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REPORT

STANDARD MINE PILOT PASSIVE TREATMENT SYSTEM OPERATIONS AND RESULTS FOR 2007 AND 2008

STANDARD MINE SUPERFUND SITE
CRESTED BUTTE, COLORADO

Submitted to:

ORD Engineering Technical Support Center
National Risk Management Research Laboratory
U. S. Environmental Protection Agency
Cincinnati, Ohio 45268

Submitted by:

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APC – Aerobic Polishing Cell
BCR – Biochemical reactor
BOD – Biochemical oxygen demand
COC – Constituent of concern
MIW – Mining influenced water
UOS – URS Operating Services Inc.
ORP – Oxidation-reduction potential
ORD – Office of research and development (EPA)
EPA – Environmental Protection Agency
ETSC – Engineering Technical Support Center
TSS – Total suspended solids

1.0 EXECUTIVE SUMMARY

In 2007, the Engineering Technical Support Center, Office of Research and Development of the United States Environmental Protection Agency directed Golder Associates Inc. to develop plans, procure material, and construct a pilot-scale system (Pilot) to treat mine influenced water (MIW) at the Standard Mine Superfund Site near Crested Butte, Colorado. The constituents of concern are cadmium, copper, iron, lead, manganese, and zinc. The Pilot consists of three passive treatment unit processes: a biochemical reactor, a chitin reactor, and an aerobic polishing cell. Passive treatment systems are low-maintenance, low-operating cost water treatment methods that require neither continuous input of chemicals nor generate a significant waste stream. The goal of the Pilot test was to operate and monitor the performance of a passive water treatment system year-round at cold, remote site. The treatment goal of the Pilot test is to reduce the COCs to levels below the applicable standards.

Passive treatment systems have been widely employed to treat MIW over the past 20 years at multiple sites across the U.S. and abroad (Gusek and Wildeman, 2002). More specifically, the biochemical reactor (BCR) technology has been effective at treating metal-laden MIW via biological reduction of sulfate and removal of metals as metal sulfide precipitates (Gusek, 2002). As with any biological process, the rate of microbial treatment is dependent on temperature. Hence, one of the goals of the Pilot is to document the performance of biological treatment (e.g., BCR) in a high-altitude environment with a cold climate. Although significant research has been completed on BCR treatment performance, there has been limited distribution of information on cold-weather performance of BCRs (Ether 2007, Kuyacak et al. 2006, Smith and Kalin 1997, Higgins and Mattes 2003, Reisinger and Gusek 1999, Eger and Wagner 2001). Of the three unit processes, the Pilot BCR has been in operation the longest, 13 months, and is therefore the focus of this treatment report. The chitin reactor was monitored for two months and the aerobic polishing cell was constructed in late 2008 and has not yet been monitored. This report is intended to be a record of the Pilot design, construction, operation, and treatment performance for the period of August 2007 to September 2008.

Treatment results from the first 13 months of BCR operation demonstrate high levels of metal removal; removal rates for cadmium, copper, lead and zinc were 98% or 99%. High levels of iron levels of iron and manganese removal will occur aerobically in the aerobic polishing cell. The Pilot performance has demonstrated that passive, biological treatment of MIW is feasible at cold, remote sites. Despite the high removal rate, however, the BCR effluent exceeds the stringent water quality standards for cadmium, lead, and zinc. Results from the first two months of chitin reactor show inconsistent manganese removal rates; further monitoring of this reactor is recommended.

2.0 INTRODUCTION

In 2007, the Engineering Technical Support Center (ETSC), Office of Research and Development of the United States Environmental Protection Agency (EPA) directed Golder Associates Inc. (Golder) to develop plans, procure materials, and construct a Pilot to treat MIW at the Standard Mine Superfund Site (Site) near Crested Butte, Colorado. The constituents of concern (COCs) are cadmium, copper, iron, lead, manganese, and zinc. The Pilot consists of three passive treatment unit processes: a BCR, a chitin reactor, and an aerobic polishing cell (APC). Passive treatment systems are low-maintenance, low-operating cost water treatment methods that require neither continuous input of chemicals nor generate a significant waste stream, and most require little or no energy inputs. The goal of the Pilot test was to operate and monitor the performance of a passive water treatment system year-round at a cold, remote site. The treatment goal of the Pilot test is to reduce the COCs to levels below the applicable standards.

Passive treatment systems have been widely employed to treat MIW over the past 20 years at multiple sites across the U.S. and abroad (Gusek and Wildeman, 2002). More specifically, the BCR technology has been effective at treating metal-laden MIW via biological reduction of sulfate and removal of metals as metal sulfide precipitates (Gusek, 2002). As with any biological process, the rate of microbial treatment is dependent on temperature. Hence, one of the goals of the Pilot is to document the performance of biological treatment (BCR) in a high-altitude environment with a cold climate. Although significant research has been completed on BCR treatment performance, there has been limited distribution of information on cold-weather performance of BCRs. A literature search revealed that only a handful of BCRs has been installed in cold or arctic climates (Ether 2007, Kuyacak et al. 2006, Smith and Kalin 1997, Higgins and Mattes 2003, Reisinger and Gusek 1999, Eger and Wagner 2001). In addition to cold weather, the Pilot was configured to withstand annual snowfall of up to 700 inches and was instrumented to allow remote monitoring of treatment performance. Of the three unit processes, the Pilot BCR has been in operation the longest, 13 months, and is therefore the focus of this treatment report. The chitin reactor was monitored for two months and the APC (constructed in late 2008) has yet to be monitored.

This report is intended to be a comprehensive record of the Pilot layout development, construction, operation, and treatment performance. The main body of the report contains site background information and Pilot treatment performance results. A detailed description of the Pilot layout and construction, including construction photographs, is provided in Appendix A. The results of frozen sample analysis are provided in Appendix B; field sheets and laboratory results are provided in Appendices C – G, and PHREEQC modeling results are provided in Appendix H.

2.1 Site Background

The Standard Mine is located on 10 acres in the Ruby Mining District of the Gunnison National Forest approximately 30 miles north of Gunnison and 10 miles west of the Town of Crested Butte, Gunnison County, Colorado (Figure 1). Mining activity began at Standard Mine around 1874. However, the most significant operations began in 1931 with the mining of lead, zinc, silver, and gold. Operations ceased in 1966 and the mine was abandoned. Wastes at Standard Mine continue to impact surface water in the area. The Level 1 Adit water drains into Elk Creek, which is devoid of all aquatic life, and feeds directly into Coal Creek. Crested Butte's drinking water supply intake is located on Coal Creek four miles downstream from the former mine.

From a water treatment perspective, the site presented several challenges since the mine adit was at an elevation of 11,000 feet a.m.s.l.(3,353 meters), had no available electric power, and limited access for six or more months during the winter season.

2.2 Climate

The Site climate is characterized by long cold winters and short summers. A NRCS weather station on Schofield Pass (Station No. CO07K115) is the closest weather station located at a similar elevation (10,700 feet a.m.s.l.) to the Site. The Schofield Pass average annual temperature is -0.1 °C, the average winter (December through February) temperature is -9.2 °C, and the average summer (June through August) temperature is 9.6 °C. Snow cover usually exists from mid November through May or June. The annual snowfall typically ranges from 400 to 700 inches (1.0 to 1.8 meters).

2.3 Constituents of Concern and Regulatory Criteria

The COCs which exceed the surface water quality standards for Elk Creek are cadmium, copper, iron, lead, manganese, and zinc. The Pilot influent COC concentrations for the treatment period (August 2007 – September 2008), as well as the applicable standards, are provided in Table 1.

3.0 DESCRIPTION OF TREATMENT TECHNOLOGIES

The initial Pilot concept included a biochemical reactor (BCR) for metals removal, an APC to polish the BCR effluent, and a manganese removal bed (MRB) to reduce effluent manganese concentrations. The MRB has yet to be completed; it may be constructed at a later date. During the summer of 2008, a chitin reactor was installed as an alternative method of manganese removal. The Pilot layout is shown on Figure 2. A description of the three technologies that have been installed (BCR, chitin, APC) follows.

3.1 Biochemical Reactors

A BCR is a gravity-flow bioreactor with a limestone-buffered organic treatment media which requires minimal operation and maintenance (Gusek, 2002). Typical full-scale BCRs resemble bermed ponds and operate as vertical-flow reactors. The limestone-buffered organic substrate (LBOS) is typically a mixture of organic materials (hay, wood chips, sawdust), fine-grained limestone, and a bacterial inoculum (e.g. cow manure). Thomas (2002) characterized the following BCR treatment processes:

- biological reduction of sulfate to sulfide, and subsequent precipitation of metal sulfides;
- alkalinity increase due to dissolution of limestone contained within the substrate;
- precipitation of metal hydroxides, and
- sorption of trace metals (e.g., cadmium, copper, lead, zinc) to metal hydroxides and the organic media.

The biological production of alkalinity in concert with sulfate reduction is also a well-documented BCR process (Wildeman et al. 1993).

The Pilot BCR cell was completed in August 2007 and began treating water in September 2007.

3.2 Aerobic Polishing Cells

BCR treatment can generate elevated levels of nuisance parameters as a result of the biological treatment, including biochemical oxygen demand (BOD), total suspended solids (TSS), ammonia, nitrate/nitrite, and *E. coli* bacteria. APCs are a type of aerobic polishing treatment that can reduce the concentrations of nuisance parameters. In addition, APCs can reduce iron and manganese concentrations after BOD levels decrease. Aerobic polishing cells are usually constructed as surface-flow systems and typically contain planted areas and open water zones. Typical APCs are constructed as several small, terraced cells with intermediate spill points.

The Pilot APC is a horizontal-flow system consisting of three treatment cells. The first and last cells were constructed with a combination of free water surface and planted areas. The second cell was constructed as a free water surface zone. The free water surface areas of the APC are intended to promote aeration/oxidation, settling, and BOD removal from the BCR effluent. The planted areas help to filter out TSS. The Pilot APC was completed and began treatment in September 2008.

3.3 Chitin Reactor

The chitin reactor treatment media is ChitoRem™, a commercially-available remediation product available from JRW Bioremediation (Lenexa, KS). The ChitoRem™ used in the testing was the SC-20 product which is largely composed of crab-shell chitin. ChitoRem™ is used for the bioremediation of a broad range of constituents including chlorinated solvents, metals, and mining influenced waters (Korte et al. 2008). The material is about 20% chitin (general formula $C_9H_{15}O_5N$), 40% limestone ($CaCO_3$), and 30% protein (Ruiz et al. 2008, JRW Bioremediation, personal communication). Similar to the BCR technology, ChitoRem™ can be placed in a flow through reactor which should subsequently create anaerobic conditions conducive to sulfate reduction and metal removal. ChitoRem™ has also been shown to be effective at manganese removal (Venot et al. 2008). The chitin reactor is an emerging technology whose chemical reactions and manganese removal mechanisms are not completely understood. Unlike the BCR technology, the use of ChitoRem™ to treat MIW has only begun to receive attention over the past several years and long-term treatment performance has not been documented.

To further evaluate the technology, a Pilot chitin reactor was installed at the site to remove manganese from the Pilot BCR effluent. The chitin reactor was constructed and began treatment in July 2008. The BCR effluent is evenly split between the chitin reactor and the APC as shown in Figure 2. In 2009, the APC and chitin reactor will continue to operate in parallel in order to allow direct comparison of the two technologies.

A detailed description of the Pilot sizing and construction is provided in Appendix A.

4.0 PILOT SAMPLING, FLOW MONITORING, DATA TRANSMISSION, OPERATIONAL HISTORY

Monitoring of the Pilot was limited to the BCR and chitin reactors; monitoring of the APC will begin in 2009. The BCR was equipped with ISCO™ 6712 autosamplers, Hydrolab™ sondes, and data transmission hardware. The chitin reactor was monitored manually by field personnel only.

4.1 SAMPLING

Sampling procedures varied during seasons when the Site was accessible (July through October) and months when the Site was inaccessible due to snow (November through June). These two periods will be termed summer and winter for the purposes of this report. Winter access to the Site was limited and was only possible on snowshoes and skis when weather and avalanche conditions permitted. Three winter trips were made to the Site during the 2007-2008 winter for Pilot maintenance and sample collection.

4.1.1 Summer Sampling

During summer months when the Site was accessible, BCR and chitin field parameter measurements were conducted by URS Operating Services Inc. or EPA personnel according to the schedules presented in Tables 2 and 3. Field measurements of pH, temperature, oxidation reduction potential, (ORP), dissolved oxygen, and specific conductance were performed using a field-calibrated YSI™ 556 multi-meter. Influent and effluent BCR field parameters (pH, temperature, ORP) were also measured at 15 minute intervals on a year-round basis by Hach™ sondes.

Summer water quality samples were collected for laboratory analysis of target analytes presented in Tables 2 and 3. Samples to be analyzed for dissolved metals, total metals, alkalinity, and sulfate concentrations were stored on-ice and submitted to the EPA ORD laboratory in Cincinnati, OH under chain-of-custody protocols. Samples collected for analysis of BOD, *E. coli*, sulfide, nitrate/nitrite, and ammonia were stored on ice and transported to the Gunnison Wastewater Treatment Facility Laboratory under chain of custody protocols. Sulfide samples were submitted to ACZ Laboratories in Steamboat Springs, CO under chain of custody protocols.

