#4206
K

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

December 18, 2012

TO: Internal File

THRU: Daron Haddock, Coal Program Manager

FROM: Steve Christensen, Hydrologist SJC

RE: Revised Probable Hydrologic Consequences Update, Genwal Resources, Inc., Crandall Canyon Mine, C/015/0032, Task ID #4206

SUMMARY:

On November 21, 2012, the Division of Oil, Gas and Mining (the Division) received a proposed amendment to the Crandall Canyon Mining and Reclamation Plan (MRP). The amendment was submitted by Genwal Resources, Inc. (the Permittee). The amendment revises the probable hydrologic consequences section of the MRP (primarily Appendix 7-15, *Probable Hydrologic Consequences Determination*) relative to the mine-water discharge. The amendment has been submitted previously and reviewed by the Division four times (Task ID #3724, #3983, #4103 and #4194). During the review of the previous amendments, deficiencies were identified and the amendments returned. The Permittee has addressed the deficiencies identified during the last technical review.

The amendment meets the Probable Hydrologic Consequences requirements of the State of Utah R645-Coal Mining Rules.

ENVIRONMENTAL RESOURCE INFORMATION

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR 783., et. al.

HYDROLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-724.

Probable Hydrologic Consequences Determination

The amendment meets the Probable Hydrologic Consequences Determination of the State of Utah R645-Coal Mining Rules.

A deficiency identified during a previous review (Task ID #3983) directed the Permittee to provide additional isotopic analyses of the untreated minewater discharge. Previous isotopic analyses had been performed prior to the 2007 mine collapse. The additional data was requested in order to evaluate whether or not the more shallow/active groundwater systems overlying the mine workings have been impacted/intercepted. Additional isotopic data was provided by the Permittee in a previous amendment.

In Appendix 7-71 the Permittee provides the latest stable and unstable isotopic compositions of the Crandall Canyon Mine discharge water (Petersen Hydrologic, May 2012). The gravity discharge from the Crandall Canyon Mine portal was sampled as part of the investigation conducted by Mr. Erik Petersen in October of 2011. Mine water samples were collected for analysis of unstable radiocarbon, tritium, stable isotopes and carbon-13. Additionally, mean groundwater residence times were calculated.

The results of the testing indicated that a measurable tritium concentration was present (2.0 TU) which indicates a component of recharge to the mine-water that is approximately 50 years old. However, based upon the very old radiocarbon age (>12,000 years), it appears that at this point; the mine-water discharge is a mixed source of both old and modern water. Mr. Petersen further discusses that the very old radiocarbon age would suggest that the majority of the sampled mine-water is "*likely a source that recharged many thousands of years ago*". The Division finds that the Permittees age characterization is reasonable; however, additional isotopic monitoring will be conducted until 2018. The additional isotopic data over this time frame will provide a better understanding as to the age of the sources of water currently flowing into the underground mine workings.

The Permittee has revised the ground water monitoring section of the approved MRP. On Table 7-4(a), Mine-Water Discharge Analysis List, the Permittee has indicated that isotopic laboratory measurements will be conducted on the pre-treatment mine-water discharge. The isotopic analysis will include: tritium, carbon-14, deuterium and oxygen-18. The isotopic testing will be conducted during the 2nd and 4th quarters until time of permit renewal in 2018. At that time, the Division and Permittee will re-evaluate if continued isotopic testing is necessary. The Permittee further discusses the frequency/duration of the pre-treatment mine-water discharge isotopic sampling on page 37 of Appendix 7-15.

The Permittee has revised Table 7-4(a) of chapter 7 as well as page 36 of Appendix 7-15 to reflect that dissolved manganese will be analyzed as part of the pre-treatment mine-water discharge analysis.

