

WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

January 18, 2008

TO: Internal File

THRU: Pamela Grubaugh-Littig, Permit Supervisor *pgl*

FROM: *D* Dana Dean, P.E., Senior Reclamation Hydrologist

RE: 2006 Third Quarter Water Monitoring, Genwal Resources, Inc., Crandall Canyon Mine, C/015/0032-WQ-06-3 Task #2731

The Crandall Canyon Mine was conducting continuous miner retreat mining in barrier pillars along the mains during the second quarter of 2007. Water monitoring requirements can be found in Section 7.31.21, and 7.31.22 of the MRP, especially Tables 7-4, 7-5, 7-8, 7-9, and 7-10.

1. Was data submitted for all of the MRP required sites? YES NO

Springs

The MRP requires the Permittee to monitor 24 springs each quarter. Some require full laboratory analysis according to Table 7-4, while others simply require field measurements.

The Permittee submitted all required samples for the spring sites.

Streams

The MRP requires the Permittee to monitor 12 streams each quarter. Some require full laboratory analysis according to Table 7-8, while others simply require field measurements.

The Permittee submitted all required samples for the stream sites.

Wells

The MRP requires the Permittee to monitor 7 wells during the second quarter. All require full laboratory analysis according to Table 7-4.

The Permittee submitted all required samples for the wells. Two were dry, and five were in-mine wells located in now inaccessible areas of the mine.

UPDES

The UPDES Permit/MRP require monthly monitoring of 2 outfalls: 001, sed. pond discharge, and 002, mine water discharge.

The Permittee submitted all required samples for the UPDES sites. Outfall 001 reported no flow.

2. Were all required parameters reported for each site? YES NO

3. Were any irregularities found in the data? YES NO

Some parameters fell outside of two standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard Deviations from Mean	Mean
LOF-1	Total Hardness	451 mg/L	2.16	310.51 mg/L
LOF-1	Sulfate	204 mg/L	2.39	75.78 mg/L
UPF-1	Total Hardness	447 mg/L	2.01	297.89 mg/L
UPF-1	Total Dissolved Solids	548 mg/L	2.24	320.04 mg/L
UPF-1	Sulfate	217 mg/L	2.07	72.71 mg/L
UT-0024368-002 – Aug 15	Water Temperature	19.6 °C	3.56	11.96 °C
UT-0024368-002 – Sep 6	Specific Conductivity	938 µmhos/cm	2.30	755.46 µmhos/cm

There is a weak upward trend in the specific conductivity at Outfall 002 ($R^2 = 0.1766$), with no real correlation to flow. There is no standard for specific conductivity, but it is closely related to total dissolved solids (TDS). The total dissolved solids concentration at Outfall 002 has no trend and is within the expected range.

There is a strong upward trend in sulfate at UPF-1 ($R^2 = 0.705$), and LOF-1 ($R^2 = 0.8134$). Sulfate is not toxic to plants or animals (even at very high concentration), but has a cathartic effect on humans in concentrations over 500 mg/L. For this reason, the EPA has set the secondary standard as 250 mg/L. The sulfate at LOF-1 has always been less than 200 mg/L, and the concentrations upstream of the mine are very similar to those downstream of the mine.

There is a fairly strong upward trend in total dissolved solids at UPF-1 ($R^2 = 0.6126$). This has affected the TDS at LOF-1, which has a very similar trend. UPF-1 is upstream of

all mine activity.

There is a fairly strong upward trend in total hardness at UPF-1 ($R^2 = 0.7768$), and LOF-1 ($R^2 = 0.6054$). The concentrations have always fallen into the hard (150-300 mg/L – 38 of 70 samples) or very hard ranges (>300 mg/l – 32 of 70 samples), and the upstream values are similar to the downstream values.

Many routine reliability checks fell outside of standard values:

Site	Reliability Check	Value Should Be...	Value is...
BCF	Conductivity/Cations	>90 & < 110	80
BCF	K/(Na + K)	< 20%	55%
BCF	Mg/(Ca + Mg)	< 40 %	52%
BCF	Na/(Na + Cl)	> 50%	23%
Horse Canyon Creek	Conductivity/Cations	>90 & < 110	80
Horse Canyon Creek	K/(Na + K)	< 20%	43%
Horse Canyon Creek	Mg/(Ca + Mg)	< 40 %	50%
Horse Canyon Creek	Na/(Na + Cl)	> 50%	32%
IBC-1	Conductivity/Cations	>90 & < 110	80
IBC-1	K/(Na + K)	< 20%	44%
IBC-1	Mg/(Ca + Mg)	< 40 %	56%
IBC-1	Na/(Na + Cl)	> 50%	26%
Indian Creek	Conductivity/Cations	>90 & < 110	81
Indian Creek	K/(Na + K)	< 20%	41%
Indian Creek	Na/(Na + Cl)	> 50%	28%
Little Bear Creek	Conductivity/Cations	>90 & < 110	81
Little Bear Creek	K/(Na + K)	< 20%	44%
Little Bear Creek	Mg/(Ca + Mg)	< 40 %	53%
Little Bear Creek	Na/(Na + Cl)	> 50%	26%
LOF-1	Conductivity/Cations	>90 & < 110	81
LOF-1	K/(Na + K)	< 20%	30%
LOF-1	Mg/(Ca + Mg)	< 40 %	44%
LOF-1	Na/(Na + Cl)	> 50%	21%
Section 4 Creek	Conductivity/Cations	>90 & < 110	78
Section 4 Creek	K/(Na + K)	< 20%	48%
Section 4 Creek	Mg/(Ca + Mg)	< 40 %	61%
Section 4 Creek	Na/(Na + Cl)	> 50%	26%
Section 5 Creek	Conductivity/Cations	>90 & < 110	82
Section 5 Creek	K/(Na + K)	< 20%	42%
Section 5 Creek	Mg/(Ca + Mg)	< 40 %	58%

Section 5 Creek	Na/(Na + Cl)	> 50%	27%
UPF-1	Conductivity/Cations	>90 & < 110	80
UPF-1	K/(Na + K)	< 20%	52%
UPF-1	Mg/(Ca + Mg)	< 40 %	43%
UPF-1	Na/(Na + Cl)	> 50%	34%
LB5-A	Conductivity/Cations	>90 & < 110	80
LB5-A	K/(Na + K)	< 20%	40%
LB5-A	Mg/(Ca + Mg)	< 40 %	49%
LB5-A	Na/(Na + Cl)	> 50%	27%
Little Bear Spring	TDS/Conductivity	>0.55 & <0.75	0.83
Little Bear Spring	Conductivity/Cations	>90 & < 110	58
Little Bear Spring	K/(Na + K)	< 20%	39%
Little Bear Spring	Mg/(Ca + Mg)	< 40 %	46%
Little Bear Spring	Na/(Na + Cl)	> 50%	33%
SP1-33	Conductivity/Cations	>90 & < 110	82
SP1-33	K/(Na + K)	< 20%	41%
SP1-33	Na/(Na + Cl)	> 50%	33%
SP1-9	Conductivity/Cations	>90 & < 110	86
SP1-9	K/(Na + K)	< 20%	62%
SP1-9	Na/(Na + Cl)	> 50%	23%
SP2-24	Cation/Anion Balance	< 5%	8.11%
SP2-24	K/(Na + K)	< 20%	91%
SP2-24	Na/(Na + Cl)	> 50%	9%
SP2-9	Cation/Anion Balance	< 5%	6.25
SP2-9	TDS/Conductivity	>0.55 & <0.75	0.53
SP2-9	Conductivity/Cations	>90 & < 110	86
SP2-9	K/(Na + K)	< 20%	63%
SP2-9	Na/(Na + Cl)	> 50%	17%
SP-36	Conductivity/Cations	>90 & < 110	83
SP-36	K/(Na + K)	< 20%	35%
SP-36	Mg/(Ca + Mg)	< 40 %	55%
SP-36	Na/(Na + Cl)	> 50%	21%
SP-58	Conductivity/Cations	>90 & < 110	81
SP-58	K/(Na + K)	< 20%	57%
SP-58	Mg/(Ca + Mg)	< 40 %	43%
SP-58	Na/(Na + Cl)	> 50%	29%
SP-79	Conductivity/Cations	>90 & < 110	79
SP-79	K/(Na + K)	< 20%	51%
SP-79	Mg/(Ca + Mg)	< 40 %	61%
SP-79	Ca/(Ca + SO ₄)	>50%	49%
SP-79	Na/(Na + Cl)	> 50%	25%

These inconsistencies do not necessarily mean that a sample is wrong, but it does indicate that something is unusual. An analysis and explanation of the inconsistencies by the Permittee would help to increase the Division's confidence in the samples. The Permittee should work with the lab to make sure that samples pass all quality checks so that the reliability of the samples does not come into question. The Permittee can learn more about these reliability checks and some of the geological and other factors that could influence them by reading Chapter 4 of *Water Quality Data: Analysis and Interpretation* by Arthur W. Hounslow. A geological influence is most likely here, since most samples have the same inconsistencies, and they recur each quarter.

4. On what date does the MRP require a five-year re-sampling of baseline water data.

Page 7-33 of the MRP states that groundwater samples collected during the low flow period every 5 years will be analyzed for baseline parameters.

Page 7-35 of the MRP states that surface water samples collected during the low flow period every 5 years will be analyzed for baseline parameters.

Therefore, the next re-sampling of baseline parameters is required by the fourth quarter of 2010.

5. Based on your review, what further actions, if any, do you recommend?

No further actions are necessary at this time.

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