4.1.2 Winter Sampling

Winter BCR influent and effluent water quality samples were collected by ISCO™ 6712 autosamplers. The autosampler bottles were pre-filled with nitric acid in order to preserve the samples. The ISCO samples were periodically collected on site visits and submitted to the EPA ORD laboratory under chain-of-custody protocols for analysis of total metals. When collected, the ISCO samples were not observed to be frozen; this probably occurred because the autosamplers were housed in an insulated and quasi-heated shed. The potential effects of frozen samples on laboratory metals analysis was a concern at the outset of the project and laboratory testing was completed to address this concern. The detailed results of this testing are provided in Appendix B but the test data suggest that sample freezing did not affect analytical results. The chitin reactor is not equipped with autosampling equipment and therefore can only be sampled during summer months.

4.2 Flow Monitoring

The BCR influent flow rate was monitored using a TRACOM™ 60^{o} trapezoidal flume and an ISCO™ 700 bubbler module installed on the influent ISCO™ 6712 autosampler. The bubbler module enabled the ISCO™ sampler to measure the water level in the flume and calculate the associated flow rate.

4.3 Remote Monitoring

In order to remotely monitor the BCR performance during the winter, the Pilot was equipped with Stratolink™ satellite units that transmitted field parameter (pH, temperature, ORP) and flow data. The data were typically viewable within several hours on ISCO's Sampler Station Access™ webpage. Field parameter and flow data were typically downloaded from the webpage on a monthly schedule.

4.4 Operational History

4.4.1 BCR Operational History

Upon completion of BCR construction, the cell was filled with Level 1 Adit MIW on 8/9/07 and allowed to incubate for two weeks. Beginning on 8/22/07, BCR effluent water was pumped back into the BCR for four weeks in order to re-circulate the high organic matter in the effluent water and to stimulate biological activity. The volume of the re-circulation water was equivalent to three BCR pore volumes, or about 54,000_liters. BCR effluent temperature was typically about 5^0C higher than the influent temperature during the start up period.

On 9/19/07, after two weeks of incubation and four weeks of recirculation, the BCR began receiving an average daily flow of 1 gpm (3.8 liters per minute) of adit water. The BCR effluent was routed directly to Elk Creek, as the APC had not been completed. Between 9/19/07 and 10/15/08, flow to the BCR varied from the design flow rate of 1 gpm during the following periods:

- 1/4/08 - 1/25/08 -_This flow stoppage was likely due to persistent cloudy weather which did not allow the solar-powered influent pump to recharge.
- 2/28/08 – 4/2/08 – This flow stoppage was due to influent pump failure. The pump was replaced during a Site visit on 4/2/08.
- 4/2/08 – 4/28/08 - Flow to the system stopped most likely due to clogging of the infiltration gallery.
- 6/ 27/08 – 7/23/08 – Flow to the BCR stopped due to clogged delivery pipes.
- 7/23/08 – 10/8/08 - The BCR flow rate was increased to 2 gpm from July 23 through October 8, 2008 to test BCR performance at a higher flow rate.

In summary, flow to the BCR was unintentionally suspended for about 15 weeks during the first year of operation due to pump failure, infiltration gallery clogging, and delivery pipe clogging. The average daily BCR flow rate from September 2007 through September 2008 is provided on Figure 3.

4.4.2 Chitin Operational History

The chitin reactor receives gravity flow of BCR effluent. The chitin reactor began treating water on 7/30/08 and continued to receive flow through 10/2/08 without apparent interruption. BCR effluent flows into a gravity distribution box, which is intended to evenly split the effluent flow between the APC and the chitin reactor. There are no flow measuring devices for the chitin reactor; the chitin flow rate is assumed to be one-half of the BCR flow rate. The chitin flow rate is also shown on Figure 3.

5.0 BCR TREATMENT RESULTS

The BCR treatment results are divided into field parameters, COCs, general performance parameters, and nuisance parameters. The numeric results presented below are limited to the operating period (9/19/07 -10/15/08) and for simplicity do not include the samples collected during the startup period (incubation or re-circulation period 8/9/07 -9/19/07) or periods of flow stoppage as these are atypical operating conditions. The BCR results are shown on Figures 4 – 14. Unlike the numeric results presented below, the data presented on the figures include the results from the startup period, treatment period, and periods of flow stoppage. All data points were included on the graphs for the sake of completeness.

5.1 Field Results

The field results include field parameters measured manually and sonde measurements.

pH- Field and sonde measurements collected at the BCR influent and effluent are provided in Figure 4. Sonde measurements were consistent with field measurements recorded during sample collection activities. Influent field and sonde pH readings ranged from 3.8 to 7.1 s.u.; effluent field and sonde pH ranged from 5.7 to 7.8 s.u. The stream standard for pH is 6.5 to 9.5 s.u. The BCR effluent pH was less than 6.5 s.u. at the beginning of the operating period and again during late July and August 2008, perhaps in response to the higher than minimal flow. The low effluent pH values during the startup period are typical and are likely due to biological fermentation which produces acidity. BCR effluent typically ranges from 6.0 to 8.0 s.u.; values between 6.0 and 6.5 s.u. are not unexpected.

Temperature **-** In general, the rate of biological treatment is positively correlated with temperature. Influent field and sonde temperature measurements varied from 1.2 to 13 degrees Celsius (^{o}C), effluent field and sonde temperature ranged from 1.6 to 11.9 ^{o}C. The average influent and effluent sonde measurements were 3.2 and 3.9 ^{o}C for the operating period. As expected at a cold site, the sonde data revealed significant seasonal variation in both the influent and effluent BCR water temperature. Notable differences were observed between field and sonde temperature measurements (Figure 5). These differences are likely due to ambient temperature influencing the field measurements during sample collection activities. Daily minimum ambient temperature, as measured at the Schofield Pass weather station, is included on Figure 5. The lowest daily minimum temperature was -28^{o}C on 12/29/07, 1/17/08, and 1/18/08.

Oxidation Reduction Potential - Negative ORP values indicate anaerobic conditions conducive to sulfate reduction. Influent ORP field and sonde measurements ranged from 19 to 748 millivolts (mv); effluent sonde readings ranged from -62 to –543 mv. Significant differences were observed between the sonde and the field measurements because the sonde ORP probes did not hold calibration. The sondes were calibrated infrequently during the winter due to limited site access and the ORP calibration only appeared to hold for several days. As such, the sonde ORP data are considered qualitative and only indicative of reducing or oxidizing conditions in general. Both the field measurements and sonde data indicated that the BCR effluent was consistently anaerobic, which was a primary operational goal.

Dissolved Oxygen - Dissolved oxygen was measured during summer sampling only. Influent dissolved oxygen ranged from 4.0 to 11 mg/L. BCR effluent dissolved oxygen ranged from 3.5 to 0.37 mg/L. Generally, the effluent dissolved oxygen concentrations were less than 2 mg/L.

Specific Conductance - Influent specific conductance (conductivity) measurements ranged from 0.32 to 0.68 mS/cm. Effluent conductivity readings varied from 0.57 to 2.6 mS/cm. The elevated effluent conductivity readings observed during startup were likely due to the dissolution of limestone and organic matter. As the BCR matured, effluent conductivity measurements decreased and were similar to influent concentrations.

5.2 Contaminants of Concern

The water quality standards for five of the six COCs (cadmium, copper, lead, manganese, and zinc) are for the dissolved fraction. The iron standard is the only total recoverable standard. Total and total recoverable analysis is considered identical and the terms are used interchangeably. From 2007 to 2008, 48 samples were analyzed for total concentrations and 21 dissolved analyses were performed (Section 4.1). The laboratory results are presented in Table 4. A summary table of COC concentrations and the applicable standards is provided in Table 6. For graphing purposes and data analysis, laboratory results that were below the detection limit were assumed to be equal to one-half the laboratory detection limit. Similar to the presentation of field parameters, the COC results discussed below are limited to the period when the BCR cell was in operation. The figures, on the other hand, contain all data measurements including those collected during periods of flow stoppage. All data points were included on the graphs for the sake of completeness.

***Cadmium* -** Influent dissolved cadmium concentrations were fairly consistent, ranging from 0.11 to 0.17 mg/L. Total and dissolved concentrations were generally equal, indicating the influent cadmium is predominantly in the dissolved (particle size less than 0.45 microns) form. BCR effluent dissolved cadmium concentrations ranged from below the detection limit of 0.0024 mg/L to 0.0049 mg/L. Of the 17 dissolved analyses performed, six resulted in dissolved concentrations greater than the detection limit (36%). The average percent removal for cadmium was 98.5%.

The chronic cadmium water quality standard (0.00025 mg/L) is less than the EPA laboratory detection limit for cadmium (0.002 mg/L). As seen on Figure 7, it appears that the effluent cadmium concentrations were consistently above the chronic standard. However, given the relatively high detection limit, it is possible that the effluent concentrations were below the chronic standard.

***Copper* -** Influent dissolved copper concentrations ranged from 0.04 to 1.06 mg/L. Dissolved concentrations were generally similar to total concentrations. Of the 17 dissolved copper analyses performed on BCR effluent water, only one sample (6% of analyses) exceeded the chronic standard. These results indicate the BCR is capable treating dissolved copper to levels below the chronic standard. The average dissolved copper percent removal was 98.6%.

***Iron* -** Unlike the other COCs, the water quality standard for iron is for the total recoverable fraction. Influent total iron concentrations ranged from 0.16 to 21 mg/L. BCR effluent iron concentrations varied considerably. From August 2007 through November 14, 2007, BCR effluent total and dissolved iron concentrations were consistently greater than influent concentrations, and consistently greater than the chronic standard of 1 mg/L. The reducing conditions in the BCR have the potential to mobilize redox sensitive metals, such as iron and manganese. This condition has been observed before during startup of new BCR cells and is due to the release of iron from the BCR substrate material. Once the iron present in the substrate had been depleted, the Pilot BCR began consistently reducing influent iron concentrations. Of the 36 total iron analyses performed on BCR effluent after November 14, 2007, eight (22% of analyses) exhibited iron concentrations above the chronic standard of 1 mg/L. Total and dissolved concentrations have been below 1 mg/L since August 1, 2008. The average percent removal for total iron was 65%.

***Lead* -** Influent dissolved lead concentrations ranged from below the detection limit of 0.008 mg/L to 2.23 mg/L. Dissolved influent concentrations were generally slightly lower than the total concentrations. The BCR effluent lead concentrations varied from below the detection limit of 0.008

mg/L to 0.034 mg/L. The highest effluent lead concentrations were observed during startup of the cell. Dissolved lead concentrations were below the laboratory detection limit in all samples collected in 2008. The average percent removal for dissolved lead was 98.1%.

The chronic water quality standard for lead (0.0012 mg/L) is less than the EPA laboratory detection limit for lead (0.008 mg/L).

Manganese **-** Dissolved influent manganese concentrations ranged from 5.3 to 12.7 mg/L. Dissolved influent concentrations were comparable to total concentrations; practically all of the manganese present in the BCR influent was present in the dissolved from. BCR effluent manganese varied considerably throughout the monitoring period. Initially, BCR effluent manganese concentrations were greater than influent concentrations, indicating manganese was being released by the substrate. Similar to iron behavior, the effluent manganese concentrations decreased to less than influent concentrations around November 14, 2007. However, during the 2007-2008 winter, effluent manganese concentrations increased considerably, reaching a peak concentration of 21 mg/L on May 7, 2008. From August 2, 2008 through October 2, 2008, BCR effluent manganese concentrations were consistently lower than influent concentrations. Influent and effluent dissolved manganese concentrations were above the water quality standards in all samples. The BCR technology does not treat manganese; the chitin and APC reactors were installed to remove manganese from BCR effluent.

Zinc **-** Influent dissolved zinc concentrations ranged from 21.0 to 30.9 mg/L. Total and dissolved concentrations were almost identical during the monitoring period. Compared to other COCs, influent zinc concentrations were relatively stable during the monitoring period. Dissolved effluent zinc concentrations ranged from below 0.009 mg/L to 1.5 mg/L. The average dissolved effluent concentration, 0.55 mg/L, exceeded the chronic standard, 0.069 mg/L. The average percent removal rate for dissolved zinc was 97.9%.

5.3 General Performance Parameters

Calcium **-** Calcium concentrations indicate whether the limestone present in the BCR cell is being dissolved and if so, its rate of dissolution. The dissolution rate can be used to estimate the limestone longevity as discussed further in Section 7.0. Influent total calcium concentrations ranged from 34 to 93 mg/L. BCR effluent calcium concentrations ranged from 80 to 265 mg/L. Dissolved and total calcium concentrations were practically identical during the monitoring period.

Alkalinity - Influent alkalinity concentrations varied from 26 to 73 mg/L as CaCO3. BCR effluent alkalinity concentrations ranged from 242 to 1,270 mg/L as CaCO3. The increase in alkalinity is due to limestone dissolution and sulfate reduction, which generates one mole of alkalinity per mole of sulfate reduction. The highest effluent alkalinity concentrations were observed in the fall of 2007 during BCR startup. In 2008, effluent concentrations ranged from 156 to 468 mg/L as CaCO3.

