

ATTACHMENT 2.4

Water in the AMT Operation

Prepared for Black Range Minerals
By Western Water & Land, Inc.



Western Water & Land, Inc.

March 29, 2016

Mr. Patrick Siglin
Black Range Minerals, Inc.
31161 Highway 90, Post Office Box 825
Nucla, Colorado 81424-0825

RE: Water Supply and Quality at the Sunday Mines Complex in Support of CDPHE Information Request

Dear Patrick:

Per your request, Western Water & Land, Inc. (WWL) has prepared this letter report for Black Range Minerals, Inc. (Black Range) in support an information request by the Colorado Department of Public Health and Environment (CDPHE), Hazardous Materials and Waste Management Division, Radiation Management (Division) related to permitting of Ablation Mining Technology (AMT).

Black Range, a subsidiary of Western Uranium Corporation (WUC), is in the process of pursuing permitting requirements for their AMT with the intent on applying the technology or method at the WUC controlled Sunday Mine Complex located in San Miquel County, Colorado. AMT involves a process whereby gangue minerals are physically disassociated from ore minerals by collisions between solids in a water slurry. Collisions of the ore material occur at the junction of opposing jets of slurry at atmospheric pressure. Post AMT, the disassociated solids within the slurry are separated based on physical size. AMT equipment would be installed and operated at the active mine site; waste material would be stored in mined-out workings and the ore mineral fraction would be transported to the mill.

Black Range has submitted a white paper to the Division that describes the AMT in detail and has requested a determination from the Division on any permitting requirements that may be required. This letter addresses specific comments submitted by the Division; each question is addressed separately below.

This letter report addresses water use and water quality associated with the Ablation Mining Technology (AMT) proposed for use at the Sunday Mines Complex by Black Range. Water use and water quality are issues of concern voiced by the Division.

Question 1: How much water will be used in the AMT operation? Where will Black Range Minerals get this water from?

Because the AMT process will recycle water, it is important to define water use terminology. The term “water use” can be applied to the water demand or the water used but not necessarily water consumed. “Consumed water” is water that is used on site and then is either lost to evaporation or permanently

transported offsite outside of the watershed. Water that is discharged to the surface, or infiltrated without plant uptake, may return to the watershed and is not considered consumed water. For the AMT process, used water that is not consumed will be recycled. Wastewater is water that has been used in the AMT process and has been temporarily or permanently removed from the AMT process for treatment and subsequent reuse, or consumed by evaporation. Wastewater can also be returned to the watershed by infiltration or discharge.

Black Range is planning to implement AMT at the Sunday Mines Complex with a design capacity of 20 tons/hour. Preliminary water requirements for the AMT process have been estimated based on the current 5 ton/hour processing equipment rate. To date, operation feed material requirements have been based on mass using the 5 ton/ hour AMT rate with a slurry solids-to-water ratio of 1 to 5 (20% solids) and an 80 gallon per minute (gpm) slurry throughput. By mass, at 80 gpm and 20% solids, the water throughput requirement to move 5 tons of solids through the AMT system is approximately 4,800 gallons of water per hour (gph). At the planned 20 ton/hour AMT rate, the water throughput requirement would be approximately 4 times this volume, or 19,200 gph. Because the majority of the AMT system throughput water can be recycled to the front end of the system after use, 19,200 gph is not a representative rate of water consumption but a rate of water use and is a function of the solids throughput rate at the designated slurry density.

Estimated water consumption and use are based on two components of the overall water budget: 1) water retention in the post AMT ore and sand waste materials, and 2) replenishment of AMT make-up water. Retained water in the ore and sand waste materials is considered consumed water. AMT replenishment water is considered fresh source water that was not previously used. Evaporation from the AMT equipment is considered negligible. Estimated water retention is conservatively calculated on the basis of 30% water retention in the post AMT ore product and 10% water retention in the sand waste. The post AMT ore material is estimated to be approximately 20% of the total mass of material processed, i.e., a 20 ton/hour processing rate will produce approximately 4 tons of post AMT ore per hour. Based on mass, about 290 gallons of water would be retained per hour as water in the post AMT ore. Similarly, retained water will occur in the coarse-grained waste sand material. The estimate of 10% (by mass) water retention in the sand waste will result in 15 tons of sand waste per hour and 385 gph of water retention. Based on the above estimates, the total water retention of 675 gph is anticipated for post AMT ore and waste materials. This water is considered consumed water and not recoverable for reuse. For an AMT system designed to recycle the throughput water, 675 gph is the minimum operating water supply requirement. This water requirement will be balanced on the front end of the AMT system as a fresh make-up water stream into the AMT mix tank module. Note that water retention in the post AMT ore may be beneficial to the milling process. Refined calculations on water retention will be conducted with further trial AMT work and methods to extract retained pore water will be investigated. It is expected that there will be a reduction in water supply requirement.

For further discussion it is estimated that the total volume of water contained by the operating AMT system and its ancillary components at any time is 4,000 gallons. At this time, it is conservatively assumed that this initial system charge volume of 4,000 gallons, as the system make-up water, will be able to be recycled a minimum of 20 cycles before being replaced with an equal volume of freshwater. Based on an hourly average, this equates to approximately 960 gph for replenished charge volume water. The water being replaced may need to be treated as wastewater.

In reality, consumed retention water and system charge water replenishment may occur continuously at an appropriate rate. Based on the above assumptions the total post AMT wastewater volume per operating day could range up to 12,000 gallons. Therefore, a conservative estimated range for total water consumption considering water retention in the post AMT materials and for replacing recycled system charge water every 20 cycles, is 675 to 1,635 gph for AMT operations. The actual water

consumption will depend on recycled system water quality and wastewater recovery methods implemented on site.

The primary water supply to AMT operations at the Sunday Mine Complex is anticipated to be supplied through the use of stored water from natural groundwater seepage into the mine workings, mostly at the West Sunday mine area. It is estimated that 55.4 million gallons of water is stored in flooded workings in the West Sunday Mine and that the mine inflow rate is 5 to 6 gpm (Denison Mines, 2012). Based on the estimated make-up water requirement of 1,650 gph, this volume of stored water would allow for up to 9 years of continuous daily supply at 10-hour per day AMT operations without including continuous mine inflow. A mine inflow rate of 5 gpm would account for about one-half of the estimated water requirement or 7,200 gallons per day; this inflow could extend a single AMT system operation to 15 years.

Alternate sources of supply will be considered and include construction of water supply wells in the Big Gypsum Valley area or transporting water from other viable sources with existing water rights. It is anticipated that the water consumed in the generation of post AMT ore will be a water use savings at the Uranium mill.

Question 2: What will be the anticipated uranium concentration in the post-AMT water during operation and when it is ready to be disposed of?

Because of the recent introduction of the AMT process, limited data are available on mineral dissolution and leaching of uranium-bearing minerals in the AMT water. Limited amounts of Sunday Mine Complex ores have been subjected to AMT testing, in support of this question, other relevant and applicable data sources are discussed here.

October Ore Pile Reclamation Mine AMT Data

In 2013, Black Range submitted multiple samples of solids and process water from an AMT test of material from the October Ore Pile Reclamation Mine (DRMS permit number M-2008-050) for laboratory analysis. The October Ore Pile Reclamation Mine is located on the Colorado Plateau within the Uravan Mineral Belt near Gateway, Colorado. This ore is expected to approximate the ore composition at the Sunday Mines Complex in that its genesis (uranium roll front) and host rock (Morrison Formation) are the same. Water used for the AMT test was from a shallow (less than 200 feet deep) well which at the time provided all the water for the testing facility. The water was run through a number of preliminary filters, infrared bacteria disinfection, and reverse osmosis prior to being stored for use.

The solid material from the AMT test was separated into a range of mesh sizes for analysis. Black Range submitted three samples to Inter-mountain Laboratory (IML) and analysis was performed on total and dissolved metals using EPA Methods 6010C or EPA Methods 200.7 and 200.8. Analyses were conducted on: 1) the run of mine (ROM) sample pre AMT, 2) post AMT sample sieve fractions, 3) post AMT water, 4) post AMT screen water, and 5) Synthetic Precipitation Leaching Procedure (SPLP) analysis of pre AMT ROM material and post AMT clean sand waste material. The analyses relevant to this discussion include the post AMT water and the SPLP results as presented in Tables 1 and 2, respectively. The IML lab reports are shown in Attachment A.

Table 1 shows analytical results for two samples. The October Post Ab sample represents a sample of the post AMT water after some settling of solids. The ABT October Post Screen sample represents a mix of post AMT water and clean raw water after solid materials were screened and washed to fully separate all fine material from coarse material. The October Post Ab sample is considered the most representative of post AMT water for uranium ore of Colorado Plateau type uranium deposits. This

water is characterized by total uranium concentration of 3.58 mg/L and a gross alpha activity of 2,940 pCi/L. It is recognized that each ore deposit will present different geochemical conditions and ablation results will likely vary somewhat from mine to mine.

Table 1. October Ore Pile Reclamation Mine Ore Uranium Concentration and Radiological Results For Post AMT Water¹

Sample ID	Dissolved U (mg/L) ³	Total U (mg/L) ³	TDS (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)
October Post Ab	3.25	3.58	980	2,940 (28)	1,140 (11)	161 (1.6)	2.7 (1.2)
ABT October Post Screen	3.14	8.31	840	2,010 (23)	556 (7.8)	69.4 (1.1)	ND

Note: ¹Analysis by EPA Method 200.8. Radionuclide precision in parentheses.

Table 2. October Reclamation Stockpile Ore Uranium Concentration from SPLP Testing of ROM and Post AMT Clean Sand (mg/L)¹

Sample	Uranium
ROM	0.217
Clean Sand	0.0399

¹ Analysis by EPA Method 200.8

SPLP analysis was conducted on pre AMT ROM material and post AMT clean sand waste product (Table 2). The term “clean sand” for this analysis refers to the coarse fraction greater than the 400 mesh size post AMT. The clean sand is post AMT waste product material. SPLP analysis (EPA Method 1312), albeit a pH adjustment, presents a significantly less vigorous agitation of the solid material than what occurs during AMT; the analysis was made to compare and evaluate potential leachate concentrations from pre AMT ROM versus post AMT waste. As the results indicate, leachate associated with the waste clean sand uranium concentration is an order of magnitude less than leachate associated with ROM material and near the drinking water maximum contaminant level (MCL) of 0.030 mg/L.

