence occurred during 2006. In 2008, 23 subsidence monitoring stations were measured and compared to data collected in 2007. No subsidence was detected.

Prior to any future mining, the Permittee commits to collect updated survey information on all subsidence monitoring points to establish a baseline from which to compare. After underground mining commences, the annual subsidence monitoring will resume and a comparison made to the baseline data will be included each year with the annual report.

Findings:

Revisions to the subsidence monitoring commitments, contents and all information provided are sufficient enough to meet the minimum requirements of this section of the Utah Coal Mining Rules.

RECOMMENDATIONS:

The amendment is recommended for approval.