Sulfate and Sulfide - BCR effluent sulfate concentrations were consistently less than influent sulfate concentrations (Figure 14) indicating that sulfate reduction was occurring in the BCR. Influent and effluent sulfide concentrations were measured 12 times during the 2007 and 2008 sampling seasons. Sulfide was not detected in the influent samples at concentrations above the laboratory detection limits. Effluent sulfide concentrations ranged from 0.9 to 27.5 mg/L. During 2008, the average effluent sulfide concentration was 21 mg/L. The presence of sulfide is a direct indicator of sulfate reduction.

5.4 Nuisance Parameters

BCR effluent water can contain nuisance parameters including BOD, *E. coli* bacteria, and nitrogen species. In a full-scale treatment system, the BCR is a single unit process that is typically followed by an aerobic unit process which treats the nuisance parameters. The recently completed APC at the Site will reduce the concentrations of the nuisance parameters.

Biochemical Oxygen Demand – Nine influent and effluent samples were analyzed for BOD from September 2007 through October 1, 2008. Influent BOD concentrations ranged from below the laboratory detection limit of 0.05 mg/L to 3.91 mg/L. Effluent concentrations ranged from 30 mg/L to 314 mg/L. The source of the BOD is the organic material that is being microbially degraded within the BCR cell. Higher effluent BOD concentrations were observed in the fall of 2007, during BCR startup. In 2008, effluent BOD ranged from 30 to 139 mg/L, indicating the BCR was approaching maturity. BCR effluent BOD concentrations are expected to decrease as the cell ages.

***E. coli* -** *E. coli* bacteria are an indicator of fecal contamination. Since animal manure was used as a BCR substrate ingredient, BCR effluent samples were analyzed for *E. coli* concentrations. From September 2007 through October 2008, nine BCR effluent samples were collected and analyzed for *E. coli*, one influent sample was analyzed for *E. coli* during this time. The analysis of the influent sample resulted in a concentration below the laboratory detection limit. BCR effluent concentrations ranged from below the laboratory detection limits to $1.2x10^7$ counts per 100 mL. *E. coli* was not detected in BCR effluent samples collected in 2008. The decrease in *E. coli* is expected as the manure is flushed from the cell or the *E. coli* bacteria are destroyed by the environmental conditions at the Site (e.g., cold temperature, acidic water).

Nitrogen - Nitrogen is a vital nutrient for biological treatment. All of the organic materials in the BCR contain nitrogen that is mobilized and partially consumed during biological treatment. Ammonia and combined nitrate and nitrite (nitrate/nitrite) analyses were performed on influent and effluent samples. Nine BCR effluent samples were analyzed for nitrate/nitrite from September 2007 to October 2, 2008. Seven effluent samples were analyzed for ammonia during the summer of 2008. Two BCR influent samples were analyzed for ammonia and seven influent samples were analyzed for nitrate/nitrite during this time. Influent nitrate/nitrite ranged from 0.33 to 1.7 mg/L as N, with an average concentration of 1.1 mg/L as N. BCR effluent concentrations ranged from 0.27 to 1.1 mg/L as N, with an average of 1.5 mg/L as N. Effluent ammonia concentrations ranged from 1.1 to 20 mg/L as N, with an average concentration of 7.2 mg/L as N. Influent ammonia concentrations were 0.42 and 0.35 mg/L as N. The aerobic polishing cell, once commissioned, is expected to reduce ammonia concentrations. The APC should be monitored for effluent ammonia concentrations during 2009.

6.0 CHITIN TREATMENT RESULTS

The influent water to the chitin reactor was BCR effluent water. The discussion of the chitin reactor results are organized into field parameters, manganese removal, other metals, general performance parameters, and nuisance parameters. Chitin results are provided in Table 5.

6.1 Chitin Field Results

Flow Rate **-** Chitin flow rates were not measured directly; the BCR effluent distribution box constructed in 2008 was assumed to evenly split the BCR effluent flow between the APC and the chitin reactor. Chitin flow rates were assumed to be half of the BCR flow rates observed from 7/30 to 10/2/08. The average flow rate to the reactor was 0.8 gpm, which is greater than the design flow rate of 0.5 gpm.

pH **-** Chitin effluent pH ranged from 7.0 to 8.2 s.u. The typical chitin effluent pH was slightly greater than the influent pH, except for measurements observed on 10/2/08. These data indicate the chitin reactor was increasing the alkalinity of the influent water. Chitin effluent pH was consistently within the water quality criteria range of 6.5 to 9.0 s.u.

Temperature **-** Chitin effluent temperature varied from 4.6 to 13.1^{o}C. Effluent temperature was usually comparable to the influent temperature.

Oxidation Reduction Potential **-** Chitin effluent ORP measurements were consistently less than -100 mv, indicating reducing conditions existed in the reactor throughout the study.

Conductivity **-** Influent conductivity measurements varied between 0.57 and 1.3 mS/cm. Chitin effluent conductivity measurements varied from 0.71 to 6.59 mS/cm. The peak effluent conductivity measurement was observed on 10/2/08, and was significantly higher than other effluent measurements. The elevated conductivity value on 10/2/08 is consistent with the elevated calcium concentration measured during the same sampling event.

Dissolved Oxygen **-** Chitin influent typically contained low dissolved oxygen concentrations. Chitin effluent dissolved oxygen concentrations were also typically low, and consistent with what would be expected for anaerobic conditions.

6.2 Manganese Removal

The goal of the chitin reactor was to treat the BCR effluent for manganese. Influent total and dissolved manganese concentrations were practically identical during the monitoring period. Dissolved influent concentrations ranged from 7.5 to 14.7 mg/L, with an average concentration of 11 mg/L. Chitin effluent total and dissolved manganese concentrations were similar during the monitoring period. Dissolved effluent concentrations ranged from 1.1 to 16 mg/L. Effluent samples collected on 7/30/08 and 8/7/08 contained manganese concentrations below the water quality standard of 1.65 mg/L. The other effluent samples collected contained manganese concentrations significantly above the water quality standard of 1.6 mg/L. The largest effluent manganese concentrations were observed during the final two sampling events of 2008; these samples contained total and dissolved manganese concentrations greater than influent concentrations. The average percent removal of manganese was 23%; the maximum percent removal was 90%.

6.3 Other Metals

In addition to manganese, the Chitin reactor influent contained concentrations of iron and zinc. The Chitin reactor reduced the concentrations of these metals until mid-September 2008 when effluent concentrations of iron and total zinc increased to levels greater than influent concentrations. This upset condition is consistent with the increased manganese concentrations and an increase in conductivity. It is unclear what caused the upset condition.

6.4 General Performance Parameters

Alkalinity - Influent alkalinity ranged from 156 to 468 mg/L as $CaCO_3$. Effluent alkalinity concentrations range from 442 to 4,875 mg/L as $CaCO_3$. Elevated effluent alkalinity concentrations indicate desirable biological processes were occurring in the reactor, and that the calcium carbonate (calcite) present in the chitin material was dissolving.

Calcium - Dissolved chitin effluent calcium concentrations were consistently greater than influent concentrations due to the dissolution of calcium carbonate present in the reactor. Dissolved and total effluent calcium concentrations reported for samples collected on 9/18/08 show a significant discrepancy between reported total and dissolved concentrations.

Sulfate **-** Influent sulfate concentrations ranged from 24 to 206 mg/L, effluent concentrations ranged from 0.025 to 164 mg/L. Effluent sulfate concentrations were generally less than influent sulfate concentrations, indicating sulfate reduction was likely occurring in the chitin reactor.

6.5 Nuisance Parameters

The chitin reactor is similar to the BCR cell in that it generates effluent nuisance parameters: BOD, *E. coli*, and nitrogen species.

BOD - Chitin effluent BOD concentrations ranged from 170 to 387 mg/L, while influent concentrations ranged from below the laboratory detection limit of 30 mg/L to 140 mg/L. The effluent BOD concentrations were consistently higher than influent concentrations, which is typical for systems with reducing conditions and biological activity. The chitin effluent BOD concentrations were similar to BCR effluent BOD concentrations observed during startup conditions.

E. coli - Effluent *E. coli* concentrations ranged from 8 to greater than the laboratory upper detection range of 2,900 counts/100 mL. The influent, or BCR effluent, *E. coli* was below the laboratory detection limit for all chitin reactor sampling events. The effluent *E. coli* data was highly variable, and inconclusive. Further monitoring is required to accurately assess chitin effluent behavior with respect to *E. coli*.

Nitrogen **-** Chitin effluent nitrate/nitrite concentrations were similar to influent nitrate/nitrite concentrations. Influent ammonia concentrations ranged from 1.1 to 20 mg/L, effluent ammonia concentrations ranged from 5.8 mg/L to above the laboratory upper detection range of 36.25 mg/L. Effluent concentrations were consistently above influent concentrations, and were consistently higher than the estimated water quality standard of 3.08 mg/L. The ammonia standard is a table value standard which was estimated based on pH of 7 s.u. and a temperature of 4ºC. The chitin material is a source of ammonia; aerobic polishing of chitin effluent should be considered to decrease effluent ammonia concentrations; however the resulting nitrate would require treatment.

6.6 Water Quality Modeling

The chitin reactor used Chitorem™ as the substrate mixture. This technology has a limited history of field implementations for treating MIW. Manganese removal in a chitin reactor had been observed during bench-scale studies at the National Tunnel in Blackhawk, Colorado (Venot 2008). PHREEQC geochemical modeling software (Parkhurst and Appelo 1999) was used to calculate saturation indices for the influent and effluent waters and to thereby identify possible manganese removal mechanisms.

Inputs to the model included influent and effluent average concentrations of metals, sulfate, and sulfide from the period 7/30/08 to 10/2/08. The chitin cell average effluent alkalinity concentration was also added to the model. The modeling results include a saturation index for rhodochrosite ($MnCO_3$) of 0.97, indicating the mineral's concentration is above saturation, and precipitates would likely form. The resulting saturation index for manganese sulfide was -5.6, indicating the solution is under saturated, and that manganese sulfide would be unlikely to precipitate from the solution. The model output is provided in Appendix H.

7.0 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

The Sampling and Analysis Plan (Golder, 2007) prescribed a collection rate of 10% for blind duplicate samples. The collection of blind duplicates was limited to summer sampling when the site was accessible. Three blind duplicates were collected during the summer sampling events during which 38 BCR samples were taken. This is a collection rate of 7.8% which is less than the specified rate of 10%. The field duplicate results were compared with primary sample results using relative percentage differences (RPDs). For all analytes present at concentrations greater than or equal to five times the quantitation limit, the RPD must be less than or equal to 30% RPD (US EPA 2008). RPDs are calculated according to the following formula:

$$\%RPD = \left|\frac{A - B}{A + B}\right| \times 200$$

where A is the concentration of the primary laboratory result per analyte and B is the corresponding duplicate result. For all analytes present at concentrations less than five times the quantitation limit, the absolute difference must be less than or equal to twice the sample quantitation limit. Data validation of quality assurance samples was limited to metals analysis of the six contaminants of concern. The average RPD for the constituents of concern for the three duplicates samples was 2.5% which is well below the recommended criteria of 30%. The maximum RPD value was 5.6%, well below the maximum recommended value of 30%. For all analytes present at concentrations less than five times the quantitation limit, the absolute difference was less than or equal to twice the quantitation limit.

8.0 BCR AND CHITIN LONGEVITY ANALYSIS

The theoretical longevity of BCR and chitin reactors can be estimated based on the consumption rate of organic carbon and dissolution rate of limestone. Once the organic carbon supply is depleted, the bacteria in the BCR will become starved, microbial kinetics will decrease, and reactor performance will decline. Once the limestone has been completely dissolved from the cell, the non-microbial buffering capacity of the BCR media will be depleted and biological treatment may decrease or cease altogether. Using the laboratory results, organic carbon and limestone consumption rates were calculated to estimate the expected lifespan of the BCR and chitin reactors.

8.1 Organic Substrate Longevity

Organic substrate longevity was calculated based on the amount of carbon required to support the sulfate reduction occurring in the reactor. The biological reduction of sulfate to sulfide requires two moles of carbon for every mole of sulfate reduced or 24 grams of carbon for every 96 grams of sulfate (Wildeman et al. 1993). Organic substrate longevity calculations were based on the initial organic carbon content of the substrate components, the observed sulfate reduction rates, and the flow rate data.

The initial organic carbon content of the BCR cell was determined by assuming values for hay and woodchip moisture contents and loss on ignition values. The hay moisture content and loss on ignition (LOI) were assumed to be 5% and 99%, respectively. Woodchip moisture content and LOI were assumed to be 5% and 95%, respectively. These assumptions were made based on LOI and percent moisture analyses performed on similar substrate mixtures used for the Elizabeth Mine Bench-Scale Study (Golder 2007), and the Luttrell Pilot-scale SRBR demonstration (Golder 2006).

The sulfate data obtained from influent and BCR effluent samples and the BCR flow rate data were used to calculate a carbon consumption rate. Based on the carbon consumption rate and the initial carbon content of the Pilot, the **carbon longevity of cell is 21 years.** The carbon content of Pilot based on the LOI values included both the cellulose and lignin fractions of organic matter. Cellulose is more bio-available than the lignin. Wood fiber is typically 15% to 25% lignin. The carbon longevity analysis assumes that the lignin is eventually consumed.