Water Chemistry at the Sunday Mine Complex

Groundwater chemistry at the Sunday Mine Complex is relevant because it provides at least a partial representation of background water quality prior to use in the AMT system as well as provides insight to the natural characteristics of groundwater chemistry in the ore zone and nearby geologic formations. Table 3 presents compiled groundwater analytical data for the Sunday Mine Complex. The sources include underground wells drilled from the mine stope in the West Sunday Mine area (WS prefix); surface monitoring wells drilled for baseline studies and completed in the “Top Rim Sandstone” Salt Wash Member (ore member) of the Morrison Formation (MW prefix); and two samples collected from the flooded mine workings (Sunday and West Sunday samples). Wells WS-2 and WS-3 are also completed in the Top Rim Sandstone. The data in Table 3 indicate that some uranium concentrations in groundwater in the vicinity of the Sunday Mines approach or exceed the concentration of the AMT water sample for the October Reclamation Stockpile ore discussed above. Detected uranium

concentrations range from 0.0008 mg/L in Well MW-Sun3 to 9.150 mg/L in Well WS-2. Flooded mine-working water showed uranium concentrations ranging from 0.280 to 1.4 mg/L. The gross alpha activity associated with the greater uranium groundwater concentrations range from approximately 500 to over 13,000 pCi/L.

It is not known if mining has affected the groundwater quality of the samples shown in Table 3. However, it is expected that the mine workings flood water would exhibit greater solute concentrations due to the water's exposure to adjacent siltstone and mudstone units. The relatively high uranium concentrations associated with Wells WS-2 and WS-3 may be related to mineralized zones, proximity to mined areas, or well development issues.

Key Considerations

As indicated in the above analysis of the October Ore Pile Reclamation Mine ore AMT test, dissolved and total uranium concentrations will likely be in the low ppm concentrations in the post AMT water. However, to conserve water resources, the AMT water will be recycled for use and the concentration of uranium in continually recycled AMT water is expected to increase with each cycle of reuse. It is conceivable that AMT wastewater could reach concentrations greater than five times that of the October Post Ab sample (Table 1). Because of the complex hydrochemistry relationships involved, estimating the final concentration of uranium in the AMT system water before treatment or disposal cannot be done without further AMT trials and associated research.

Ultimately, it is anticipated that the upper limit of uranium concentration in the AMT system water will be dependent on: 1) risk of potential health hazards from external exposure to the AMT water; 2) the impact of salinity and other precipitates on the AMT equipment and performance; 3) recovery considerations of the dissolved uranium from the AMT water; and 4) the solubility thermodynamics associated with uranium precipitates.

Potential Worker Exposure

Very little technical information on external radiation dose rates from uranium-bearing water is available, but Black Range is researching the subject. Water is considered a shielding material for radiation sources, e.g., in nuclear fuel reactor applications, and the AMT water can be managed underground to minimize worker exposure. Exposure to radon degassing from the AMT water is not considered an issue of concern as radon mitigation will be implemented as part of normal mining operations.

Salinity Impact to AMT Equipment and Performance

The increasing salinity of AMT water with reuse may approach saturation of certain mineral species and while this is not expected to chemically impact the mechanical ore disassociation, equipment performance may be impacted by scaling or corrosion. This will be monitored and adjustments to water quality will be made as needed.

Uranium Recovery

Depending on dissolved concentrations, dissolved uranium in AMT wastewater may be controlled in part by recovery treatment methods. Or, water treatment can be implemented to reduce uranium mobility in the wastewater. Appropriate wastewater best management practices will be implemented to control onsite management of AMT wastewater. Options include hauling wastewater to the mill for uranium extraction, onsite treatment and reuse, and onsite evaporation or storage.

Mineral Solubility

Uranium in an aqueous environment, is soluble and mobile under oxidizing and alkaline conditions. The presence of carbonate in the system can contribute to the formation of uranyl carbonate complexes and uranium solubility. Uranium is expected to be present predominately in an oxidized state as U(VI). The uranyl species ($[UO_2]^{2+}$) in groundwater near the mine workings and in the flooded workings is likely predominant, and based on measured pH and the presence of alkalinity, will likely readily form soluble carbonate complexes. Uranyl may form other complexes with hydroxide, fluoride, nitrate, and sulfate. In deep, less oxidized environments such as those at the MW-Sun1, MW-Sun2 and MW-Sun3 well locations, uranium may occur in the less soluble U(IV) state.

The theoretical limit of uranium concentration in the AMT water will be determined by uranium mineral solubility products and the chemical composition of the AMT water. Stable primary and secondary mineral phases in the Sunday Mine ores have not been vigorously studied at this time; X-ray diffraction spectroscopy and other analyses may be required to determine this information. It is relatively safe to assume that various uranyl minerals such as uranyl oxide hydrates, uranyl carbonates, and uranyl silicates form secondary minerals in the ores. But, a thorough understanding of geochemical composition of the rock and water systems is needed to model the uranium mineral solubilities. Some research has found that higher dissolved uranium concentrations may be associated with higher total dissolved solids (TDS) concentrations (Kumar and others, 2011; Hathaway, 1977). In addition, calculated solubilities do not always account for the formation of dissolved uranyl complexes.

Goodwin (1982) conducted a study of uranium solubility in groundwater as an effort to assess uranium mobility in stored nuclear waste. Goodwin modeled groundwater compositions of granite and a brine solution with ionic strengths of 0.00184 and 1.43, respectively, and TDS concentrations of 105 mg/L and 55,500 mg/L, respectively. While this work is not directly comparable to the application of post AMT of uranium ore, the results of the brine water modeling may illustrate a first approximation of uranium solubility in the AMT system where water is recycled. Goodwin found that Eh and pH were still the defining parameters that controlled uranium solubility and that for a brine solution under pH conditions between 8 and 9 s.u., uranium solubility for the major uranium species, $U(OH)_5^-$ and possibly $UO_2(CO_3)_2^{2-}$, was in the order of 10^{-10} to 10^{-9} M (molar), or 0.02 to 0.2 ppb.

The concentrations presented by Goodwin are significantly lower than what is observed in groundwater at the Sunday Mine Complex (Table 3), and clearly, many authors have described dissolved uranium concentrations in natural settings that are significantly greater than estimated uranium compound solubilities based on thermodynamics. Hem (1989), for example, cited a uranium concentration of 15 mg/L from a 90-meter deep well in Helsinki, Finland. The discrepancies likely reflect the shortcomings of the geochemical modeling approach where kinetics, the existence of colloids, and missing input data for certain uranium minerals affect model results.

To more completely understand and approximate uranium concentrations in the AMT water, the mineralogy of the Sunday Mine Complex ore and the geochemistry of AMT water needs to be studied. Physical experiments and potentially a geochemical model could then be applied to approximate uranium solubility limits. For example, ferricoxyhydroxides have the greatest sorptive affinity for uranium of any mineral species (Elless and Lee, 1977), and these minerals are suspected to be a key host for uranium at the Sunday Mines Complex.

Ultimately, whatever the uranium concentration of the AMT waste water may be, Black Range will manage it in accordance with existing environmental regulations (see following question).

Question 3: How and when will the post-AMT water be disposed of, if not being re-circulated through the AMT system?

As discussed above, Black Range will evaluate disposal of post-AMT water based on four criteria: 1) the risk of potential health hazards to humans and ecological receptors from external exposure to the AMT water; 2) the impact of salinity and other precipitates on the AMT equipment performance; 3) recovery considerations of dissolved and precipitated uranium associated with the AMT water; and 4) the solubility thermodynamics associated with uranium precipitates.

Black Range anticipates the development of thresholds for each of the above criteria. The first criteria, potential health risk, will be strictly followed to protect worker and ecological health. The remaining criteria are expected to be implemented with some flexibility.

The following disposal options may be applied to the post-AMT wastewater.

- Active or passive treatment for uranium removal or recovery. This may include pH adjustment and reagent amendments to precipitate uranium.
- Onsite evaporation (no discharge) and offsite milling of precipitates, if practicable.
- Discharge under a CDPS permit, possibly associated with one of the above.

Note that these disposal options are not mutually exclusive; post-AMT water may experience all or some of these options. Post-AMT water that is treated will likely be recycled into the system or discharged under a permit. If evaporation of post-AMT water is conducted, appropriate impoundments would be constructed in accordance with environmental regulations.

Please contact me with any questions or comments you may have.

Sincerely,



WESTERN WATER & LAND, INC.
Bruce D. Smith
Principal Hydrogeologist

attachment

REFERENCES

- Denison Mines, 2012. Environmental Protection Plan, Denison Mines (USA) Corp., Sunday Mines Group. January, 2012. Prepared by CDM Inc. and Denison Mines (USA) Corp. Submitted to Colorado Division of Reclamation, Mining and Safety for permits: Sunday Mine (M-1977-285), Carnation Mine (M-1977-416), St. Jude Mine (M-1978-039HR), Topaz Mine (M-1980-055 HR) and West Sunday Mine (M-1981-021).
- Elless, M.P. and S.Y. Lee, 1977. Uranium Solubility of Carbonate-Rich Uranium-Contaminated Soils. Water, Air, and Soil Pollution. October 1998, Volume 107, [Issue 1](#), pp 147-162
- Goodwin, B. 1982. Calculated uranium solubility in groundwater: implications for nuclear waste disposal. Canadian Journal of Chemistry. No. 60 1759 (1982).
- Hathaway, L.R. 1977. Interpretation of Uranium Content of Ground Water in West-Central Kansas. In Short Papers of the U.S. Geologic Survey Uranium – Thorium Symposium Geologic Survey Circular 753, Ed. John A. Campbell
- Hem, J.D., 1989. Study and Interpretation of the Chemical Characteristics of Natural Water. U.S.G.S. Water-Supply Paper 2254, 264 pp.

ATTACHMENT A

Inter-Mountain Labs Report

October Ore Pile Reclamation Mine Sample Analytical Results



Date: 8/19/2013

CLIENT: Black Range Minerals
Project: ROM/Clean Sand
Lab Order: S1306384

CASE NARRATIVE
Report ID: S1306384001

Samples +50, -100+200, -200+270, -270+325, -325+400, -400 (Ablated Concentrate), -50+100, Clean Sand, and ROM were received on June 24, 2013.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition
40 CFR Parts 136 and 141
40 CFR Part 50, Appendices B, J, L, and O
Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012
ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by:

Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-001
ClientSample ID: +50
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init
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Metals - Total

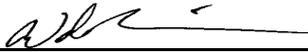
Uranium	214	mg/Kg		0.6	6010C	07/10/2013 1740 DG
Vanadium	224	mg/Kg		0.05	6010C	07/10/2013 1740 DG

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - C Calculated Value
 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-002
ClientSample ID: -50+100
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init
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Metals - Total

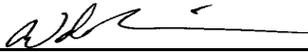
Uranium	80.0	mg/Kg		0.6	6010C	07/10/2013 1744 DG
Vanadium	122	mg/Kg		0.05	6010C	07/10/2013 1744 DG

These results apply only to the samples tested.