A previous PHC amendment (Task ID #3983) made a statement in the 2nd to last paragraph of page 8 that the written work plan (outlining the field-work/analysis for the revised PHC) submitted to the Division had been "*approved*". The Permittee was directed to revise this statement as the Division did not approve the submitted work plan on at least two different occasions. On page 15 of the most recent amendment, the Permittee has revised this portion of the Spring and Seep Interception section and discussed how the initial work plan was discussed on April 4th, 2011. However, due to Board directed negotiations relative to bonding/costs, a follow-up meeting to discuss Division concerns with the work-plan never took place. The amendment has been revised to more accurately reflect the events/chronology relative to the work-plan.

A previous technical review (Task ID #3983) identified a deficiency on page 10 where the Permittee indicated that "An analysis of the current year's surface-water monitoring data together with data from previous years is provided". Based upon a review of the former amendment, it appeared that the report was not submitted. The Permittee was directed to provide the report and subsequently did in the current amendment (Petersen Hydrologic- *Summary of Hydrologic Monitoring at the Genwal Resources, Inc. Crandall Canyon Mine* During 2011, March 27th, 2012).

A previous analysis (Task ID #3983) identified two deficiencies relative to state appropriated water rights (water rights). The Permittee was directed to provide more discussion of the potential impacts to water rights (specifically to Indian Creek and water rights that may be associated with the Joe's Valley Fault system). The amendment discusses potential impacts to water rights in several sections of the amendment.

Beginning on page 3 of Appendix 7-15, the Permittee discusses the Joe's Valley Fault system. The Joe's Valley Fault was encountered by the Permittee during active mining operations in the western most portion of the permit area (see longwall panels 7, 8, 9, 10, 11 and 12). Based upon conversations with former mine managers and Genwal Resources, Inc.

personnel, minimal amounts of water were encountered when mining occurred within the Joe's Valley Fault itself. The Permittee indicates that the majority of the water that discharged into the mine workings was a result of encountering the sympathetic faults and damage zone associated with the Joe's Valley Fault. Additionally, appreciable contributions of mine-water were produced from the underlying Star Point Sandstone layer (Spring Canyon member). As a result, the source of recharge to the mine-water discharge is in all likelihood, a mixture of multiple sources:

- Drainage of ancient, perched groundwater systems in the mine roof
- Upwelling of Star Point Sandstone groundwater through fractures in the mine floor (in the western portion of the mine).
- Discharge of ancient groundwater leaking from the Joes Valley Fault.

Based upon the Permittee's field investigation conducted in 2011, there is no indication that overlying springs and seeps in the vicinity of the Joe's Valley Fault have been impacted as a result of the Crandall Canyon mine-water discharge. The Permittee found that discharge rates measured at the springs located on East Mountain in the area adjacent to or overlying Joe's Valley Fault did not show any appreciable evidence of impact as a result of the mine-water discharge.

The Permittee discusses potential impacts to Indian Creek on page 5 of Appendix 7-15. A plot of discharge rates at the Indian Creek monitoring station are presented in Figure PHC-6. Figure PHC-6 also provides a plot of the Palmer Hydrologic Drought Index (PHDI) for Utah Region 4. The PHDI takes into account parameters that can potentially affect the balance between moisture supply and moisture demand. Based on Figure PHC-6, the flow rates measured at the Indian Creek monitoring station have been variable over the period of record (circa 1996). It appears that the discharge rates of Indian Creek correspond to long-term climatic variability when juxtaposed with the PHDI for the region.

For the hydrologic resources associated with Joe's Valley Fault and Indian Creek, the Division of Water Rights is not aware of any water right holder asserting that their water rights have been impacted as a result of mining at the Crandall Canyon Mine. Additional water monitoring/analysis will be conducted in order to insure that state appropriated water rights have not been impacted.

A previous technical analysis (Task ID #3983) identified a deficiency relative to the Permittee's assertion that mine-water discharge rates were declining. The Division noted that there are several reasons to believe that there have been extended periods of time where the reported mine-water discharge rates were inaccurate.