The initial organic carbon content of the chitin reactor was estimated by assuming a 10% moisture content and the generalized formula for chitin ($C_9H_{15}O_5N$). The average carbon consumption rate for the chitin reactor was calculated based on the average observed sulfate reduction. The sulfate data obtained from influent and chitin effluent samples and the assumed chitin flow rates were used to calculate an average carbon consumption rate, which was used to estimate a **carbon longevity of 4.5 years.**

8.2 Limestone Longevity

Influent and effluent calcium concentrations were used to estimate the limestone dissolution rate in the BCR, and to estimate the length of time to deplete the limestone under steady –state conditions. The calcium dissolution rate was calculated as the difference in the BCR influent and effluent calcium concentrations multiplied by the daily flow rate. The calcium dissolution rate was then converted to a limestone dissolution mass rate (grams per day). Assuming a 90% pure calcium carbonate limestone, the limestone dissolution rate was then subtracted from the initial mass of limestone placed in the cell to estimate the limestone longevity. The BCR limestone longevity is estimated as 6 years.

Chitin influent and effluent calcium concentrations were used to estimate the longevity of the chitin reactor. The calcium dissolution rate was calculated as the difference in the influent and effluent calcium concentrations multiplied by the daily flow rate. The calcium dissolution rate was then used to develop a limestone dissolution rate. Due to the variability in effluent calcium concentrations, the calcium dissolution rate for samples collected on 8/7/08, 8/21/08, and 8/27/08 were averaged to determine an average limestone dissolution rate for the chitin reactor. This dissolution rate was used to calculate a limestone lifespan of 0.6 years. This calculated lifespan is based on a flow rate of 1 gpm, which is twice the design flow of the reactor. Since the reactor flow rate was reduced to 0.5 gpm in October 2008, the limestone mass in the chitin reactor is projected to be depleted in about 1.5 years.

9.0 DISCUSSION

9.1 Influent Water Quality

The Level 1 Adit water quality, or Pilot influent, was relatively consistent for the majority of the year except for a significant drop in pH in May, June, and July 2008 that was likely due to the high flows associated with seasonal snowmelt. The adit concentrations of cadmium, copper, and iron decreased during this snowmelt period while the concentrations of manganese and zinc remained relatively constant.

9.2 Pilot Construction and Operation

Construction of the Pilot at the remote Site posed unique challenges. The primary operational issue has been stoppage of flow to the system due to periods of inadequate solar power, pump failure, infiltration gallery plugging, and clogging of the influent pipes.

9.3 BCR Molar Metal and Sulfate Removal

In order for metals to be removed as metal sulfide precipitates, the BCR cell must reduce sufficient sulfate to sulfide. The Pilot BCR was sized based on removing 0.3 moles per day per cubic meter of substrate (mol/day/m^3) of sulfate and metals (Wildeman et al. 1993). The actual molar metal removal rate was estimated using influent and effluent cadmium, copper, iron, lead, and zinc concentrations, the flow rate, and the volume of substrate. The metal removal rate, shown on Figure 17, varied from 0.04 to 1.0 mol/day/m^3, with an average value of 0.29 mole/d/m^3, which is slightly below the benchmark criteria of 0.3 mol/day/m^3. The metal removal rate was only calculated for periods when the cell was operation. During the monitoring period, sulfate reduction varied from 0.2 to 1.1 moles/day/m^3 with an average of 0.32 moles/day/m^3. During the summer 2008, the BCR flow rate was doubled in order to optimize treatment performance. As seen on Figure 17, the molar sulfate removal rates increased indicating that the BCR cell was able to handle the increased metal loading.

9.4 Ability of BCR to Meet Water Quality Standards for Metals

The BCR has been operating successfully since startup with little variation in effluent quality. The cold winter temperatures and flow stoppages did not appear to significantly affect the treatment process. The BCR achieved average removal percentages for cadmium, copper, lead, and zinc of about 98%. Copper was consistently removed to concentrations below the chronic water quality standard. The detection limits for cadmium and lead were not sufficiently low to verify compliance with water quality standards. Effluent zinc concentrations were consistently above the chronic water quality standard. The high removal rates for cadmium, copper, lead, and zinc are consistent with those measured in other BCR systems (Gusek et al. 2008). The BCR iron removal rate was 61% and the manganese removal rate was 4%. Iron and manganese are not consistently removed under anaerobic conditions but can be removed in an aerobic polishing process such as an APC.

The removal of COCs as metal sulfide precipitates occurs via the generalized formula:

$$Me^{2+} + HS^{-} \longrightarrow MeS_{(S)} + H^{+}$$

The reaction is dependent on the pH, Eh, and sulfide concentration of the system, but is also governed by solubility constants which vary for each metal. Solubility constants (pK values) for the COCs are provided in Table 7 and provide an indication of the relative solubility of the various metal sulfides. The values are listed in Table 7 in order of increasing solubility; for example, the sulfide mineral in the first column (CuS) is the least soluble, and therefore more likely to precipitate than all of the other minerals. Based on the values shown, the sulfide solubility of the COCs from lowest to highest is:

$$Cu < Cd < Pb < Zn < Fe < Mn$$

The list shown above attempts takes into account the form of metal sulfide that is most likely to precipitate in the BCR. For example, pyrite is excluded from the list above because is a crystalline mineral unlikely to form in a BCR; the more likely iron sulfide precipitate is an amorphous iron sulfide (FeS [ppt]). Therefore, the pK value for amorphous iron sulfide is included in the list above. It should be recognized that pK values for all amorphous sulfide minerals are not necessarily available, so the order of metal sulfide solubility is considered approximate. Regardless, the removal of metals in the BCR is represented well by the order of solubility constants shown above. The extremely low solubilities of copper and cadmium were exhibited by low BCR effluent concentrations. The solubility of zinc sulfide (ZnS [am]), on the other hand, is thirteen orders of magnitude greater than that of copper sulfide and zinc effluent concentrations were correspondingly higher. The Pilot BCR could likely achieve higher zinc removal rates with a longer hydraulic retention time under which more sulfide would be generated; this should increase the precipitation of zinc sulfide. Iron and manganese are the most soluble metal sulfides and are therefore more difficult to remove as metal sulfides in a BCR. Further iron removal and manganese removal would be expected to occur in the APC and MRB cells.

9.5 Chitin Results

The chitin reactor was constructed for manganese treatment. During the first two months of operation, the chitin reactor achieved an average manganese removal rate of 23%. During the last few sampling events, the chitin effluent manganese concentration was greater than the influent concentration indicating that manganese was being released from the reactor. One possible explanation for the low manganese removal rate is that the flow rate to cell was greater than the design flow rate. Continued operation and monitoring of the chitin reactor is recommended to better understand the treatment process.

9.6 Nuisance Parameters

The BCR and chitin reactors generate nuisance parameters such as BOD, *E. coli*, and ammonia that will require treatment prior to discharge. These parameters are amenable to treatment in an APC. Monitoring of the APC in 2009 will help determine the proper APC dimensions to treat these nuisance parameters.

9.7 Longevity Estimates

The estimated BCR carbon and limestone longevities are 51and 7 years, respectively. For future treatment efforts on Site, increasing the amount of limestone in the substrate mixture at the expense of wood chips would extend the combined carbon/limestone longevity. A reasonable goal for the carbon and limestone longevity estimate is 20 years. The estimated chitin reactor carbon and limestone longevities are 7 and 1.5 years, respectively. The chitin longevity estimates are based on only two months of data; further evaluation is recommended.

9.8 Remote Monitoring

The ISCO™ Stratolink transmitters did not operate consistently. Typically, transmissions from only one of the two transmitters were received at a time. When it was operational, the advantage of the Stratolink system was that field parameters and flow data could be viewed on an internet webpage within several hours. This was a valuable tool because the daily cell performance could be monitored closely from a remote location. In the summer 2008, ISCO decided to abandon the use of the Stratolink transmitters because of the operational issues and replaced the transmitters with satellite phones. During the first few months of operation, data retrieval via the satellite phones has also been problematic. Overall, remote monitoring of the Pilot has been a significant challenge and warrants further study.

10.0 CONCLUSIONS

To date, three pilot-scale passive treatment technologies (BCR, chitin reactor, APC) have been constructed at the Standard Mine Superfund Site to test their ability to operate at a high-altitude, cold, remote site. The Pilot BCR has been in operation the longest, approximately 13 months. Despite the cold climate and cold influent water temperature, the startup and operation of the BCR process was successful; metal removal rates for cadmium, copper, lead, and zinc were, on average, 98% for the treatment period. The Pilot performance has further demonstrated that passive, biological treatment of MIW is feasible at cold, remote sites. Despite the high removal rate, the BCR effluent exceeds the water quality standards for cadmium, lead, and zinc. Results from the first two months of chitin reactor show inconsistent manganese removal rates; further monitoring of the reactor is recommended. The third passive technology, the APC, was completed in the fall 2008 and monitoring of the APC will begin in 2009.

11.0 RECOMMENDATIONS

The following recommendations are provided for future operations of the Pilot:

- Perform weekly monitoring events on the chitin reactor during 2009. The 2008 chitin reactor data set included only eight sampling events, and there was significant variation in the data. Flow measurements should also be monitored to ensure the chitin cell is being loaded appropriately. Additional information about the chitin reactor performance is necessary to evaluate the technology with regard to its MIW treatment potential.

- Monitor the APC according to the project sampling and analysis plan in 2009.

- Establish a gravity flow regime to convey adit water to the Pilot in order to eliminate the need for the influent pump and thereby increase the reliability of the BCR.

- On October 6, 2008, the flow rate through the BCR was reduced to 0.75 gpm. This operational change was implemented to investigate a potential relationship between hydraulic retention time and effluent zinc concentrations. Data collected during 2008 and 2009 will provide valuable information regarding zinc removal.

The EPA ORD detection limits for cadmium and copper were above or close to the water quality standards. Future samples should be analyzed to a lower detection limit.

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TABLES

Table 1

STANDARD MINE PILOT INFLUENT WATER QUALITY SUMMARY TABLE WITH ELK CREEK WATER QUALITY STANDARDS FOR THE TREATMENT PERIOD (AUGUST 2007 - SEPTEMBER 2008)

Parameter	EPA Laboratory Detection Limit	Acute Standard[1]	Chronic Standard[1]	Influent Average	Influent Minimum	Influent Maximum
Cadmium, dissolved (mg/L)	0.0024	0.0009 (tr)[2]	0.00025	0.14	0.11	0.17
Copper, dissolved (mg/L)	0.0036	0.007	0.005	0.26	0.04	1.06
Iron, total (mg/L)	0.021	NA	1.0 (Trec)[3]	5.61	0.16	21.22
Lead, dissolved (mg/L)	0.008	0.03	0.0012	0.502	0.004	2.23
Manganese, dissolved (mg/L)	0.0066	2.37	1.31	11.0	5.3	12.7
Zinc, dissolved (mg/L)	0.0067	0.079	0.069	26.5	21.0	30.9

Notes:

1 - Metal table value standards were calculated based on a hardness of 50 mg/L

2 - tr- trout standard

3 - Trec - the standard is total recoverable. The summary data for iron are all total concentrations.

4 - Shaded values exceed the acute and/or chronic standards.

Table 2
BCR Sample Collection Schedule and Sampling Suites
Standard Mine Passive Treatment System

		Target Laboratory Analytes									Target Laboratory Analytes								
		Influent Sample									Effluent Sample								
Date	**Event Type**	**Total Metals**	**Dissolved Metals**	**Alkalinity**	**BOD**	**E. Coli**	**Ammonia**	**Nitrate**	**Sulfide**	**Sulfate**	**Total Metals**	**Dissolved Metals**	**Alkalinity**	**BOD**	**E. Coli**	**Ammonia**	**Nitrate**	**Sulfide**	**Sulfate**
8/9/2007	Field Sample Collection	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		X
8/15/2007	Field Sample Collection	X	X	X						X	X	X	X						X
8/22/2007	Field Sample Collection	X	XX	X	X	X	X	X	X	X	X	XX	X	X	X	X	X	X	X
8/28/2007	Field Sample Collection	X	X	X					X	X	X	X	X					X	X
9/6/2007	Field Sample Collection	X	X	X					X	X	X	X	X					X	X
9/12/2007	Field Sample Collection	X	X	X					X	X	X	X	X					X	X
9/19/2007	Field Sample Collection	X	X	X						X	X	X	X						X
9/26/2007	Field Sample Collection	X	X	X					X	X	X	X	X					X	X
10/4/2007	Field Sample Collection	X	X	X						X	X	X	X						X
10/15/2007	Field Sample Collection	X	X	X	X					X	X	X	X	X					X
11/1/2007	Field Sample Collection	X	X	X	X					X	XX	XX	X	X					X
11/14/2007	ISCO Sample Collection	X								X	X								X
11/21/2007	ISCO Sample Collection	X								X	X								X
11/28/2007	ISCO Sample Collection	X								X	X								X
12/05/07	ISCO Sample Collection										X								X
12/12/07	ISCO Sample Collection										X								X
12/26/07	ISCO Sample Collection	X								X	X								X
01/02/08	ISCO Sample Collection	X								X	X								X
01/09/08	ISCO Sample Collection	X								X	X								X
01/16/08	ISCO Sample Collection	X								X	X								X
01/23/08	ISCO Sample Collection	X								X	X								X
02/06/08	ISCO Sample Collection	X								X	X								X
02/13/08	ISCO Sample Collection	X								X	X								X
02/20/08	ISCO Sample Collection	X								X	X								X
02/27/08	ISCO Sample Collection	X								X	X								X
03/05/08	ISCO Sample Collection	X								X	X								X
03/12/08	ISCO Sample Collection	X								X	X								X
03/19/08	ISCO Sample Collection	X								X	X								X
03/26/08	ISCO Sample Collection	X								X	X								X
04/02/08	ISCO Sample Collection	X								X	X								X
04/09/08	ISCO Sample Collection	X								X	X								X
04/16/08	ISCO Sample Collection	X								X	X								X
04/23/08	ISCO Sample Collection	X								X	X								X
04/30/08	ISCO Sample Collection	X								X	X								X
05/07/08	ISCO Sample Collection	X								X	X								X
05/14/08	ISCO Sample Collection										X								X
05/21/08	ISCO Sample Collection										X								X
05/28/08	ISCO Sample Collection										X								X
06/04/08	ISCO Sample Collection	X								X	X								X
06/11/08	ISCO Sample Collection	X								X	X								X
07/30/08	Field Sample Collection									X	X	X	X	X		X	X		X
08/07/08	Field Sample Collection	X	X	X	X			X	X	X	X	X	X	X		X	X	X	X
08/14/08	Field Sample Collection	X	X	X	X			X	X	X	X	X	X	X		X	X	X	X
08/21/08	Field Sample Collection	X	X	X	X			X	X	X	X	X	X	X		X	X	X	X
08/27/08	Field Sample Collection	X	X	X	X			X	X	X	X	X	X	X		X	X	X	X
09/04/08	Field Sample Collection	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X
09/18/08	Field Sample Collection	X	X	X	X			X	X	X	X	X	X	X		X	X	X	X
10/02/08	Field Sample Collection	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X