RL - Reporting Limit

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 - C Calculated Value
 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-003
ClientSample ID: -100+200
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

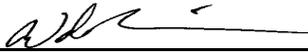
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Metals - Total							
Uranium	157	mg/Kg		0.6	6010C	07/10/2013 1758	DG
Vanadium	219	mg/Kg		0.05	6010C	07/10/2013 1758	DG

These results apply only to the samples tested.

RL - Reporting Limit

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 - ND Not Detected at the Reporting Limit
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- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-004
ClientSample ID: -200+270
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

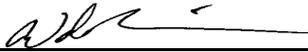
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Metals - Total							
Uranium	321	mg/Kg		0.6	6010C	07/10/2013 1800	DG
Vanadium	501	mg/Kg		0.05	6010C	07/10/2013 1800	DG

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
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 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-005
ClientSample ID: -270+325
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init
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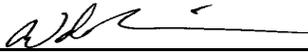
Metals - Total

Uranium	417	mg/Kg		0.6	6010C	07/10/2013 1802 DG
Vanadium	680	mg/Kg		0.05	6010C	07/10/2013 1802 DG

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:	* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
C	Calculated Value	E Value above quantitation range
H	Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	M Value exceeds Monthly Ave or MCL
ND	Not Detected at the Reporting Limit	O Outside the Range of Dilutions
S	Spike Recovery outside accepted recovery limits	

Reviewed by: 
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-006
ClientSample ID: -325+400
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init
----------	--------	-------	------	----	--------	--------------------

Metals - Total

Uranium	454	mg/Kg		0.6	6010C	07/10/2013 1805 DG
Vanadium	746	mg/Kg		0.05	6010C	07/10/2013 1805 DG

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
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 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
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- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-007
ClientSample ID: -400 (Ablated Concentrate)
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Radionuclides - Total							
Lead 210	809	pCi/g		1	OTW01	07/30/2013 1531	SH
Lead 210 Precision (±)	7.2	pCi/g			OTW01	07/30/2013 1531	SH
Polonium 210	215	pCi/g		1	OTW01	07/30/2013 1202	SH
Polonium 210 Precision (±)	10	pCi/g			OTW01	07/30/2013 1202	SH
Radium 226	1200	pCi/g		0.2	E901.1 Mod.	08/14/2013 1025	SH
Radium 226 Precision (±)	12	pCi/g			E901.1 Mod.	08/14/2013 1025	SH
Radium 228	ND	pCi/g		1	E901.1 Mod.	08/15/2013 1259	SH
Radium 228 Precision (±)	NA	pCi/g			E901.1 Mod.	08/15/2013 1259	SH
Thorium 230	1610	pCi/g		0.2	ACW10	07/25/2013 917	MB
Thorium230 Precision (±)	177	pCi/g			ACW10	07/25/2013 917	MB
Uranium 234	830	pCi/g		0.4	ACW01-Mod	08/01/2013 1331	MB
Uranium 234 Precision (±)	216	pCi/g			ACW01-Mod	08/01/2013 1331	MB
Uranium 235	432	pCi/g		0.4	ACW01-Mod	08/01/2013 1331	MB
Uranium 235 Precision (±)	113	pCi/g			ACW01-Mod	08/01/2013 1331	MB
Uranium 238	938	pCi/g		0.4	ACW01-Mod	08/01/2013 1331	MB
Uranium 238 Precision (±)	244	pCi/g			ACW01-Mod	08/01/2013 1331	MB
General Parameters - Soil							
pH	8.2	s.u.		0.1	USDA 60-21a	07/10/2013 800	ARF
Electrical Conductivity	3.32	dS/m		0.01	USDA 60-4a	07/10/2013 800	ARF
Organic Matter	1.1	%		0.1	SSSA Part 3	07/10/2013 000	CDB
Nutrients							
Carbonate	11.2	%		0.1	USDA 60-23	07/12/2013 000	MEL
Acid Potential							
Total Sulfur	0.16	%		0.01	EPA600/2-78-054	07/15/2013 000	JZ
Neutralization Potential	112	t/1000t			EPA600/2-78-054	07/11/2013 1909	MEL
Acid Base	5.12	t/1000t		0.01	EPA600/2-78-054	07/18/2013 1149	KS
Acid Base Potential	107	t/1000t			EPA600/2-78-054	07/18/2013 1149	KS

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:	* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
C Calculated Value	E Value above quantitation range	
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits	
L Analyzed by a contract laboratory	M Value exceeds Monthly Ave or MCL	
ND Not Detected at the Reporting Limit	O Outside the Range of Dilutions	
S Spike Recovery outside accepted recovery limits		

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-007
ClientSample ID: -400 (Ablated Concentrate)
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Metals - Total							
Aluminum	48700	mg/Kg		0.6	6010C	07/10/2013 1807	DG
Antimony	6.4	mg/Kg		1.4	6010C	07/10/2013 1807	DG
Arsenic	2110	mg/Kg		0.6	6010C	07/10/2013 1807	DG
Barium	2030	mg/Kg		0.2	6010C	07/10/2013 1807	DG
Beryllium	4.3	mg/Kg		0.3	6010C	07/10/2013 1807	DG
Boron	25.9	mg/Kg		0.5	6010C	07/10/2013 1807	DG
Cadmium	21.6	mg/Kg		0.04	6010C	07/10/2013 1807	DG
Calcium	39000	mg/Kg		2.2	6010C	07/10/2013 1807	DG
Chromium	572	mg/Kg		0.05	6010C	07/10/2013 1807	DG
Cobalt	22.0	mg/Kg		0.1	6010C	07/10/2013 1807	DG
Copper	74.7	mg/Kg		0.1	6010C	07/11/2013 1812	BK
Iron	23200	mg/Kg		1.5	6010C	07/10/2013 1807	DG
Lead	936	mg/Kg		0.8	6010C	07/10/2013 1807	DG
Lithium	125	mg/Kg		0.05	6010C	07/11/2013 1812	BK
Magnesium	18400	mg/Kg		2.5	6010C	07/10/2013 1807	DG
Manganese	488	mg/Kg		0.05	6010C	07/10/2013 1807	DG
Mercury	0.2	mg/Kg		0.2	7471A	07/11/2013 000	CS
Molybdenum	21.3	mg/Kg		0.2	6010C	07/10/2013 1807	DG
Nickel	288	mg/Kg		0.1	6010C	07/10/2013 1807	DG
Phosphorus	930	mg/Kg		0.5	6010C	07/10/2013 1807	DG
Potassium	11100	mg/Kg		1	6010C	07/10/2013 1807	DG
Selenium	176	mg/Kg		0.5	6010C	07/10/2013 1807	DG
Silver	11.6	mg/Kg		0.5	6010C	07/10/2013 1807	DG
Sodium	2370	mg/Kg		10	6010C	07/10/2013 1807	DG
Thallium	13	mg/Kg		1	6010C	07/10/2013 1807	DG
Uranium	4590	mg/Kg		0.6	6010C	07/10/2013 1807	DG
Vanadium	10600	mg/Kg		0.05	6010C	07/10/2013 1807	DG
Zinc	2070	mg/Kg		0.2	6010C	07/10/2013 1807	DG

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- C Calculated Value
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-007
ClientSample ID: -400 (Ablated Concentrate)
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Sulfur							
Sulfur, Sulfate	0.12	%		0.01	EPA600/2-78-054	07/15/2013 000	JZ
Sulfur, Pyritic	0.05	%		0.01	EPA600/2-78-054	07/15/2013 000	JZ
Sulfur, Organic	ND	%		0.01	EPA600/2-78-054	07/15/2013 000	JZ
Total Organic Carbon							
Total Carbon	1.4	%		0.1	ASA9 29-3.2	07/15/2013 000	JZ
Total Organic Carbon	ND	%		0.1	ASA9 29-3.2	07/18/2013 1149	KS

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:

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- C Calculated Value
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-008
ClientSample ID: Clean Sand
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Table with 7 columns: Analyses, Result, Units, Qual, RL, Method, Date Analyzed/Init. Rows include Radionuclides - Total (Lead 210, Polonium 210, Radium 226, Radium 228, Thorium 230), General Parameters - Soil (pH, Electrical Conductivity, Organic Matter), Nutrients (Carbonate), and Acid Potential (Total Sulfur, Neutralization Potential, Acid Base).

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers: * Value exceeds Maximum Contaminant Level
C Calculated Value
H Holding times for preparation or analysis exceeded
L Analyzed by a contract laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL
O Outside the Range of Dilutions

Reviewed by: [Signature]
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-008
ClientSample ID: Clean Sand
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Metals - Total							
Aluminum	854	mg/Kg		0.6	6010C	07/11/2013 1954	DG
Antimony	ND	mg/Kg		1.4	6010C	07/11/2013 1954	DG
Arsenic	67.5	mg/Kg		0.6	6010C	07/11/2013 1954	DG
Barium	39.0	mg/Kg		0.2	6010C	07/11/2013 1954	DG
Beryllium	ND	mg/Kg		0.3	6010C	07/11/2013 1954	DG
Boron	ND	mg/Kg		0.5	6010C	07/11/2013 1954	DG
Cadmium	ND	mg/Kg		0.04	6010C	07/11/2013 1954	DG
Calcium	6460	mg/Kg		2.2	6010C	07/11/2013 1954	DG
Chromium	181	mg/Kg		0.05	6010C	07/26/2013 1623	DG
Cobalt	ND	mg/Kg		0.1	6010C	07/11/2013 1954	DG
Copper	ND	mg/Kg		0.1	6010C	07/11/2013 1954	DG
Iron	2330	mg/Kg		1.5	6010C	07/11/2013 1954	DG
Lead	ND	mg/Kg		0.8	6010C	07/11/2013 1954	DG
Lithium	2.91	mg/Kg		0.05	6010C	07/11/2013 1954	DG
Magnesium	1190	mg/Kg		2.5	6010C	07/11/2013 1954	DG
Manganese	62.2	mg/Kg		0.05	6010C	07/11/2013 1954	DG
Mercury	ND	mg/Kg		0.2	7471A	07/11/2013 000	CS
Molybdenum	ND	mg/Kg		0.2	6010C	07/11/2013 1954	DG
Nickel	ND	mg/Kg		0.1	6010C	07/11/2013 1954	DG
Phosphorus	46.5	mg/Kg		0.5	6010C	07/15/2013 1438	BK
Potassium	431	mg/Kg		1	6010C	07/11/2013 1954	DG
Selenium	ND	mg/Kg		0.5	6010C	07/11/2013 1954	DG
Silver	ND	mg/Kg		0.5	6010C	07/11/2013 1954	DG
Sodium	ND	mg/Kg		10	6010C	07/11/2013 1954	DG
Thallium	ND	mg/Kg		1	6010C	07/11/2013 1954	DG
Uranium	110	mg/Kg		0.6	6010C	07/11/2013 1954	DG
Vanadium	165	mg/Kg		0.05	6010C	07/11/2013 1954	DG
Zinc	59.2	mg/Kg		0.2	6010C	07/11/2013 1954	DG

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
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 - S Spike Recovery outside accepted recovery limits

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- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-008
ClientSample ID: Clean Sand
COC:

WorkOrder: S1306384
CollectionDate:
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Table with 7 columns: Analyses, Result, Units, Qual, RL, Method, Date Analyzed/Init. Rows include Sulfur (Sulfate, Pyritic, Organic) and Total Organic Carbon (Total Carbon, Organic Carbon).