On numerous occasions, Mr. Dave Shaver (former resident agent) conveyed to Division staff and other agency representatives that the in-line totalizing flow meter (utilized prior to the 2007 collapse) produced much higher discharge rates than observed. These statements directly

contradict the statement on the bottom of page 11 that these readings "*are believed to be accurate*". A more precise flow meter was not installed until approximately March of 2010 (See DOGM Inspection Report #2302).

Additionally, information submitted by the Permittee provided further confirmation that flow values obtained at the mine site were questionable. On December 14th, 2010, the Division received an amendment in response to Task #3582 and the Revised Stipulation of November 4th, 2010. The amendment provided a chart entitled Crandall Canyon Mine Flows. The chart provided flow values from January 1st, 2010 to May 31st, 2010. Footnotes at the bottom of the chart state, "*Old meter not accurate. Do not use total flows. New Meter installed on 03/19/2010*". In the subsequent deficiency letter (dated February 7th, 2011), the Division asked the Permittee to identify the date when the flow meter was first suspected or known to be malfunctioning and to place a footnote on Figure PHC-1, *Reported discharge for Crandall Canyon Mine (UPDES 002)* to indicate that flow measurements prior to 3/19/2010 were not accurate. The Permittee did not provide an explanation as to why the meter was malfunctioning or for how long. A subsequent submittal to the Division (See Work Plan Hydrogeologic Study, January 26th, 2011) contained Figure PHC-1 but did not provide the requested footnote.

During a field inspection conducted on July 21st, 2011 (See DOGM Inspection # 2815), Genwal staff reported that the flow meter installed on 3/19/2010 was no longer functioning. Genwal staff indicated that as a result of utilizing a ferric chloride coagulant (WaterSolve 3), the electrodes of the flow meter had been destroyed and that Nielsen Construction had been contacted to provide a quote for replacing the inoperable flow meter. A new flow meter was installed in October of 2011. The Permittee was unable to provide an exact estimate of the amount of time that the flow meter was malfunctioning.

The recently submitted PHC revision discusses how flow readings obtained from the onset of gravity discharge from the mine portals in early 2008 until October 2011 are considered "*less accurate*". The Division agrees with the Permittee's assertion that one reason the flow values were less accurate was due to the complications that arose from having to correct the flow meter readings as a result of the recirculation of treatment basin water into the flow stream.

On page 18 of Appendix 7-15, the Permittee discusses the various flow measurements that have been obtained at the mine-site. According to Gary Gray, Genwal Resources Engineer, the totalizing flow meter (utilized prior to 2007) was "*believed to be reasonably accurate*". According to Mr. Gray, he periodically checked the accuracy of the discharge meter by comparing the measured discharge at the upper flume on Crandall Creek (UPF-1) with that measured below the mine discharge point (LOF-1). Mr. Ray found that the readings were in agreement with each other.

The Permittee acknowledges that there have been complicating factors relative to obtaining accurate flow measurements, but asserts that based on the overall trend (as shown in

Figures 4,5 and 6 of Appendix 7-67), mine-water discharge rates are declining. The Permittee provided a 6-month rolling average analysis of the mine-water discharge (See Figure 5 of Appendix 7-67). Upon review of Figure 5 of Appendix 7-67, it does appear that after peaking in approximately 2000, the discharge rate is declining. Given that an accurate flow-meter was installed in October of 2011, additional water monitoring in future years will verify whether the discharge is declining.

A previous review of the amendment identified a deficiency that directed the Permittee to revise references to Appendix 7-66. There were several references (pages 19, 23 and 25) where the Permittee cited Appendix 7-66. It was determined that the reference to that appendix was in error as Appendix 7-66 deals with the Crandall Canyon Burma Evaporation Pond. The Permittee was directed to revise references to Appendix 7-66. Upon review of the most recent submittal, the Permittee has addressed this error and removed the references to Appendix 7-66.

FINDINGS:

The amendment meets the Probable Hydrologic Consequences requirements of the State of Utah R645-Coal Mining Rules.

O:\015032.CRA\WG4206\WG4206skc.docx