X denotes routine sample collection event; XX denotes duplicate sample collection event

Table 3
Chitin Reactor Sample Collection Schedule and Sampling Suites
Standard Mine Pilot Passive Treatment System

		Target Laboratory Analytes								
		Influent Sample								
Date	**Event Type**	**Total Metals**	**Dissolved Metals**	**Alkalinity**	**BOD**	**E. Coli**	**Ammonia**	**Nitrate**	**Sulfide**	**Sulfate**
07/30/08	Field Sample Collection	X	X	X	X		X	X		X
08/07/08	Field Sample Collection	X	X	X	X		X	X	X	X
08/14/08	Field Sample Collection	X	X	X	X		X	X	X	X
08/21/08	Field Sample Collection	X	X	X	X		X	X	X	X
08/27/08	Field Sample Collection	X	X	X	X		X	X	X	X
09/04/08	Field Sample Collection	X	X	X	X		X	X	X	X
09/18/08	Field Sample Collection	X	X	X	X		X	X	X	X
10/02/08	Field Sample Collection	X	X	X	X		X	X	X	X

		Target Laboratory Analytes								
		Effluent Sample								
Date	**Event Type**	**Total Metals**	**Dissolved Metals**	**Alkalinity**	**BOD**	**E. Coli**	**Ammonia**	**Nitrate**	**Sulfide**	**Sulfate**
07/30/08	Field Sample Collection									X
08/07/08	Field Sample Collection	X	X	X	X	X	X	X	X	X
08/14/08	Field Sample Collection	X	X	X	X	X	X	X	X	X
08/21/08	Field Sample Collection	X	X	X	X	X	X	X	X	X
08/27/08	Field Sample Collection	X	X	X	X	X	X	X	X	X
09/04/08	Field Sample Collection	X	X	X	X	X	X	X	X	X
09/18/08	Field Sample Collection	X	X	X	X	X	X	X	X	X
10/02/08	Field Sample Collection	X	X	X	X	X	X	X	X	X

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		8/15/2007		9/6/2007		9/12/2007		9/19/2007		9/26/2007		10/4/2007	
	Parameter	Detection Limit	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent
Dissolved Metals	Cadmium, mg/L	0.0024	NA	0.0057	0.14	*0.0012*	0.14	0.0043	0.11	0.0046	0.14	0.0043	0.13	*0.0012*
	Calcium, mg/L	NA	NA	NA	NA	NA	*86*	NA	*85*	NA	*81*	NA	*66*	*219*
	Copper, mg/L	0.0023	NA	0.030	0.13	*0.0011*	0.13	0.0060	0.039	0.010	0.19	*0.0011*	0.18	*0.0011*
	Iron, mg/L	0.021	NA	4.5	0.20	15	0.16	13	0.11	15	0.13	13	0.092	11
	Lead, mg/L	0.0080	NA	0.23	0.27	0.037	0.25	0.028	0.12	0.029	0.50	0.025	0.49	0.034
	Magnesium, mg/L	NA	NA	*48*	*7.7*	*45*	*7.7*	*37*	*7.7*	*32*	*7.2*	*25*	*6.4*	*16*
	Manganese, mg/L	0.0066	NA	NA	NA	NA	11	14	10	15	11	13	9.9	11
	Zinc, mg/L	0.0067	NA	2.9	24	0.65	24	1.1	21	0.84	24	0.64	23	0.84
Total Metals	Cadmium, mg/L	0.0024	NA	0.015	0.13	0.0063	0.13	0.017	0.11	0.015	0.13	0.013	0.12	0.0061
	Calcium, mg/L	NA	NA	NA	NA	NA	*85*	*265*	*88*	NA	*85*	NA	*65*	*222*
	Copper, mg/L	0.0023	NA	0.063	0.19	0.014	0.19	0.034	0.12	0.031	0.25	0.039	0.24	0.026
	Iron, mg/L	0.021	NA	5.0	0.83	15	0.70	13	0.40	16	0.79	13	0.78	11
	Lead, mg/L	0.0080	NA	0.24	0.55	0.15	0.53	0.13	0.25	0.12	0.90	0.10	0.90	0.091
	Magnesium, mg/L	NA	NA	NA	*7.7*	*45*	*7.2*	*36*	*7.8*	*34*	*7.3*	*27*	*6.0*	*16*
	Manganese, mg/L	0.0066	NA	NA	NA	NA	11	15	11	15	11	13	9.9	11
	Zinc, mg/L	0.0067	NA	3.1	24	2.4	24	3.2	25	1.8	23	2.1	26	0.42
General Parameters	Sulfate, mg/L	NA	NA	*71*	*245*	*55*	*241*	*53*	*212*	*27*	*245*	*33*	*339*	*57*
	Alkalinity, mg/L as $CaCO_3$	NA	NA	NA	*42*	*1269*	*42*	*1102*	*73*	*1071*	*31*	*936*	*31*	*759*
	Sulfide, mg/L	NA	NA	NA	*0.050*	*1.7*	*0.050*	*3.1*	NA	*2.2*	*0.010*	*2.6*	*0.010*	*2.4*
	BOD, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Nitrate-Nitrite, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ammonia, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	E. Coli, Cnts. per 100 mL.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		**10/15/2007**		**11/1/2007**		**11/14/2007**		**11/21/2007**		**11/28/2007**		**12/5/2007**	
	Parameter	**Detection Limit**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**
Dissolved Metals	Cadmium, mg/L	0.0024	0.13	*0.0012*	0.14	*0.0012*	NA	NA	NA	NA	NA	NA	NA	NA
	Calcium, mg/L	NA	*80*	*255*	*76*	*175*	NA	NA	NA	NA	NA	NA	NA	NA
	Copper, mg/L	0.0023	0.12	*0.0011*	0.14	*0.0011*	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, mg/L	0.021	0.14	1.0	*0.011*	4.4	NA	NA	NA	NA	NA	NA	NA	NA
	Lead, mg/L	0.0080	0.22	*0.0040*	0.020	0.0081	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium, mg/L	NA	*7.8*	*19*	*7.4*	*12*	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, mg/L	0.0066	11	12	11	7.4	NA	NA	NA	NA	NA	NA	NA	NA
	Zinc, mg/L	0.0067	26	0.26	26	0.0088	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals	Cadmium, mg/L	0.0024	0.13	*0.0012*	0.14	*0.0012*	0.14	*0.0012*	0.13	*0.0012*	0.13	*0.0012*	NA	*0.0012*
	Calcium, mg/L	NA	*81*	*265*	*77*	*190*	*80*	*142*	*82*	*141*	*83*	*136*	NA	*134*
	Copper, mg/L	0.0023	0.12	*0.0011*	0.85	0.0052	0.71	0.0070	0.81	0.0063	0.37	*0.0011*	NA	*0.0011*
	Iron, mg/L	0.021	0.16	15	13	5.0	8.5	0.99	11	0.91	3.8	0.63	NA	0.44
	Lead, mg/L	0.0080	0.22	0.016	4.1	0.024	3.2	0.012	3.8	0.011	1.5	0.010	NA	*0.0045*
	Magnesium, mg/L	NA	*7.8*	*20*	*8.2*	*13*	*8.0*	*10*	*8.5*	*10*	*8.5*	*10.0*	NA	*9.9*
	Manganese, mg/L	0.0066	11	12	11	8.1	12	8.3	12	8.3	12	9.0	NA	9.8
	Zinc, mg/L	0.0067	26	0.42	27	0.61	27	0.94	27	0.94	26	1.3	NA	1.2
General Parameters	Sulfate, mg/L	NA	*374*	*8.7*	*348*	*144*	NA	NA	NA	NA	NA	NA	NA	NA
	Alkalinity, mg/L as $CaCO_3$	NA	*62*	*832*	*31*	*426*	NA	NA	NA	NA	NA	NA	NA	NA
	Sulfide, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	BOD, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Nitrate-Nitrite, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ammonia, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	E. Coli, Cnts. per 100 mL.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		**12/12/2007**		**12/26/2007**		**12/26/2007**		**1/2/2008**		**1/9/2008**		**1/16/2008**	
	Parameter	**Detection Limit**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**
Dissolved Metals	Cadmium, mg/L	0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Calcium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Copper, mg/L	0.0023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, mg/L	0.021	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lead, mg/L	0.0080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, mg/L	0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Zinc, mg/L	0.0067	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals	Cadmium, mg/L	0.0024	NA	*0.0012*	0.13	*0.0012*	0.13	*0.0012*	0.13	*0.0012*	0.14	*0.0012*	0.14	*0.0012*
	Calcium, mg/L	NA	NA	*131*	*87*	NA	*87*	NA	*88*	*127*	*91*	*138*	*94*	*161*
	Copper, mg/L	0.0023	NA	*0.0011*	0.35	*0.0018*	0.35	*0.0018*	0.37	0.013	0.63	0.052	0.28	0.0078
	Iron, mg/L	0.021	NA	0.36	4.3	*0.011*	4.3	*0.011*	4.5	0.39	4.4	0.67	4.4	1.9
	Lead, mg/L	0.0080	NA	*0.0047*	1.3	*0.0040*	1.3	*0.0040*	1.2	*0.0076*	1.1	0.013	1.00	0.010
	Magnesium, mg/L	NA	NA	*9.5*	*8.9*	NA	*8.9*	NA	*9.2*	*9.6*	*9.6*	*9.1*	*9.9*	*13*
	Manganese, mg/L	0.0066	NA	10	12	NA	12	NA	12	11	10	11	11	14
	Zinc, mg/L	0.0067	NA	1.4	28	*0.0034*	28	*0.0034*	28	2.1	31	0.69	30	0.77
General Parameters	Sulfate, mg/L	NA	NA	NA	*265*	*173*	*265*	*173*	*265*	*173*	*277*	*173*	*281*	*27*
	Alkalinity, mg/L as $CaCO_3$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sulfide, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	BOD, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Nitrate-Nitrite, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ammonia, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	E. Coli, Cnts. per 100 mL.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		**1/23/2008**		**2/6/2008**		**2/13/2008**		**2/27/2008**		**3/5/2008**		**3/12/2008**	
	Parameter	**Detection Limit**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**
Dissolved Metals	Cadmium, mg/L	0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Calcium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Copper, mg/L	0.0023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, mg/L	0.021	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lead, mg/L	0.0080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, mg/L	0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Zinc, mg/L	0.0067	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals	Cadmium, mg/L	0.0024	0.13	*0.0012*	0.12	*0.0012*	0.12	*0.0012*	0.12	0.0089	0.12	*0.0012*	0.14	*0.0012*
	Calcium, mg/L	NA	*89*	*138*	*86*	*123*	*88*	*126*	*90*	*126*	*91*	*126*	*91*	*126*
	Copper, mg/L	0.0023	0.87	*0.0018*	1.3	0.0056	0.79	*0.0018*	0.61	0.034	0.86	0.10	0.52	*0.0018*
	Iron, mg/L	0.021	15	0.47	21	0.21	13	0.13	9.0	0.13	8.8	0.087	3.3	0.50
	Lead, mg/L	0.0080	3.7	*0.0040*	5.8	*0.0040*	3.2	*0.0040*	2.6	0.036	2.6	*0.0040*	1.1	*0.0040*
	Magnesium, mg/L	NA	*9.6*	*11*	*9.2*	*9.7*	*9.2*	*10*	*9.5*	*10*	*9.6*	*10*	*9.6*	*10*
	Manganese, mg/L	0.0066	12	11	12	11	11	11	11	11	11	11	10	11
	Zinc, mg/L	0.0067	28	2.1	28	1.5	27	1.3	29	1.2	29	1.1	31	1.0
General Parameters	Sulfate, mg/L	NA	*273*	*194*	*270*	*187*	*273*	*183*	*274*	*153*	*278*	*86*	*278*	*72*
	Alkalinity, mg/L as $CaCO_3$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sulfide, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	BOD, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Nitrate-Nitrite, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ammonia, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	E. Coli, Cnts. per 100 mL.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		3/19/2008		3/26/2008		4/2/2008		4/9/2008		4/16/2008		4/23/2008	
	Parameter	Detection Limit	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent	BCR Influent	BCR Effluent
Dissolved Metals	Cadmium, mg/L	0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Calcium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Copper, mg/L	0.0023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, mg/L	0.021	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lead, mg/L	0.0080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, mg/L	0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Zinc, mg/L	0.0067	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals	Cadmium, mg/L	0.0024	0.17	*0.0012*	0.16	*0.0012*	0.15	*0.0012*	0.15	*0.0012*	0.14	*0.0012*	0.13	*0.0012*
	Calcium, mg/L	NA	*91*	*127*	*90*	*131*	*89*	*137*	*91*	*144*	*92*	*161*	*92*	*183*
	Copper, mg/L	0.0023	0.56	*0.0018*	0.41	*0.0018*	0.74	*0.0018*	0.24	*0.0018*	0.25	0.0067	0.20	0.054
	Iron, mg/L	0.021	2.7	0.73	1.9	0.93	1.8	1.1	1.8	1.1	2.3	1.7	1.5	1.5
	Lead, mg/L	0.0080	0.93	*0.0040*	0.70	*0.0040*	0.71	*0.0040*	0.75	*0.0040*	0.93	*0.0040*	0.58	*0.0040*
	Magnesium, mg/L	NA	*9.5*	*10*	*9.4*	*11*	*9.3*	*11*	*9.5*	*12*	*9.6*	*13*	*9.6*	*14*
	Manganese, mg/L	0.0066	10	11	11	12	11	12	12	13	11	14	11	16
	Zinc, mg/L	0.0067	31	1.0	30	0.94	29	0.90	29	0.78	29	0.76	29	0.71
General Parameters	Sulfate, mg/L	NA	*284*	*67*	*280*	*49*	*278*	*49*	*285*	*33*	*282*	*27*	*277*	*21*
	Alkalinity, mg/L as $CaCO_3$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sulfide, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	BOD, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Nitrate-Nitrite, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ammonia, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	E. Coli, Cnts. per 100 mL.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		**4/30/2008**		**5/7/2008**		**5/14/2008**		**5/21/2008**		**5/28/2008**		**6/4/2008**	
	Parameter	**Detection Limit**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**
Dissolved Metals	Cadmium, mg/L	0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Calcium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Copper, mg/L	0.0023	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Iron, mg/L	0.021	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lead, mg/L	0.0080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Magnesium, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Manganese, mg/L	0.0066	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Zinc, mg/L	0.0067	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals	Cadmium, mg/L	0.0024	0.13	*0.0012*	0.13	0.0078	NA	0.0031	NA	*0.0012*	NA	*0.0012*	NA	*0.0012*
	Calcium, mg/L	NA	*90*	*205*	*88*	*249*	NA	*163*	NA	*137*	NA	*124*	NA	*111*
	Copper, mg/L	0.0023	0.21	*0.0018*	0.20	0.031	NA	*0.0018*	NA	0.012	NA	*0.0018*	NA	*0.0018*
	Iron, mg/L	0.021	1.5	1.9	1.6	1.2	NA	0.70	NA	0.66	NA	0.74	NA	0.53
	Lead, mg/L	0.0080	0.55	*0.0040*	0.58	0.067	NA	0.020	NA	0.0096	NA	*0.0040*	NA	*0.0040*
	Magnesium, mg/L	NA	*9.5*	*16*	*9.2*	*17*	NA	*11*	NA	*9.0*	NA	*8.2*	NA	*7.4*
	Manganese, mg/L	0.0066	11	18	10	21	NA	14	NA	11	NA	10	NA	9.0
	Zinc, mg/L	0.0067	28	0.72	28	0.83	NA	0.68	NA	0.73	NA	0.74	NA	0.79
General Parameters	Sulfate, mg/L	NA	*271*	*19*	*272*	*163*	NA	*180*	NA	*173*	NA	*153*	NA	*122*
	Alkalinity, mg/L as $CaCO_3$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sulfide, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	BOD, mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Nitrate-Nitrite, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ammonia, mg/L as N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	E. Coli, Cnts. per 100 mL.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		**6/11/2008**		**7/30/2008**		**8/7/2008**		**8/14/2008**		**8/21/2008**		**8/27/2008**	
	Parameter	**Detection Limit**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**
Dissolved Metals	Cadmium, mg/L	0.0024	0.12	*0.0012*	0.17	*0.0012*	0.16	0.0049	0.16	*0.0012*	0.16	*0.0012*	0.16	0.0036
	Calcium, mg/L	NA	*34*	*107*	*72*	*185*	*74*	*133*	*72*	*123*	*75*	*121*	*78*	*122*
	Copper, mg/L	0.0023	1.1	*0.0018*	0.31	0.0060	0.20	0.0050	0.19	0.0060	0.65	0.0050	0.081	0.0050
	Iron, mg/L	0.021	4.5	0.20	0.21	1.1	0.21	0.21	0.19	0.10	7.8	0.16	*0.011*	0.10
	Lead, mg/L	0.0080	1.8	*0.0040*	0.46	*0.0040*	0.33	*0.0040*	0.36	*0.0040*	2.2	*0.0040*	*0.0040*	*0.0040*
	Magnesium, mg/L	NA	*3.0*	*6.9*	*7.4*	*9.5*	*7.3*	*7.1*	*7.2*	*7.1*	*7.4*	*7.5*	*7.7*	*7.7*
	Manganese, mg/L	0.0066	5.3	8.4	11	13	11	8.9	11	9.1	12	9.7	12	10.0
	Zinc, mg/L	0.0067	21	1.5	31	0.42	29	0.58	28	0.50	29	0.46	29	0.47
Total Metals	Cadmium, mg/L	0.0024	0.12	*0.0012*	0.16	0.0033	0.16	0.0050	0.15	0.0043	0.15	*0.0012*	0.15	0.0040
	Calcium, mg/L	NA	*34*	*98*	*73*	*184*	*76*	*129*	*73*	*124*	*75*	*120*	*75*	*120*
	Copper, mg/L	0.0023	1.1	*0.0018*	0.39	0.014	0.58	0.021	0.51	0.013	0.19	0.020	0.26	0.0096
	Iron, mg/L	0.021	4.9	0.19	2.0	1.0	10	0.23	8.8	0.15	0.22	0.30	1.9	0.13
	Lead, mg/L	0.0080	1.9	*0.0040*	0.87	0.014	2.0	*0.0040*	1.9	*0.0040*	0.31	*0.0040*	0.69	*0.0040*
	Magnesium, mg/L	NA	*3.4*	*6.3*	*7.0*	*9.3*	*7.7*	*6.9*	*7.4*	*7.0*	*7.4*	*7.5*	*7.8*	*7.9*
	Manganese, mg/L	0.0066	5.9	7.8	11	13	12	8.7	11	9.0	12	9.7	12	10.0
	Zinc, mg/L	0.0067	20	0.83	30	0.82	30	1.5	28	1.4	28	1.4	29	1.5
General Parameters	Sulfate, mg/L	NA	*144*	*92*	*366*	*24*	*358*	*169*	*324*	*123*	*323*	*153*	*267*	*134*
	Alkalinity, mg/L as $CaCO_3$	NA	NA	NA	*26*	*468*	*26*	*221*	*26*	*208*	*26*	*182*	*26*	*182*
	Sulfide, mg/L	NA	NA	NA	NA	NA	*0.050*	*19*	*0.050*	*23*	*0.050*	*17*	*0.050*	*15*
	BOD, mg/L	NA	NA	NA	NA	NA	*0.050*	*73*	*1.2*	*56*	*0.050*	*55*	*0.050*	*37*
	Nitrate-Nitrite, mg/L as N	NA	NA	NA	NA	NA	*1.7*	*0.88*	*1.5*	*0.27*	*0.69*	*1.1*	*0.34*	*1.1*
	Ammonia, mg/L as N	NA	NA	NA	NA	NA	NA	*1.1*	NA	*5.2*	NA	*5.6*	NA	*6.3*
	E. Coli, Cnts. per 100 mL.	NA	NA	NA	NA	NA	NA	*0.50*	NA	*0.50*	NA	*0.05*	NA	*0.50*