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers: * Value exceeds Maximum Contaminant Level
C Calculated Value
H Holding times for preparation or analysis exceeded
L Analyzed by a contract laboratory
ND Not Detected at the Reporting Limit
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J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL
O Outside the Range of Dilutions

Reviewed by: [Signature]
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-009
ClientSample ID: ROM
COC:

WorkOrder: S1306384
CollectionDate: 6/21/2013
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Table with 7 columns: Analyses, Result, Units, Qual, RL, Method, Date Analyzed/Init. Rows include Radionuclides - Total (Lead 210, Polonium 210, Radium 226, Radium 228, Thorium 230), General Parameters - Soil (pH, Electrical Conductivity, Organic Matter), Nutrients (Carbonate), and Acid Potential (Total Sulfur, Neutralization Potential, Acid Base).

These results apply only to the samples tested.

RL - Reporting Limit

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Reviewed by: [Signature]
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-009
ClientSample ID: ROM
COC:

WorkOrder: S1306384
CollectionDate: 6/21/2013
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Metals - Total							
Aluminum	11300	mg/Kg		0.6	6010C	07/11/2013 2000	DG
Antimony	ND	mg/Kg		1.4	6010C	07/11/2013 2000	DG
Arsenic	527	mg/Kg		0.6	6010C	07/11/2013 2000	DG
Barium	509	mg/Kg		0.2	6010C	07/11/2013 2000	DG
Beryllium	1.3	mg/Kg		0.3	6010C	07/11/2013 2000	DG
Boron	12.3	mg/Kg		0.5	6010C	07/11/2013 2000	DG
Cadmium	6.40	mg/Kg		0.04	6010C	07/11/2013 2000	DG
Calcium	14700	mg/Kg		2.2	6010C	07/11/2013 2000	DG
Chromium	76.0	mg/Kg		0.05	6010C	07/26/2013 1625	DG
Cobalt	4.7	mg/Kg		0.1	6010C	07/11/2013 2000	DG
Copper	20.5	mg/Kg		0.1	6010C	07/11/2013 2000	DG
Iron	5730	mg/Kg		1.5	6010C	07/11/2013 2000	DG
Lead	268	mg/Kg		0.8	6010C	07/11/2013 2000	DG
Lithium	42.3	mg/Kg		0.05	6010C	07/11/2013 2000	DG
Magnesium	5510	mg/Kg		2.5	6010C	07/11/2013 2000	DG
Manganese	145	mg/Kg		0.05	6010C	07/11/2013 2000	DG
Mercury	ND	mg/Kg		0.2	7471A	07/11/2013 000	CS
Molybdenum	4.0	mg/Kg		0.2	6010C	07/11/2013 2000	DG
Nickel	6.4	mg/Kg		0.1	6010C	07/11/2013 2000	DG
Phosphorus	220	mg/Kg		0.5	6010C	07/15/2013 1440	BK
Potassium	3140	mg/Kg		1	6010C	07/11/2013 2000	DG
Selenium	67.8	mg/Kg		0.5	6010C	07/11/2013 2000	DG
Silver	1.0	mg/Kg		0.5	6010C	07/11/2013 2000	DG
Sodium	360	mg/Kg		10	6010C	07/11/2013 2000	DG
Thallium	4	mg/Kg		1	6010C	07/11/2013 2000	DG
Uranium	1350	mg/Kg		0.6	6010C	07/11/2013 2000	DG
Vanadium	2520	mg/Kg		0.05	6010C	07/11/2013 2000	DG
Zinc	482	mg/Kg		0.2	6010C	07/11/2013 2000	DG

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- C Calculated Value
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported 8/19/2013
Report ID: S1306384001

ProjectName: ROM/Clean Sand
Lab ID: S1306384-009
ClientSample ID: ROM
COC:

WorkOrder: S1306384
CollectionDate: 6/21/2013
DateReceived: 6/24/2013
FieldSampler:
Matrix: Solid

Comments

Table with 7 columns: Analyses, Result, Units, Qual, RL, Method, Date Analyzed/Init. Rows include Sulfur (Sulfate, Pyritic, Organic) and Total Organic Carbon (Total Carbon, Total Organic Carbon).

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers: * Value exceeds Maximum Contaminant Level
C Calculated Value
H Holding times for preparation or analysis exceeded
L Analyzed by a contract laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL
O Outside the Range of Dilutions

Reviewed by: [Signature]
Wade Nieuwsma, Assistant Laboratory Manager



Date: 8/19/2013

CLIENT: Black Range Minerals
Project: Ablated
Lab Order: S1307044

CASE NARRATIVE
Report ID: S1307044001

Samples ABT October Post Screen, and October Post Ab were received on June 26, 2013.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition
40 CFR Parts 136 and 141
40 CFR Part 50, Appendices B, J, L, and O
Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012
ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by:

Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-001
ClientSample ID: October Post Ab
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/7/2013 8:30:00 AM
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Anions/Cations							
Alkalinity, Total (As CaCO3)	227	mg/L		5	SM 2320B	07/03/2013 1632	KV
Alkalinity, Bicarbonate as HCO3	262	mg/L		5	SM 2320B	07/03/2013 1632	KV
Alkalinity, Carbonate as CO3	8	mg/L		5	SM 2320B	07/03/2013 1632	KV
Chloride	37	mg/L		1	EPA 300.0	07/03/2013 1815	AMB
Fluoride	0.3	mg/L		0.1	SM 4500FC	07/03/2013 1632	KV
Nitrogen, Nitrate+Nitrite (as N)	0.8	mg/L		0.1	EPA 353.2	07/05/2013 933	RH
Sulfate	392	mg/L		5	EPA 300.0	07/03/2013 1815	AMB
Calcium	100	mg/L		1	EPA 200.7	07/03/2013 1502	BK
Magnesium	38	mg/L		1	EPA 200.7	07/03/2013 1502	BK
Potassium	8	mg/L		1	EPA 200.7	07/03/2013 1502	BK
Sodium	130	mg/L		1	EPA 200.7	07/03/2013 1502	BK
Nitrogen, Ammonia (As N)	0.2	mg/L		0.1	EPA 350.1	07/05/2013 1128	RH
Silica as SiO2	15.4	mg/L		0.1	EPA 200.7	07/03/2013 1502	BK
General Parameters							
pH	8.5	s.u.		0.1	SM 4500 H B	07/03/2013 1632	KV
Electrical Conductivity	1280	µmhos/cm		5	SM 2510B	07/03/2013 1632	KV
Total Dissolved Solids (180)	980	mg/L		10	SM 2540	07/05/2013 1042	JCG
Sulfide	ND	mg/L		0.01	HACH 8131	07/03/2013 1010	MZ
Sulfide as H2S	ND	mg/L		0.01	HACH 8131	07/03/2013 1010	MZ

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:	* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
C	Calculated Value	E Value above quantitation range
H	Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	M Value exceeds Monthly Ave or MCL
ND	Not Detected at the Reporting Limit	O Outside the Range of Dilutions
S	Spike Recovery outside accepted recovery limits	

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-001
ClientSample ID: October Post Ab
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/7/2013 8:30:00 AM
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Table with 7 columns: Analyses, Result, Units, Qual, RL, Method, Date Analyzed/Init

Metals - Dissolved

Table listing various metals (Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Manganese, Mercury, Molybdenum, Nickel, Phosphorus, Selenium, Silver, Thallium, Uranium, Vanadium, Zinc) with their respective results, units, and reporting limits.

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers: * Value exceeds Maximum Contaminant Level
C Calculated Value
H Holding times for preparation or analysis exceeded
L Analyzed by a contract laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL
O Outside the Range of Dilutions

Reviewed by: [Signature]
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-001
ClientSample ID: October Post Ab
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/7/2013 8:30:00 AM
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Table with 7 columns: Analyses, Result, Units, Qual, RL, Method, Date Analyzed/Init

Metals - Total

Table listing various metals (Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Manganese, Mercury, Molybdenum, Nickel, Phosphorus, Selenium, Silver, Thallium, Uranium, Vanadium, Zinc) with their respective results, units, and reporting limits.

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers: * Value exceeds Maximum Contaminant Level
C Calculated Value
H Holding times for preparation or analysis exceeded
L Analyzed by a contract laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL
O Outside the Range of Dilutions

Reviewed by: [Signature]
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-001
ClientSample ID: October Post Ab
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/7/2013 8:30:00 AM
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Radionuclides - Dissolved							
Gross Alpha	2940	pCi/L		2	SM 7110B	07/16/2013 1653	SH
Gross Alpha Precision (±)	28	pCi/L			SM 7110B	07/16/2013 1653	SH
Gross Beta	1140	pCi/L		3	SM 7110B	07/16/2013 1653	SH
Gross Beta Precision (±)	11	pCi/L			SM 7110B	07/16/2013 1653	SH
Lead 210	9.6	pCi/L		1	OTW01	07/22/2013 1436	SH
Lead 210 (Dissolved) Precision (±)	1.1	pCi/L			OTW01	07/22/2013 1436	SH
Polonium 210	ND	pCi/L		1	OTW01	07/22/2013 1102	SH
Polonium 210 (Dissolved) Precision (±)	NA	pCi/L			OTW01	07/22/2013 1102	SH
Radium 226	161	pCi/L		0.2	SM 7500 Ra-B	07/24/2013 1251	SH
Radium 226 Precision (±)	1.6	pCi/L			SM 7500 Ra-B	07/24/2013 1251	SH
Radium 228	2.7	pCi/L		1	Ga-Tech	08/05/2013 500	MK
Radium 228 Precision (±)	1.2	pCi/L			Ga-Tech	08/05/2013 500	MK
Thorium 230	0.2	pCi/L		0.2	ACW10	08/07/2013 1628	MB
Thorium 230 Precision (±)	0.1	pCi/L			ACW10	08/07/2013 1628	MB
Thorium 229 Tracer (30-120)	71	pCi/L			ACW10	08/07/2013 1628	MB

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - C Calculated Value
 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-002
ClientSample ID: ABT October Post Screen
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/21/2013
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Table with 7 columns: Analyses, Result, Units, Qual, RL, Method, Date Analyzed/Init. Rows include Anions/Cations (Alkalinity, Chloride, etc.) and General Parameters (pH, Conductivity, etc.).

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers: * Value exceeds Maximum Contaminant Level
C Calculated Value
H Holding times for preparation or analysis exceeded
L Analyzed by a contract laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL
O Outside the Range of Dilutions

Reviewed by: [Signature]
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-002
ClientSample ID: ABT October Post Screen
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/21/2013
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init
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Metals - Dissolved

Aluminum	ND	mg/L		0.1	EPA 200.7	07/03/2013 1507 BK
Antimony	ND	mg/L		0.005	EPA 200.8	07/03/2013 2336 MS
Arsenic	0.682	mg/L		0.005	EPA 200.8	07/03/2013 2336 MS
Barium	ND	mg/L		0.1	EPA 200.8	07/03/2013 2336 MS
Beryllium	ND	mg/L		0.01	EPA 200.7	07/03/2013 1507 BK
Boron	0.2	mg/L		0.1	EPA 200.7	07/03/2013 1507 BK
Cadmium	ND	mg/L		0.001	EPA 200.8	07/03/2013 2336 MS
Chromium	ND	mg/L		0.01	EPA 200.7	07/03/2013 1507 BK
Cobalt	ND	mg/L		0.01	EPA 200.8	07/03/2013 2336 MS
Copper	ND	mg/L		0.01	EPA 200.8	07/03/2013 2336 MS
Iron	ND	mg/L		0.05	EPA 200.7	07/03/2013 1507 BK
Lead	ND	mg/L		0.002	EPA 200.8	07/03/2013 2336 MS
Lithium	0.08	mg/L		0.01	EPA 200.7	07/03/2013 1507 BK
Manganese	0.02	mg/L		0.02	EPA 200.7	07/03/2013 1507 BK
Mercury	ND	mg/L		0.001	EPA 245.1	07/09/2013 914 CS
Molybdenum	ND	mg/L		0.02	EPA 200.8	07/03/2013 2336 MS
Nickel	ND	mg/L		0.01	EPA 200.7	07/03/2013 1507 BK
Phosphorus	0.3	mg/L		0.1	EPA 200.7	07/03/2013 1507 BK
Selenium	0.070	mg/L		0.005	EPA 200.8	07/03/2013 2336 MS
Silver	ND	mg/L		0.003	EPA 200.8	07/03/2013 2336 MS
Thallium	ND	mg/L		0.1	EPA 200.7	07/03/2013 1507 BK
Uranium	3.14	mg/L		0.0003	EPA 200.8	07/03/2013 2336 MS
Vanadium	0.65	mg/L		0.02	EPA 200.8	07/03/2013 2336 MS
Zinc	ND	mg/L		0.01	EPA 200.7	07/03/2013 1507 BK

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- C Calculated Value
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-002
ClientSample ID: ABT October Post Screen
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/21/2013
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init
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Metals - Total

Aluminum	20.3	mg/L		0.1	EPA 200.7	07/05/2013 2027 DG
Antimony	ND	mg/L		0.005	EPA 200.8	07/05/2013 1943 MS
Arsenic	2.79	mg/L		0.005	EPA 200.8	07/05/2013 1943 MS
Barium	2.0	mg/L		0.1	EPA 200.8	07/05/2013 1943 MS
Beryllium	ND	mg/L		0.01	EPA 200.7	07/05/2013 2027 DG
Boron	0.2	mg/L		0.1	EPA 200.7	07/05/2013 2027 DG
Cadmium	0.022	mg/L		0.001	EPA 200.8	07/05/2013 1943 MS
Chromium	0.07	mg/L		0.01	EPA 200.7	07/05/2013 2027 DG
Cobalt	0.02	mg/L		0.01	EPA 200.8	07/05/2013 1943 MS
Copper	0.07	mg/L		0.01	EPA 200.8	07/05/2013 1943 MS
Iron	18.4	mg/L		0.05	EPA 200.7	07/05/2013 2027 DG
Lead	0.99	mg/L		0.02	EPA 200.8	07/05/2013 1943 MS
Lithium	0.14	mg/L		0.01	EPA 200.7	07/05/2013 2027 DG
Manganese	0.37	mg/L		0.02	EPA 200.7	07/05/2013 2027 DG
Mercury	ND	mg/L		0.001	EPA 245.1	07/09/2013 1204 CS
Molybdenum	0.03	mg/L		0.02	EPA 200.8	07/05/2013 1943 MS
Nickel	0.05	mg/L		0.01	EPA 200.7	07/05/2013 2027 DG
Phosphorus	1.0	mg/L		0.1	EPA 200.7	07/05/2013 2027 DG
Selenium	0.115	mg/L		0.005	EPA 200.8	07/05/2013 1943 MS
Silver	ND	mg/L		0.003	EPA 200.8	07/05/2013 1943 MS
Thallium	ND	mg/L		0.1	EPA 200.7	07/05/2013 2027 DG
Uranium	8.31	mg/L		0.0003	EPA 200.8	07/05/2013 1943 MS
Vanadium	10.1	mg/L		0.02	EPA 200.8	07/05/2013 1943 MS
Zinc	1.82	mg/L		0.01	EPA 200.7	07/05/2013 2027 DG

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:	* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
C	Calculated Value	E Value above quantitation range
H	Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	M Value exceeds Monthly Ave or MCL
ND	Not Detected at the Reporting Limit	O Outside the Range of Dilutions
S	Spike Recovery outside accepted recovery limits	

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

Company: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 8/19/2013
Report ID: S1307044001

ProjectName: Ablated
Lab ID: S1307044-002
ClientSample ID: ABT October Post Screen
COC: 147772

WorkOrder: S1307044
CollectionDate: 6/21/2013
DateReceived: 6/26/2013 3:00:00 PM
FieldSampler:
Matrix: Water

Comments

Analyses	Result	Units	Qual	RL	Method	Date Analyzed/Init	
Radionuclides - Dissolved							
Gross Alpha	2010	pCi/L		2	SM 7110B	07/16/2013 1653	SH
Gross Alpha Precision (±)	23	pCi/L			SM 7110B	07/16/2013 1653	SH
Gross Beta	556	pCi/L		3	SM 7110B	07/16/2013 1653	SH
Gross Beta Precision (±)	7.8	pCi/L			SM 7110B	07/16/2013 1653	SH
Lead 210	23.4	pCi/L		1	OTW01	07/25/2013 1324	SH
Lead 210 (Dissolved) Precision (±)	1.2	pCi/L			OTW01	07/25/2013 1324	SH
Polonium 210	ND	pCi/L		1	OTW01	07/25/2013 958	SH
Polonium 210 (Dissolved) Precision (±)	NA	pCi/L			OTW01	07/25/2013 958	SH
Radium 226	69.4	pCi/L		0.2	SM 7500 Ra-B	07/24/2013 1251	SH
Radium 226 Precision (±)	1.1	pCi/L			SM 7500 Ra-B	07/24/2013 1251	SH
Radium 228	ND	pCi/L		1	Ga-Tech	08/05/2013 801	MK
Radium 228 Precision (±)	NA	pCi/L			Ga-Tech	08/05/2013 801	MK
Thorium 230	0.3	pCi/L		0.2	ACW10	08/08/2013 755	MB
Thorium 230 Precision (±)	0.2	pCi/L			ACW10	08/08/2013 755	MB
Thorium 229 Tracer (30-120)	62	pCi/L			ACW10	08/08/2013 755	MB

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - C Calculated Value
 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma
Wade Nieuwsma, Assistant Laboratory Manager



Sample Analysis Report

CLIENT: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 7/18/2013
Report ID: S1307135001

Project: SPLP Leached Metals
Lab ID: S1307135-001
Client Sample ID: ROM
COC: 149923

Work Order: S1307135
Collection Date: 7/10/2013 12:30:00 PM
Date Received: 7/10/2013 1:00:00 PM
Sampler:
Matrix: Water

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Dissolved Metals						
Aluminum	3.5	0.1		mg/L	07/11/2013 1756 DG	EPA 200.7
Antimony	ND	0.005		mg/L	07/10/2013 1809 MS	EPA 200.8
Arsenic	0.790	0.005		mg/L	07/10/2013 1809 MS	EPA 200.8
Beryllium	ND	0.01		mg/L	07/11/2013 1756 DG	EPA 200.7
Cadmium	ND	0.001		mg/L	07/10/2013 1809 MS	EPA 200.8
Chromium	0.01	0.01		mg/L	07/11/2013 1756 DG	EPA 200.7
Cobalt	ND	0.01		mg/L	07/10/2013 1809 MS	EPA 200.8
Lead	0.03	0.02		mg/L	07/10/2013 1809 MS	EPA 200.8
Molybdenum	ND	0.02		mg/L	07/10/2013 1809 MS	EPA 200.8
Nickel	0.03	0.01		mg/L	07/11/2013 1756 DG	EPA 200.7
Selenium	0.020	0.005		mg/L	07/10/2013 1809 MS	EPA 200.8
Silver	ND	0.003		mg/L	07/10/2013 1809 MS	EPA 200.8
Uranium	0.217	0.0003		mg/L	07/10/2013 1809 MS	EPA 200.8
Zinc	0.11	0.01		mg/L	07/11/2013 1756 DG	EPA 200.7

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - C Calculated Value
 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor



Sample Analysis Report

CLIENT: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 7/18/2013
Report ID: S1307135001

Project: SPLP Leached Metals
Lab ID: S1307135-002
Client Sample ID: Clean Sand
COC: 149923

Work Order: S1307135
Collection Date: 7/10/2013 12:30:00 PM
Date Received: 7/10/2013 1:00:00 PM
Sampler:
Matrix: Water

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Dissolved Metals						
Aluminum	0.2	0.1		mg/L	07/11/2013 1759 DG	EPA 200.7
Antimony	ND	0.005		mg/L	07/10/2013 1815 MS	EPA 200.8
Arsenic	0.064	0.005		mg/L	07/10/2013 1815 MS	EPA 200.8
Beryllium	ND	0.01		mg/L	07/11/2013 1759 DG	EPA 200.7
Cadmium	ND	0.001		mg/L	07/10/2013 1815 MS	EPA 200.8
Chromium	ND	0.01		mg/L	07/11/2013 1759 DG	EPA 200.7
Cobalt	ND	0.01		mg/L	07/10/2013 1815 MS	EPA 200.8
Lead	ND	0.02		mg/L	07/10/2013 1815 MS	EPA 200.8
Molybdenum	ND	0.02		mg/L	07/10/2013 1815 MS	EPA 200.8
Nickel	ND	0.01		mg/L	07/11/2013 1759 DG	EPA 200.7
Selenium	ND	0.005		mg/L	07/10/2013 1815 MS	EPA 200.8
Silver	ND	0.003		mg/L	07/10/2013 1815 MS	EPA 200.8
Uranium	0.0399	0.0003		mg/L	07/10/2013 1815 MS	EPA 200.8
Zinc	ND	0.01		mg/L	07/11/2013 1759 DG	EPA 200.7

These results apply only to the samples tested.