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 4
BCR Laboratory Data for Samples Collected from 8/15/07 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System
Crested Butte, CO

	Date		**9/4/2008**		**9/18/2008**		**10/2/2008**	
	Parameter	**Detection Limit**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**	**BCR Influent**	**BCR Effluent**
Dissolved Metals	Cadmium, mg/L	0.0024	0.15	*0.0012*	0.15	*0.0012*	0.14	*0.0012*
	Calcium, mg/L	NA	*78*	*124*	*80*	*121*	*48*	*94*
	Copper, mg/L	0.0023	0.17	*0.0018*	0.11	*0.0018*	0.14	*0.0018*
	Iron, mg/L	0.021	0.090	0.026	0.074	*0.011*	0.38	*0.011*
	Lead, mg/L	0.0080	0.22	*0.0040*	0.12	*0.0040*	0.16	*0.0040*
	Magnesium, mg/L	NA	*2.7*	*2.9*	*0.95*	*0.71*	*7.4*	*0.0034*
	Manganese, mg/L	0.0066	13	11	12	10	12	9.7
	Zinc, mg/L	0.0067	28	0.40	28	0.45	27	0.36
Total Metals	Cadmium, mg/L	0.0024	0.15	*0.0012*	*0.0012*	*0.0012*	0.12	*0.0012*
	Calcium, mg/L	NA	*78*	*123*	*80*	*120*	*37*	*80*
	Copper, mg/L	0.0023	0.38	*0.0018*	*0.0022*	0.0093	0.36	0.023
	Iron, mg/L	0.021	1.00	0.026	4.1	0.28	1.6	0.34
	Lead, mg/L	0.0080	0.77	*0.0040*	*0.0040*	*0.0040*	1.1	0.0090
	Magnesium, mg/L	NA	*2.7*	*2.9*	NA	NA	NA	NA
	Manganese, mg/L	0.0066	13	11	14	9.9	11	8.9
	Zinc, mg/L	0.0067	28	1.1	0.11	1.7	27	1.5
General Parameters	Sulfate, mg/L	NA	*184*	*207*	*390*	*108*	*258*	*38*
	Alkalinity, mg/L as $CaCO_3$	NA	*26*	*156*	*46*	*202*	*33*	*325*
	Sulfide, mg/L	NA	*0.050*	*18*	*0.050*	*26*	*0.050*	*28*
	BOD, mg/L	NA	*0.37*	*0.050*	*0.88*	*30*	*0.30*	*139*
	Nitrate-Nitrite, mg/L as N	NA	NA	*0.71*	*1.2*	*3.1*	NA	*3.5*
	Ammonia, mg/L as N	NA	NA	*20*	NA	*6.1*	NA	*6.5*
	E. Coli, Cnts. per 100 mL.	NA	NA	*0.50*	NA	*0.50*	NA	*0.50*

Notes:
Detection limits are only provided for the constituents of concern.

NA = parameter was not analyzed or not applicable.

Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 5
Chitin Laboratory Data For Samples Collected From July 30, 2008 through October 2, 2008.
Standard Mine Pilot Scale Passive Treatment System