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - C Calculated Value
 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

RL - Reporting Limit

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor



Sample Analysis Report

CLIENT: Black Range Minerals
110 N Rubey Drive, Ste 201
Golden, CO 80402

Date Reported: 7/18/2013
Report ID: S1307135001

Project: SPLP Leached Metals
Lab ID: S1307135-003
Client Sample ID: Blank
COC: 149923

Work Order: S1307135
Collection Date: 7/10/2013 12:30:00 PM
Date Received: 7/10/2013 1:00:00 PM
Sampler:
Matrix: Water

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Dissolved Metals						
Aluminum	ND	0.1		mg/L	07/11/2013 1801 DG	EPA 200.7
Antimony	ND	0.005		mg/L	07/10/2013 1820 MS	EPA 200.8
Arsenic	ND	0.005		mg/L	07/10/2013 1820 MS	EPA 200.8
Beryllium	ND	0.01		mg/L	07/11/2013 1801 DG	EPA 200.7
Cadmium	ND	0.001		mg/L	07/10/2013 1820 MS	EPA 200.8
Chromium	ND	0.01		mg/L	07/11/2013 1801 DG	EPA 200.7
Cobalt	ND	0.01		mg/L	07/10/2013 1820 MS	EPA 200.8
Lead	ND	0.02		mg/L	07/10/2013 1820 MS	EPA 200.8
Molybdenum	ND	0.02		mg/L	07/10/2013 1820 MS	EPA 200.8
Nickel	ND	0.01		mg/L	07/11/2013 1801 DG	EPA 200.7
Selenium	ND	0.005		mg/L	07/10/2013 1820 MS	EPA 200.8
Silver	ND	0.003		mg/L	07/10/2013 1820 MS	EPA 200.8
Uranium	0.0004	0.0003		mg/L	07/10/2013 1820 MS	EPA 200.8
Zinc	ND	0.01		mg/L	07/11/2013 1801 DG	EPA 200.7

These results apply only to the samples tested.

RL - Reporting Limit

- Qualifiers:**
- * Value exceeds Maximum Contaminant Level
 - C Calculated Value
 - H Holding times for preparation or analysis exceeded
 - L Analyzed by a contract laboratory
 - ND Not Detected at the Reporting Limit
 - S Spike Recovery outside accepted recovery limits

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

TABLE 3.0 Groundwater Quality Data at The Sunday Mines Complex

Analytes	Units	Underground Wells								Mine	
		WS-1	WS-1	WS-2	WS-2	WS-3	WS-3	WS-4	WS-4	Sunday	West Sunday
Metals		2/23/09	3/17/09	2/23/09	3/17/09	2/23/09	3/17/09	2/23/09	3/17/09	9/16/15	9/16/15
Aluminum	ug/L	Dry	Dry	159	<100	NM	1410	<100	<100	23	720
Antimony	ug/L	Dry	Dry	<50	<50	NM	<50	<50	<50	NM	NM
Arsenic	ug/L	Dry	Dry	1040	615	NM	3870	<1	29	360	450
Barium	ug/L	Dry	Dry	<100	<100	NM	<100	<100	120	4.5	8.2
Beryllium	ug/L	Dry	Dry	<10	<10	NM	<10	<10	<10	NM	NM
Boron	ug/L	Dry	Dry	675	445	NM	401	612	324	410	500
Cadmium	ug/L	Dry	Dry	<10	<10	NM	<10	<10	<10	<0.18	<0.18
Chromium	ug/L	Dry	Dry	<50	<50	NM	<50	<50	<50	0.75	0.7
Cobalt	ug/L	Dry	Dry	<10	<10	NM	<10	<10	<10	76	NM
Copper	ug/L	Dry	Dry	<10	<10	NM	<10	<10	47	<3	<3
Iron	ug/L	Dry	Dry	55	<70	NM	563	207	155	110	45
Lead	ug/L	Dry	Dry	<50	<50	NM	<50	<50	<50	<0.13	<0.13
Lithium	ug/L	Dry	Dry	141	127	NM	143	792	847	NM	NM
Manganese	ug/L	Dry	Dry	<10	14	NM	<10	23	294	1.2	2.4
Mercury	ug/L	Dry	Dry	<1	<1	NM	<1	<1	<1	<0.06	<0.06
Molybdenum	ug/L	Dry	Dry	1090	627	NM	4870	<100	271	8600	2900
Nickel	ug/L	Dry	Dry	<50	<50	NM	<50	<50	<50	<2.4	<2.4
Selenium	ug/L	Dry	Dry	68	37	NM	1900	2	51	4300	1500
Silver	ug/L	Dry	Dry	<10	<10	NM	<10	<10	<10	NM	NM
Thallium	ug/L	Dry	Dry	<100	<100	NM	<100	<100	<100	NM	NM
Uranium	ug/L	Dry	Dry	9150	7070	NM	1650	1.4	17.9	280	1400
Vanadium	ug/L	Dry	Dry	1280	956	NM	468	<100	<100	21000	11000
Zinc	ug/L	Dry	Dry	<10	<10	NM	<10	<10	78	60	51
Radionuclides - Total											
Gross Alpha	pCi/L	Dry	Dry	13100	7140	NM	2130	15.7	17.5	307	506
Gross Alpha - Corrected	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Gross Alpha minus U	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Gross Beta	pCi/L	Dry	Dry	2930	1690	NM	497	32.8	-20	258	132
Radium 226	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	10	5.9
Radium 226 + Alpha Emitting Radium Isotopes	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Radium 228	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	<0.09	<0.14
Lead 210	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	166	17.2
Thorium 230	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	3.29	<0.04
Ac-228	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Bf-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Bf-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Ba-133	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Co-60	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Cs-134	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	<1.5	<-5.9
Cs-137	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	<-0.7	<-3
Pb-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pb-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Th-229	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	2.56	4.29
Zn-65	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Major Ions											
Alkalinity, Total as CaCO3	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	280	450
Bicarbonate as HCO3	mg/L	Dry	Dry	NM	630	NM	444	NM	412	280	430
Calcium	mg/L	Dry	Dry	-6	2	NM	<1	27	28	41	7.6
Carbonate as CO3	mg/L	Dry	Dry	NM	39	NM	63	NM	<1	<20	20
Chloride	mg/L	Dry	Dry	42	42	NM	53	516	491	100	90
Fluoride	mg/L	Dry	Dry	NM	3.5	NM	4.4	NM	1.7	2	2.2
Magnesium	mg/L	Dry	Dry	<1	<1	NM	<1	11	11	5.3	1.3
Nitrogen, Nitrate+Nitrite as N	mg/L	Dry	Dry	0.2	0.3	NM	9.3	<0.1	<0.1	2.3	10
Nitrogen, Nitrite as N	mg/L	Dry	Dry	0.1	<0.1	NM	7.2	<0.1	<0.1	<0.5	<0.2
Nitrate as N	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	2.3	10
Nitrogen, ammonia	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	<0.1	<0.1
Potassium	mg/L	Dry	Dry	NM	5	NM	8	NM	21	12	8.9
Phosphorus	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Silicon	mg/L	Dry	Dry	NM	5.2	NM	5.9	NM	4.1	4	4
Sodium	mg/L	Dry	Dry	NM	460	NM	564	NM	2240	640	550
Silica	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	8.5	8.6
Sulfide as S	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	<2	<2
Sulfate	mg/L	Dry	Dry	418	412	NM	697	4170	4260	960	610
Total Organic Carbon (TOC)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	0.96	1.2
Physical Properties											
Hardness as CaCO3	mg/L	Dry	Dry	2	5	NM	2	113	113	NM	NM
Hydroxide as CaCO3	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
TDS	mg/L	Dry	Dry	1350	1300	NM	1710	7330	6990	2000	1700
Total Suspended Solids (TSS)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	<20	<20
QA/QC											
Cation-Anion Balance	%	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Sum of AnioNM	meq/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Sum of CatioNM	meq/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
TDS (calculated)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
TDS (ratio - measured/calculated)		NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Field Parameters											
Temperature	C		15		15.51		15.34		15		
pH	s.u.		8.14		9.04		9.28		8.29		
Conductivity	mS/cm		3.272		2.108		2.658		9.719		
Dissolved Oxygen	%		26.9		18.86		18.3		14.3		
Dissolved Oxygen	mg/L		2.67		1.86		1.81		1.39		
ORP			161.8		82		133		-51.5		

Notes:

Well WS-1 had insufficient volume of water to collect samples for laboratory analysis during both February and March sampling events

NM - indicates sample was not analyzed for the indicated parameter

< - indicates that analyte was not detected above the reporting limit indicated

TABLE 3.0 Groundwater Quality Data at The Sunday Mines Complex

Analytes	Units	MW-1									
		Sunday 1	Sunday 65	SMW1 Pre	SMW1 Final	SMW11	Sun 1	Sunday MW 1	Sunday MW 1D	MW Sun 1	
Metals		12/10/12	12/10/12	9/24/13	9/24/13	9/24/13	12/10/13	3/10/14	3/10/14	5/12/14	
Aluminum	ug/L	<5000	<5000	487	411	374	968	408	380	234	
Antimony	ug/L	<6	<6	<3	<3	<3	<3	<3	<3	<3	
Arsenic	ug/L	<10	<10	5.88	<5	<5	<5	<5	<5	<5	
Barium	ug/L	<2000	<2000	<100	<100	<100	<100	<100	<100	<100	
Beryllium	ug/L	<4	<4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Boron	ug/L	<750	<750	433	420	445	514	516	501	477	
Cadmium	ug/L	<50	<50	<10	<10	<10	<10	<10	<10	<10	
Chromium	ug/L	<100	<100	<25	<25	<25	<25	<25	<25	<25	
Cobalt	ug/L	<50	<50	<10	<10	<10	<10	<10	<10	<10	
Copper	ug/L	<200	<200	<10	<10	<10	<10	<10	<10	<10	
Iron	ug/L	<1000	<1000	<100	<100	138	<100	<100	<100	<100	
Lead	ug/L	<100	<100	<10	<10	<10	<10	<10	<10	<10	
Lithium	ug/L	<2500	<2500	595	509	562	510	455	506	443	
Manganese	ug/L	<100	<100	<10	<10	11.1	<10	<10	<10	<10	
Mercury	ug/L	<2	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Molybdenum	ug/L	<100	<100	32.4	30.6	31.3	23.9	25.4	24	32.2	
Nickel	ug/L	<100	<100	<20	<20	<20	<20	<20	<20	<20	
Selenium	ug/L	<20	20.4	10.3	6.63	8.14	5.38	<5	<5	<5	
Silver	ug/L	<50	<50	<10	<10	<10	13.7	<50	<50	<10	
Thallium	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Uranium	ug/L	78.9	78.8	115	212	109	81.1	31.7	34.8	19.7	
Vanadium	ug/L	951	954	690	672	454	681	663	642	430	
Zinc	ug/L	<2000	<2000	11.7	10.3	<10	<10	<10	<10	<10	
Radionuclides - Total											
Gross Alpha	pCi/L	72.7	73.5	127	258	104	71.6	25.8	30.6	15.1	
Gross Alpha - Corrected	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Gross Alpha minus U	pCi/L	17.7	18.6	47.2	110	27.8	15.1	3.66	6.36	1.34	
Gross Beta	pCi/L	64.3	54	107	108	110	76.7	47.9	75.5	48.9	
Radium 226	pCi/L	<0.692	<0.724	<0.178	<0.466	<0.567	<0.272	<0.3	<0.3	0.33	
Radium 226 + Alpha Emitting Radium Isotopes	pCi/L	1.49	1.53	<0.724	1.25	<0.961	<0.991	<1	<1	<1	
Radium 228	pCi/L	1.21	<0.379	<0.602	<0.837	<0.516	<0.497	<1	<1	<1	
Lead 210	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Thorium 230	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Ac-228	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Bi-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Bi-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Ba-133	pCi/L	<8.69	<8.79	<7.19	<8.67	<7.62	<6.19	<10	<10	<10	
Co-60	pCi/L	<7.27	<6.68	<7.21	<6.59	<6.45	<5.46	<10	<10	<10	
Cs-134	pCi/L	<8.03	<6.59	<6.07	<7.77	<6.78	<5.69	<10	<10	<10	
Cs-137	pCi/L	<6.96	<6.13	<6.45	<6.18	<6.65	<5.37	<10	<10	<10	
Pb-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Pb-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Th-229	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Zn-65	pCi/L	<13.5	<14.9	<15	<12.4	<13.6	<9.68	<10	<10	<10	
Major Ions											
Alkalinity, Total as CaCO3	mg/L	334	331	601	510	609	687	598	583	530	
Bicarbonate as HCO3	mg/L	111	105	<1	37.2	<1	<1	1	1	<1	
Calcium	mg/L	3.69	3.67	4.01	3.81	5.84	3.97	2.44	2.32	2.39	
Carbonate as CO3	mg/L	224	226	436	473	478	505	452	457	404	
Chloride	mg/L	<250	<250	161	171	163	167	157	156	172	
Fluoride	mg/L	<2	<2	2.05	2	2.06	2.02	1.79	1.78	2.17	
Magnesium	mg/L	<3	<3	0.752	0.685	1.42	0.743	<0.5	<0.5	<0.5	
Nitrogen, Nitrate+Nitrite as N	mg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	
Nitrogen, Nitrite as N	mg/L	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	
Nitrate as N	mg/L	<10	<10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Nitrogen, ammonia	mg/L	0.374	0.414	1.46	0.985	1.39	1.37	1.35	1.65	1.6	
Potassium	mg/L	55.7	54.2	77.6	77	58.2	72	67.5	64.6	53.8	
Phosphorus	mg/L	<0.05	<0.05	<0.05	<0.05	0.0543	0.0563	<0.05	<0.05	<0.05	
Silicon	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Sodium	mg/L	871	863	956	949	953	936	1040	994	1050	
Silica	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Sulfide as S	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Sulfate	mg/L	1290	1390	1420	1580	1510	1450	1410	1440	1520	
Total Organic Carbon (TOC)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
Physical Properties											
Hardness as CaCO3	mg/L	<12.4	<12.4	13.1	12.3	20.4	13	8.03	7.73	7.88	
Hydroxide as CaCO3	mg/L	<1	<1	165	<1	130	182	146	126	126	
TDS	mg/L	2710	2700	3010	2940	3020	3050	2970	2980	2990	
Total Suspended Solids (TSS)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	
QA/QC											
Cation-Anion Balance	%	12.3	8.19	12.3	6.99	9.19	12.4	16.4	13.3	12.7	
Sum of AnionNM	meq/L	30.9	33.2	34.2	37.8	36.1	35	33.9	34.5	36.5	
Sum of CationNM	meq/L	39.5	39.1	43.9	43.5	43.4	44.9	47.3	45.1	47.1	
TDS (calculated)	mg/L	2560	2660	2970	4790	4650	3020	2980	2960	3060	
TDS (ratio - measured/calculated)		1.06	1.02	1.01	0.612	0.651	1.01	0.997	1.01	0.979	
Field Parameters											
Temperature	C	12.4	NM	16.93	19.67	NM	12.14	9.93	NM	10.07	
pH	s.u.	10	NM	11.31	10.36	NM	11.83	12.26	NM	11.38	
Conductivity	mS/cm	3949	NM	4790	4555	NM	4778	4475	NM	4543	
Dissolved Oxygen	%	NM	NM	5.8	19.1	NM	5.9	5.1	NM	4.4	
Dissolved Oxygen	mg/L	NM	NM	0.55	1.71	NM	0.65	NM	NM	NM	
ORP		89	NM	-104	-119	NM	-106	-150	NM	-142	

Notes:

- Well WS-1 had insufficient volume of water to collect samples for labo
- NM - indicates sample was not analyzed for the indicated parameter
- < - indicates that analyte was not detected above the reporting limit ind

TABLE 3.0 Groundwater Quality Data at The Sunday Mines Complex

Analytes	Units	MW-2							
		MW-Sunday #2	MW-Sunday #2 65	SMW 2 Pre	SMW 2 Final	Sun 2	Sunday MW 2	MW Sun 2	MW-SUN 2
Metals									
Aluminum	ug/L	<5000	<5000	5920	<5000	5080	6660	2160	70
Antimony	ug/L	<6	<6	<6	<6	<3	<3	<3	<0.4
Arsenic	ug/L	12	11.4	<10	<10	5.57	<5	<5	4.7
Barium	ug/L	<2000	<2000	<2000	<2000	<100	<100	<100	16
Beryllium	ug/L	<4	<4	<4	<4	<0.5	<0.5	<0.5	<0.05
Boron	ug/L	<750	<750	<750	<750	257	221	237	190
Cadmium	ug/L	<5	<5	<5	<5	<10	<10	<10	<0.1
Chromium	ug/L	<100	<100	<100	<100	<25	<25	<25	<10
Cobalt	ug/L	<50	<50	<50	<50	<10	<10	<10	<10
Copper	ug/L	<200	<200	<200	<200	<10	<10	<10	<10
Iron	ug/L	<300	<300	2730	2360	2170	2720	934	50
Lead	ug/L	<50	<50	<50	<50	<10	<10	<10	<0.1
Lithium	ug/L	<2500	<2500	<2500	<2500	115	98.4	113	114
Manganese	ug/L	<50	<50	<50	<50	36.3	35.3	14.1	<5
Mercury	ug/L	<2	<2	<2	<2	<0.5	<0.5	<0.5	<0.2
Molybdenum	ug/L	<35	<35	<35	<35	10.2	<10	10.3	<20
Nickel	ug/L	<100	<100	<100	<100	<20	<20	<20	8
Selenium	ug/L	<20	<20	<20	<20	6.27	8.49	9.85	5.5
Silver	ug/L	<50	<50	<50	<50	<10	<10	<10	<0.05
Thallium	ug/L	<2	<2	<2	<2	<2	<2	<2	<0.1
Uranium	ug/L	30	30.3	<30	<30	23.3	18.5	42.7	36.4
Vanadium	ug/L	<100	<100	<100	<100	<15	<15	<15	<5
Zinc	ug/L	<2000	<2000	<2000	<2000	22.1	<10	<10	<10
Radionuclides - Total									
Gross Alpha	pCi/L	41.6	49.8	64.1	68.5	38.4	15.5	44.7	34
Gross Alpha - Corrected	pCi/L	NM	NM	NM	NM	NM	NM	NM	9.61
Gross Alpha minus U	pCi/L	20.7	28.7	43.4	48.6	22.1	2.57	15	NM
Gross Beta	pCi/L	8.9	9.67	17.7	18.3	16.4	11.4	14.6	12
Radium 226	pCi/L	<0.623	<0.529	<0.266	<0.223	0.351	0.373	0.35	0.45
Radium 226 + Alpha Emitting Radium Isotopes	pCi/L	<0.553	<0.631	1.46	1.19	<0.963	<1	1.99	NM
Radium 228	pCi/L	<0.523	<0.516	<0.863	<0.545	<0.551	<1	<1	0.56
Lead 210	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM
Thorium 230	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM
Ac-228	pCi/L	NM	NM	NM	NM	NM	NM	NM	8.14
Bi-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	27.12
Bi-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	57.17
Ba-133	pCi/L	<6.33	<5.93	<7.99	<6.91	<6.5	<10	<10	NM
Co-60	pCi/L	<4.95	<5.24	<6.86	<5.88	<5.19	<10	<10	-1.38
Cs-134	pCi/L	<5.06	<4.88	<6.68	<5.68	<5.25	<10	<10	-9.8
Cs-137	pCi/L	<4.42	<4.04	<5.37	<5.99	<5.31	<10	<10	-2.76
Pb-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	0
Pb-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	55.69
Th-229	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM
Zn-65	pCi/L	<11.7	<7.6	<12.1	<11	<9.59	<10	<10	NM
Major Ions									
Alkalinity, Total as CaCO3	mg/L	419	423	479	469	437	407	467	597
Bicarbonate as HCO3	mg/L	212	232	435	425	399	382	427	538
Calcium	mg/L	3.96	4.01	1.91	1.89	2.22	1.96	1.66	1.4
Carbonate as CO3	mg/L	207	191	44	44	38	25.1	40.4	58.5
Chloride	mg/L	<2	<2	19.2	19	12.3	10.6	11.7	14.5
Fluoride	mg/L	<0.1	<0.1	1.76	1.76	1.93	1.79	1.67	1.83
Magnesium	mg/L	<0.5	<0.5	1.19	1.1	1.05	1.25	<0.5	<0.2
Nitrogen, Nitrate+Nitrite as N	mg/L	<10	<10	<10	<10	<10	<10	<10	0.73
Nitrogen, Nitrite as N	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.365
Nitrate as N	mg/L	<0.1	<0.1	0.197	0.215	1.31	1.65	1.24	NM
Nitrogen, ammonia	mg/L	0.0817	0.109	0.266	0.182	0.219	0.147	0.161	<0.05
Potassium	mg/L	2.12	2.12	3.13	3.06	3.38	3.29	1.97	1.2
Phosphorus	mg/L	<0.05	0.142	<0.05	<0.05	0.107	<0.05	0.108	0.03
Silicon	mg/L	NM	NM	NM	NM	NM	NM	NM	NM
Sodium	mg/L	288	293	291	294	241	241	302	299
Silica	mg/L	NM	NM	NM	NM	NM	NM	NM	NM
Sulfide as S	mg/L	NM	NM	NM	NM	NM	NM	NM	NM
Sulfate	mg/L	<4	<4	172	170	107	<4	<8	158
Total Organic Carbon (TOC)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM
Physical Properties									
Hardness as CaCO3	mg/L	10.4	10	9.68	9.27	9.86	10	5.96	3.5
Hydroxide as CaCO3	mg/L	<1	<1	<1	<1	<1	1	<1	<2
TDS	mg/L	991	800	924	937	850	814	851	820
Total Suspended Solids (TSS)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM
QA/QC									
Cation-Anion Balance	%	47.6	47.1	50.8	51.6	59.3	56.4	55.8	-10.3
Sum of AnioNM	meq/L	4.55	4.68	4.22	4.18	2.75	3	3.77	16
Sum of CatioNM	meq/L	12.8	13	12.9	13.1	10.8	10.8	13.3	13
TDS (calculated)	mg/L	753	766	782	777	636	629	761	843
TDS (ratio - measured/calculated)		1.32	1.04	1.18	1.21	1.34	1.29	1.12	0.97
Field Parameters									
Temperature	C	14.35	NM	16.55	18.51	10.6	13.18	14.89	18.51
pH	s.u.	10.21	NM	8.83	6.86	8.85	8.85	8.95	6.86
Conductivity	mS/cm	1280	NM	1295	1328	961	1070	1183	1328
Dissolved Oxygen	%	28.4	NM	9.6	18.8	7.8	30.5	8.9	18.8
Dissolved Oxygen	mg/L	2.87	NM	0.94	1.76	0.87	3.18	NM	1.76
ORP		62	NM	118	109	12	59	53	109