	Date		7/30/2008		8/7/2008		8/14/2008		8/21/2008		8/27/2008		9/4/2008		9/18/2008		10/2/2008	
	Parameter	Detection Limit	BCR Effluent	Chitin Effluent	BCR Effluent	Chitin Effluent	BCR Effluent	Chitin Effluent	BCR Effluent	Chitin Effluent	BCR Effluent	Chitin Effluent	BCR Effluent	Chitin Effluent	BCR Effluent	Chitin Effluent	BCR Effluent	Chitin Effluent
Dissolved Metals Concentrations	Cadmium, mg/	0.0024	*0.0012*	*0.0018*	0.0049	*0.0018*	*0.0012*	NA	*0.0012*	*0.0018*	0.0036	*0.0018*	*0.0012*	*0.0018*	*0.0012*	*0.0018*	*0.0012*	*0.0018*
	Calcium, mg/L	NA	*185*	*175*	*133*	*211*	*123*	NA	*121*	*208*	*122*	*301*	*124*	*229*	*121*	*1282*	*94*	*1444*
	Copper, mg/L	0.0036	0.0060	0.036	0.0050	*0.0018*	0.0060	NA	0.0050	0.0050	0.0050	0.0050	*0.0018*	*0.0018*	*0.0018*	*0.0018*	*0.0018*	0.011
	Iron, mg/L	0.021	1.1	0.14	0.21	0.064	0.10	NA	0.16	0.039	0.10	0.055	0.026	*0.011*	*0.011*	0.20	*0.011*	7.4
	Lead, mg/L	0.0080	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	NA	*0.0040*	*0.0040*	*0.0040*	NA	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*
	Magnesium, m	NA	*9.5*	*46*	*7.1*	*21*	*7.1*	NA	*7.5*	*13*	*7.7*	*19*	*2.9*	*7.7*	*0.71*	*106*	*0.0034*	*27*
	Manganese, m	0.0066	13	1.1	8.9	1.6	9.1	NA	9.7	6.8	10.0	7.3	11	4.9	10	11	9.7	16
	Zinc, mg/L	0.0067	0.42	0.39	0.58	0.45	0.50	NA	0.46	0.39	0.47	0.019	0.40	0.33	0.45	*0.0034*	0.36	*0.0034*
Total Metals Concentrations	Cadmium, mg/	0.0024	0.0033	*0.0012*	0.0050	0.0059	0.0043	NA	*0.0012*	*0.0012*	0.0040	0.0033	*0.0012*	0.0033	*0.0012*	0.15	*0.0012*	*0.0012*
	Calcium, mg/L	NA	*184*	*175*	*129*	NA	*124*	NA	*120*	NA	*120*	*191*	*123*	*226*	*120*	*80*	*80*	*1444*
	Copper, mg/L	0.0036	0.014	0.068	0.021	0.012	0.013	NA	0.020	0.011	0.0096	*0.0018*	*0.0018*	*0.0015*	0.0093	1.7	0.023	0.011
	Iron, mg/L	0.021	1.0	0.18	0.23	0.10	0.15	NA	0.30	0.18	0.13	0.081	0.026	*0.011*	0.28	44	0.34	7.4
	Lead, mg/L	0.0080	0.014	0.018	*0.0040*	*0.0040*	*0.0040*	NA	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	6.4	0.0090	*0.0040*
	Magnesium, m	NA	*9.3*	*46*	*6.9*	*21*	*7.0*	NA	*7.5*	*11*	*7.9*	*19*	*2.9*	*6.3*	NA	*0.50*	NA	*27*
	Manganese, m	0.0066	13	1.3	8.7	1.7	9.0	NA	9.7	7.3	10.0	7.0	11	4.7	9.9	14	8.9	16
	Zinc, mg/L	0.0067	0.82	0.64	1.5	1.13	1.4	NA	1.4	1.0	1.5	NA	1.1	507	1.7	46	1.5	NA
General Parameters	Sulfate, mg/L	NA	*24*	*41*	*169*	*142*	*123*	NA	*153*	*117*	*134*	*122*	*207*	*164*	*108*	*6.4*	*38*	NA
	Alkalinity, mg/L as $CaCO_3$	NA	*468*	*1092*	*221*	*494*	*208*	NA	*182*	*442*	*182*	*676*	*156*	*507*	*202*	*585*	*325*	*4875*
	Sulfide, mg/L	NA	NA	NA	*19*	*1.13*	*23*	NA	*17*	*17*	*15*	*7.1*	*18*	*15*	*26*	*17*	*28*	*1.7*
	BOD, mg/L	NA	NA	NA	NA	*194*	NA	NA	NA	*208*	NA	*353*	NA	*170*	NA	*388*	NA	*354*
	Nitrate/Nitrite mg/l as N	NA	NA	NA	NA	*1.0*	NA	NA	NA	*1.0*	NA	*1.1*	NA	*0.96*	NA	*4.1*	NA	*1.2*
	Ammonia, mg/L as N	NA	NA	NA	NA	*9.0*	NA	NA	NA	*15*	NA	*28*	NA	*5.9*	NA	*37*	NA	*7.2*
	E. Coli, Cnts/100 mL	NA	NA	NA	NA	*187*	NA	NA	NA	*20*	NA	*>2400*	NA	*8.6*	NA	*>2900*	NA	*8.6*

Notes:
Detection limits are only provided for the constituents of concern.
NA = parameter was not analyzed or not applicable.
Concentrations not detected above laboratory detection limits are shown as *italics* as half the detection limit

Table 6
Summary Statistics for Contaminants of Concern for the Treatment Period, 9/19/07 to 10/2/08 with Water Quality Standards

Parameter	EPA Laboratory Detection Limit	Acute[1]	Chronic[1]	Influent Average	Influent Minimum	Influent Maximum	Effluent Average	Effluent Minimum	Effluent Maximum	Percent Removal[2]
Cadmium, dissolved (mg/L)	0.0024	0.0009 (tr)[3]	0.00025	0.14	0.11	0.17	***0.0021***	***0.0012***	0.0049	99%
Copper, dissolved (mg/L)	0.0036	0.007	0.005	0.26	0.04	1.06	***0.0035***	***0.0011***	0.010	99%
Iron, total (mg/L)	0.021	NA	1.0 (Trec)[4]	5.23	0.16	21.22	2.01	***0.01***	16.48	61%
Lead, dissolved (mg/L)	0.008	0.03	0.0012	0.502	***0.004***	2.23	0.010	***0.004***	0.034	98%
Manganese, dissolved (mg/L)	0.0066	2.37	1.31	11.0	5.3	12.7	10.5	7.4	14.7	4%
Zinc, dissolved (mg/L)	0.0067	0.079	0.069	26.5	21.0	30.9	0.55	0.009	1.50	98%

Note:

1 - Metal table value standards are based on a hardness of 50 mg/L

2 - The percent removal was calculated with the average influent and the average effluent concentrations.

3 - tr- trout standard

4 - Trec - the standard is total recoverable. The summary data for iron are all total concentrations.

Shaded values exceed the acute and/or chronic standards.

Bold italicized values are below the detection limit.

Table 7
Sulfide Mineral Solubility Constants for the Constituents of Concern

Less Soluble → More Soluble

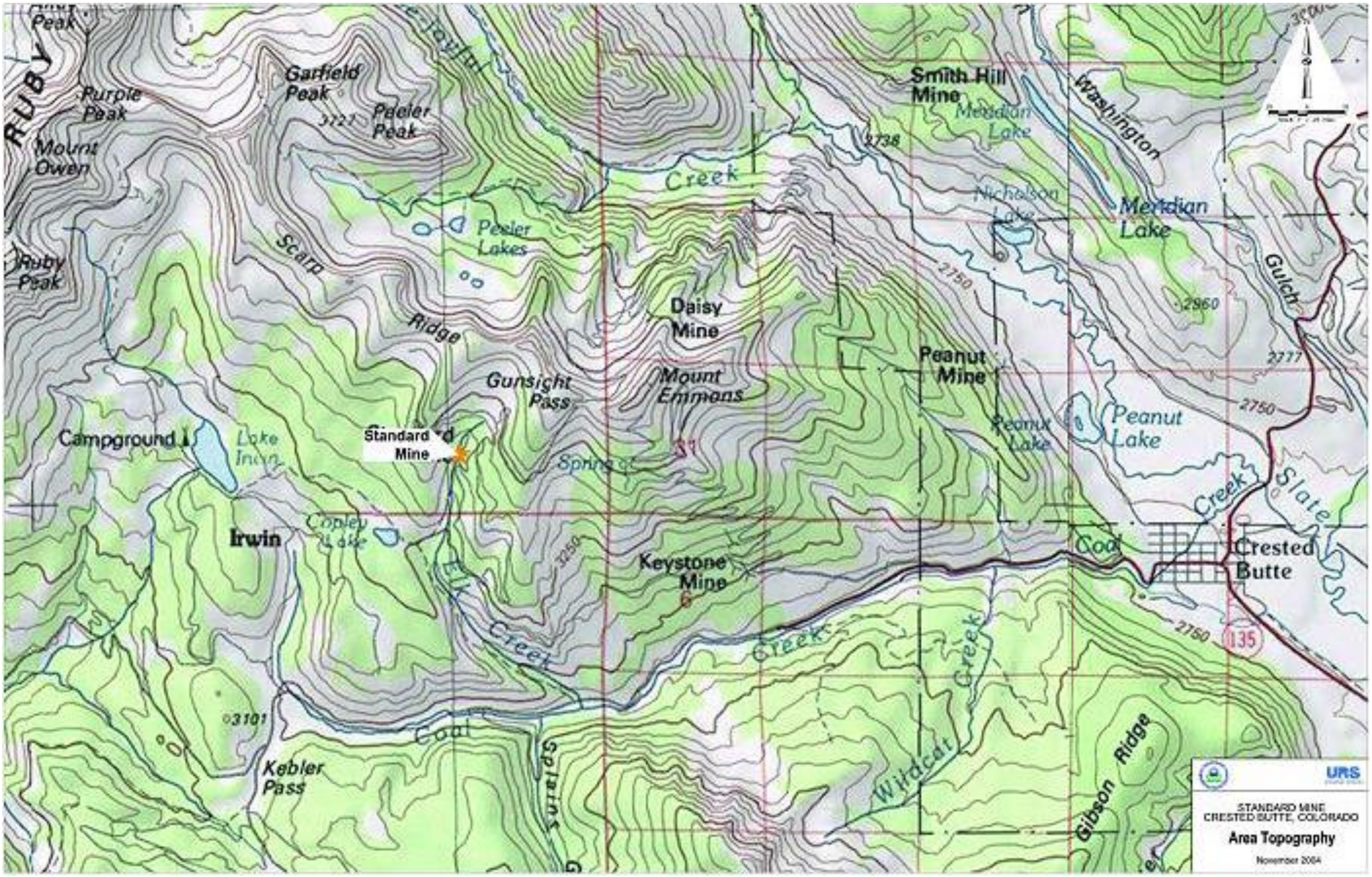
Element	Copper	Iron	Cadmium	Lead	Zinc	Zinc	Zinc	Iron	Iron	Manganese	Manganese
Mineral	Covellite	Pyrite	Greenockite	Galena	Sphalerite	ZnS(am)	Wurtzite	Mackinawite	FeS(ppt)	MnS(grn)	MnS(pnk)
Formula	CuS	FeS2	CdS	PbS	ZnS	ZnS(am)	ZnS	FeS	FeS(ppt)	MnS(grn)	MnS(pnk)
pK values (minteq.v4.dat)	22.30	18.51	14.36	13.97	11.45	9.05	8.95	3.60	2.95	-0.17	-3.34
pK values (minteq.dat)	23.04	18.48	15.93	15.13	11.62	9.05	9.68	4.65	3.92	-3.80	--

Notes:

-Values from databases provided with Phreeqc 2.15.0

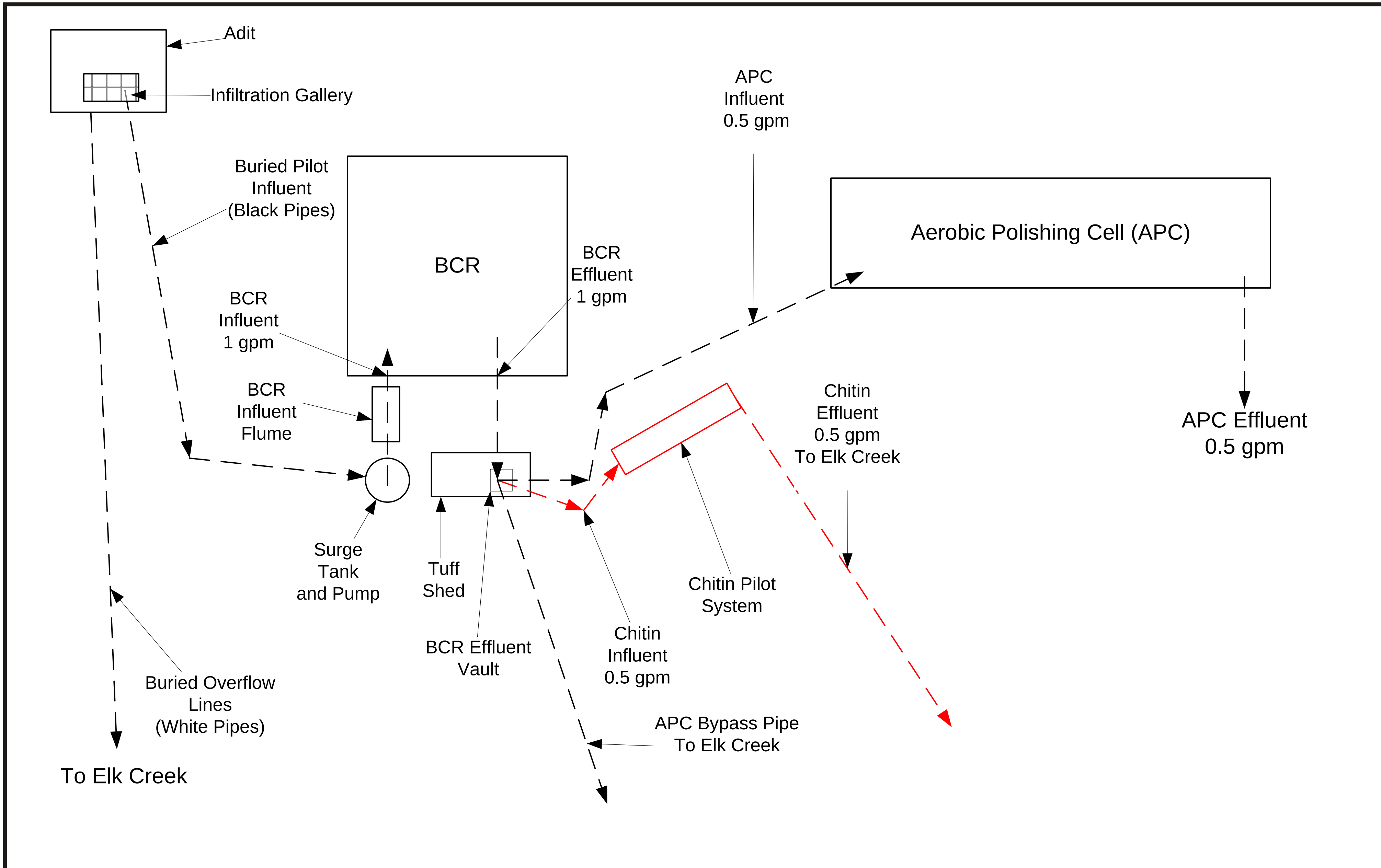
-Minteq databases derived from MINTEQA2 (Allison et al. 1990)

FIGURES



Topographic map provided by URS Inc.