Notes:

Well WS-1 had insufficient volume of water to collect samples for labo

NM - indicates sample was not analyzed for the indicated parameter

< - indicates that analyte was not detected above the reporting limit ind

TABLE 3.0 Groundwater Quality Data at The Sunday Mines Complex

Analytes	Units	MW-3									
		Sunday MW-3	Sunday MW-65	SMW3 Pre	SMW 3 Final	Sun 3	Sun 33	Sunday MW 3	MW Sun 3	MW Sun 33	MW-SUN 3
Metals											
Aluminum	ug/L	<5000	<5000	216	<5000	<200	<200	314	<200	<200	50
Antimony	ug/L	<6	<6	<3	<6	<3	<3	<3	<3	<3	<0.4
Arsenic	ug/L	<10	<10	<5	<10	<5	<5	<5	<5	<5	0.9
Barium	ug/L	<2000	<2000	<100	<2000	<100	<100	<100	<100	<100	16
Beryllium	ug/L	<4	<4	<0.5	<4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.05
Boron	ug/L	<750	<750	337	<750	376	373	361	347	347	330
Cadmium	ug/L	<5	<5	<10	<5	<10	<10	<10	<10	<10	<0.1
Chromium	ug/L	<100	<100	<25	<100	<25	<25	<25	<25	<25	<10
Cobalt	ug/L	<50	<50	<10	<50	<10	<10	<10	<10	<10	<10
Copper	ug/L	<200	<200	<10	<200	<10	<10	<10	<10	<10	<10
Iron	ug/L	<300	<300	139	360	<100	<100	<100	<100	<100	<20
Lead	ug/L	<50	<50	<10	<50	<10	<10	<10	<10	<10	<0.1
Lithium	ug/L	<2500	<2500	115	<2500	121	113	107	100	103	100
Manganese	ug/L	<50	<50	<10	<50	<10	<10	<10	<10	<10	<5
Mercury	ug/L	<2	<2	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
Molybdenum	ug/L	<35	<35	<10	<35	<10	<10	<10	<10	<10	<20
Nickel	ug/L	<100	<100	<20	<100	<20	<20	<20	<20	<20	<8
Selenium	ug/L	<20	<20	<5	<20	<5	<5	<5	<5	<5	<0.1
Silver	ug/L	<50	<50	<10	<50	<50	<50	<10	<10	<10	<0.05
Thallium	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<0.1
Uranium	ug/L	<30	<30	<3	<30	<3	<3	<3	<3	<3	0.8
Vanadium	ug/L	<100	<100	<15	<100	<15	<15	<15	<15	<15	6
Zinc	ug/L	<2000	<2000	<10	<2000	<10	<10	<10	<10	<10	<10
Radionuclides - Total											
Gross Alpha	pCi/L	3.02	1.89	<4.43	13.7	705	560	<1	<1	<1	110
Gross Alpha - Corrected	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	109
Gross Alpha minus U	pCi/L	-4.82	-6.34	0.259	13	704	558	-0.514	1.16	0.888	NM
Gross Beta	pCi/L	2.91	<2.05	3.14	6.46	249	254	<1	<1	<1	67
Radium 226	pCi/L	1.73	1.82	1.24	1.6	7.68	1.17	0.864	0.848	0.791	17
Radium 226 + Alpha Emitting Radium Isotopes	pCi/L	1.35	1.19	1.76	1.97	32.1	32.1	<1	1.38	1.51	NM
Radium 228	pCi/L	<0.696	<0.637	<0.533	<0.593	<0.541	<0.516	<1	<1	<1	1.7
Lead 210	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Thorium 230	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Ac-228	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.01
Bf-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	-0.51
Bf-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	50.74
Ba-133	pCi/L	<5.33	<7.47	<6.95	<6.23	<7.18	<8.55	<10	<10	<10	
Co-60	pCi/L	<5.35	<7.03	<6.02	<5.5	<5.02	<6.26	<10	<10	<10	-2.15
Cs-134	pCi/L	<4.96	<5.77	<5.72	<5.08	<5.88	<7.19	<10	<10	<10	-2.96
Cs-137	pCi/L	<5.01	<5.33	<4.5	<5.41	<5.01	<6.29	<10	<10	<10	1.44
Pb-212	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	16.37
Pb-214	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	27.33
Th-229	pCi/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Zn-65	pCi/L	<8.8	<9.82	<9.29	<11.8	<12	<15.9	<10	<10	<10	NM
Major Ions											
Alkalinity, Total as CaCO3	mg/L	462	473	378	377	416	456	377	381	371	454
Bicarbonate as HCO3	mg/L	318	330	252	251	269	375	236	255	240	197
Calcium	mg/L	0.853	0.888	0.577	1.82	0.801	0.818	0.657	0.624	0.634	0.6
Carbonate as CO3	mg/L	145	142	126	127	147	81.5	141	126	131	258
Chloride	mg/L	27.2	25.9	36.4	36.5	36.3	36.1	33.9	36	36	38.6
Fluoride	mg/L	1.74	1.73	1.95	1.95	1.87	1.87	1.8	1.88	1.85	1.97
Magnesium	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
Nitrogen, Nitrate+Nitrite as N	mg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.02
Nitrogen, Nitrite as N	mg/L	0.246	0.222	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.015
Nitrate as N	mg/L	0.134	0.169	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NM
Nitrogen, ammonia	mg/L	0.118	0.396	0.264	0.303	0.326	0.301	0.257	0.263	0.251	0.34
Potassium	mg/L	3.6	3.59	2.7	3.05	3.19	3.08	2.33	2.13	2.35	2.4
Phosphorus	mg/L	<0.05	<0.05	0.0541	<0.05	0.982	0.884	<0.05	0.0864	0.37	0.55
Silicon	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Sodium	mg/L	284	286	274	275	273	273	279	291	299	278
Silica	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Sulfide as S	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Sulfate	mg/L	152	144	199	198	197	196	<8	<8	<8	186
Total Organic Carbon (TOC)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Physical Properties											
Hardness as CaCO3	mg/L	2.66	2.91	1.44	5.4	2	2.04	1.64	1.56	2.08	1.5
Hydroxide as CaCO3	mg/L	<2	<2	<1	<1	<1	<1	1	<1	<1	<2
TDS	mg/L	760	790	797	751	766	754	776	774	766	770
Total Suspended Solids (TSS)	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
QA/QC											
Cation-Anion Balance	%	51.1	53.1	39	39.5	39.5	39.7	41.7	42.5	44.1	-7.7
Sum of AnioNM	meq/L	4.04	3.85	5.28	5.26	5.21	5.19	5.03	5.16	5.08	14
Sum of CatioNM	meq/L	12.5	12.6	12	12.1	12	12	12.2	12.8	13.1	12
TDS (calculated)	mg/L	750	749	744	746	764	788	737	758	756	783
TDS (ratio - measured/calculated)		1.01	1.05	1.07	1.01	1	0.957	1.05	1.02	1.01	0.98
Field Parameters											
Temperature	C	25.26	NM	18.06	18.13	13.26	NM	19.01	14.23	NM	20.72
pH	s.u.	9.06	NM	9.55	9.5	9.25	NM	9.91	9.59	NM	9.51
Conductivity	mS/cm	1245	NM	1284	1253	1239	NM	1188	1207	NM	1307
Dissolved Oxygen	%	31.3	NM	15.7	15.5	32.9	NM	15.2	25.2	NM	32.9
Dissolved Oxygen	mg/L	2.59	NM	1.48	1.46	3.44	NM	NM	NM	NM	2.95
ORP		34	NM	4	87	-52	NM	-15	58	NM	67

Notes:

Well WS-1 had insufficient volume of water to collect samples for labo

NM - indicates sample was not analyzed for the indicated parameter

< - indicates that analyte was not detected above the reporting limit ind