Golder Associates, Denver, Colorado	TITLE: Site Location				
CLIENT/PROJECT: EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT	DRAWN: PCS	DATE: 8/13/2009	JOB NO. 043-2269		
	CHECKED: TLR	SCALE: Not To Scale	DWG. NO.		
	REVIEWED: JJG	FILE NO. J:\04JOBS\043-2269 EPA GSA II\Standard Mine\Visio\FNL RPT Figure 1.vsd	FIGURE NO. 1		



Golder Associates

Denver, Colorado

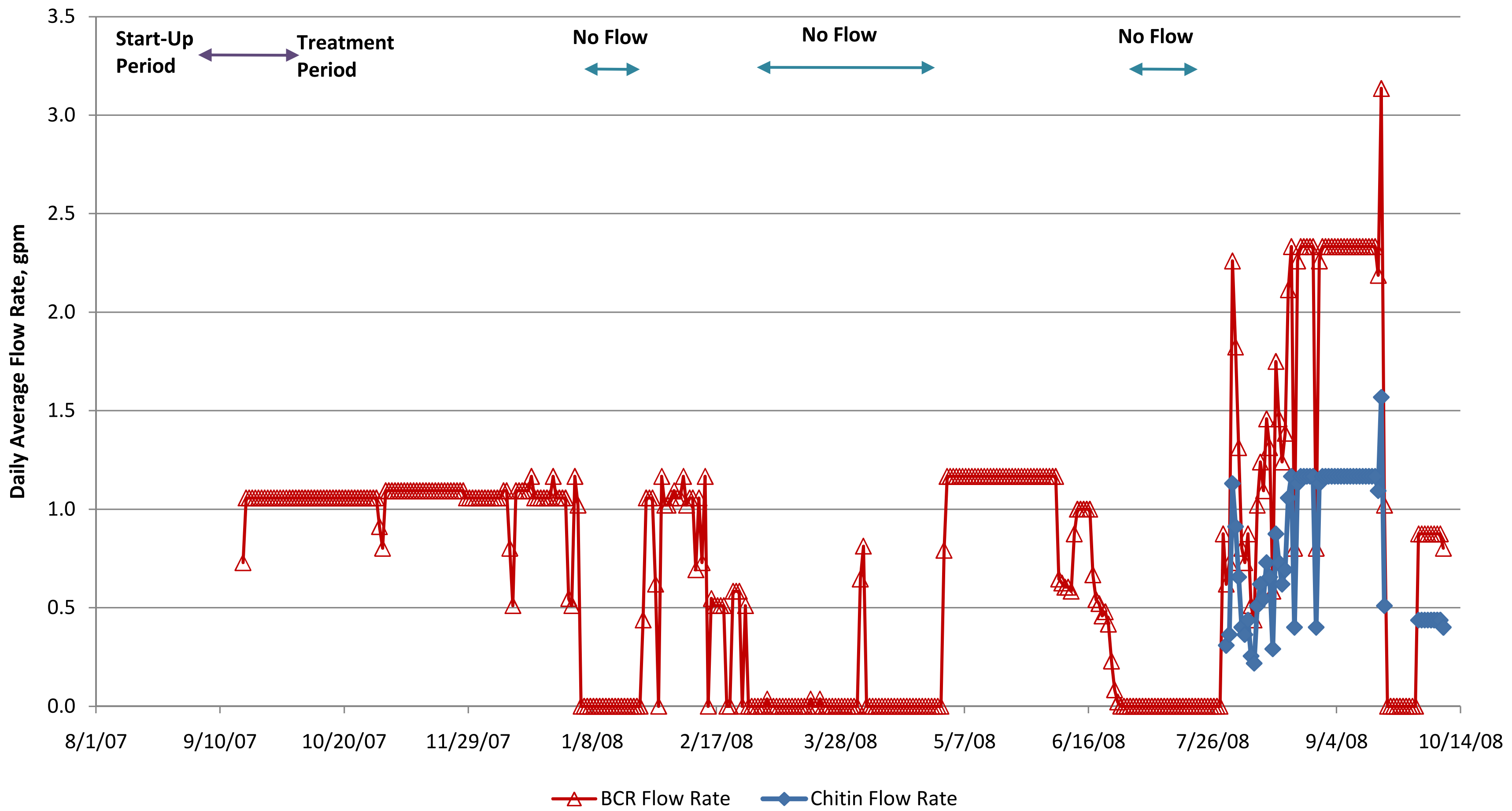
TITLE

PILOT TREATMENT SYSTEM LAYOUT

CLIENT/PROJECT

EPA Standard Mine
Pilot Scale Passive Treatment System

DRAWN	PCS	DATE	3/16/2009	JOB NO.	043-2269
CHECKED	PCS	SCALE	Not To Scale	DWG. NO.	
REVIEWED	TLR	FILE NO.	J:\04JOBS\043-2269 EPA GSA II\Standard Mine\Visio\ChitoRem Design_TLR.vsd	FIGURE NO.	2



Golder Associates
Denver, Colorado

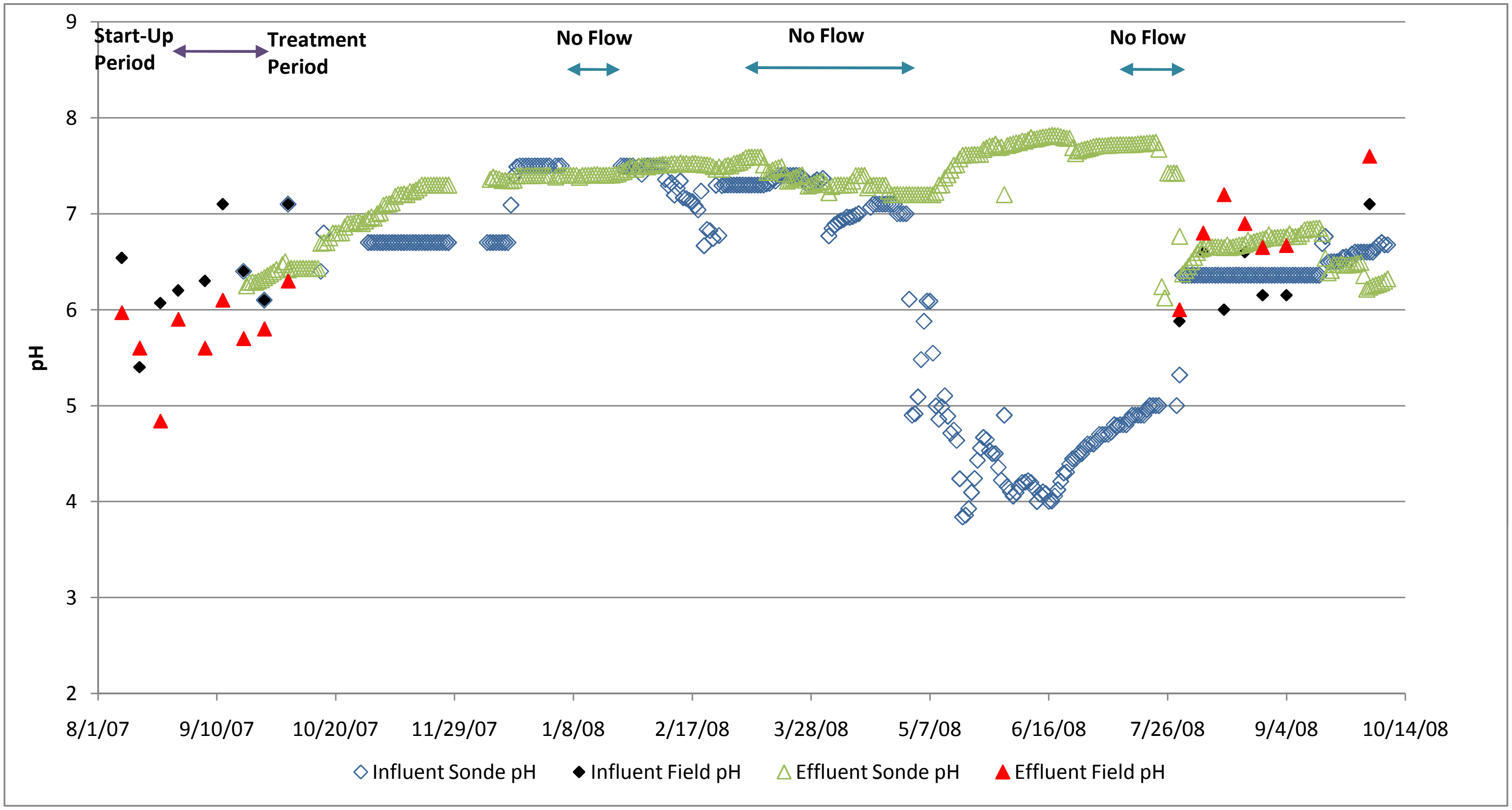
TITLE

BCR and Chitin Flow Rates

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	3



Golder Associates

Denver, Colorado

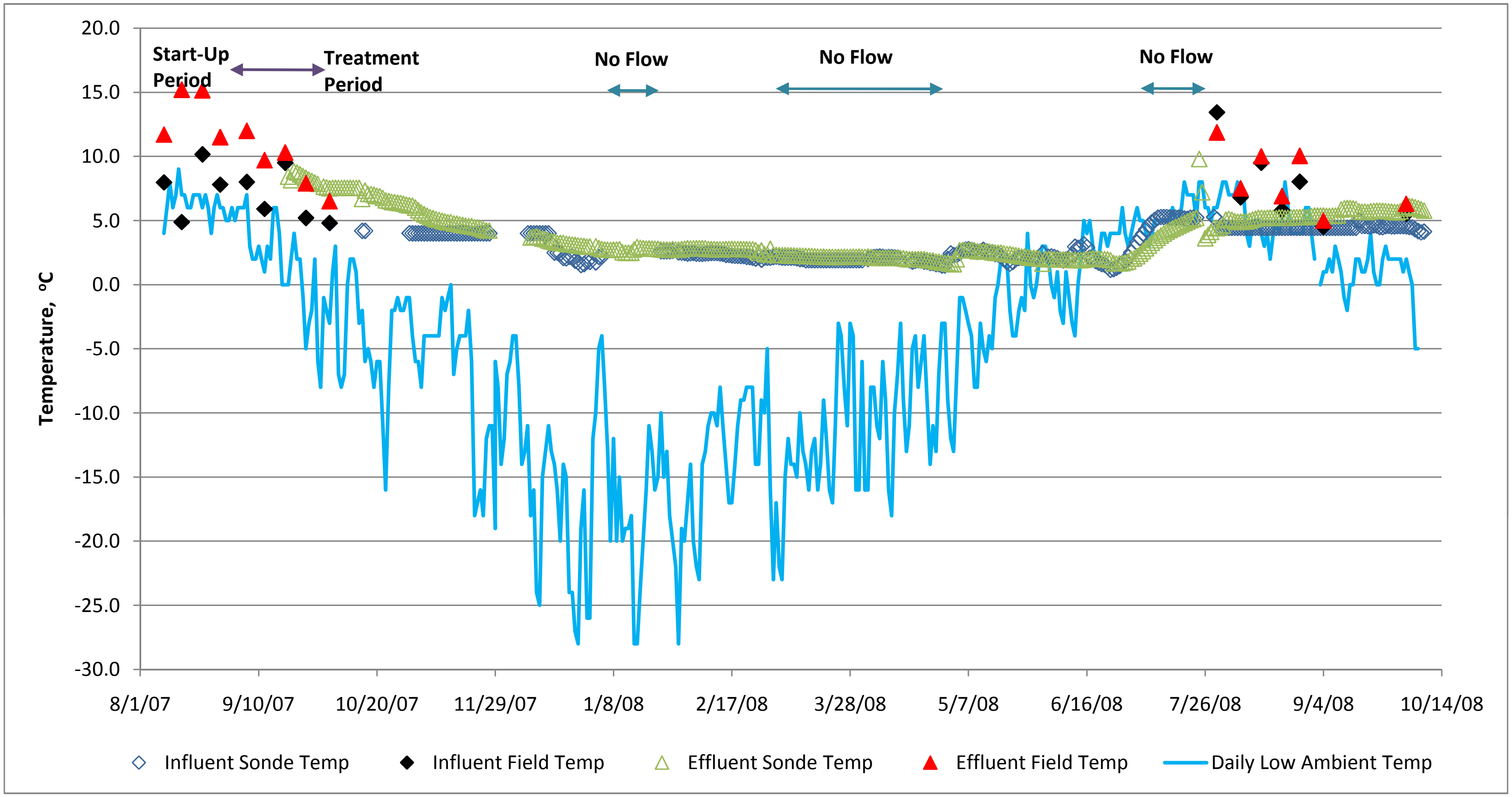
TITLE

pH Data Downloaded from the Hydrolab Sondes and Field Measurements

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	4



Golder Associates

Denver, Colorado

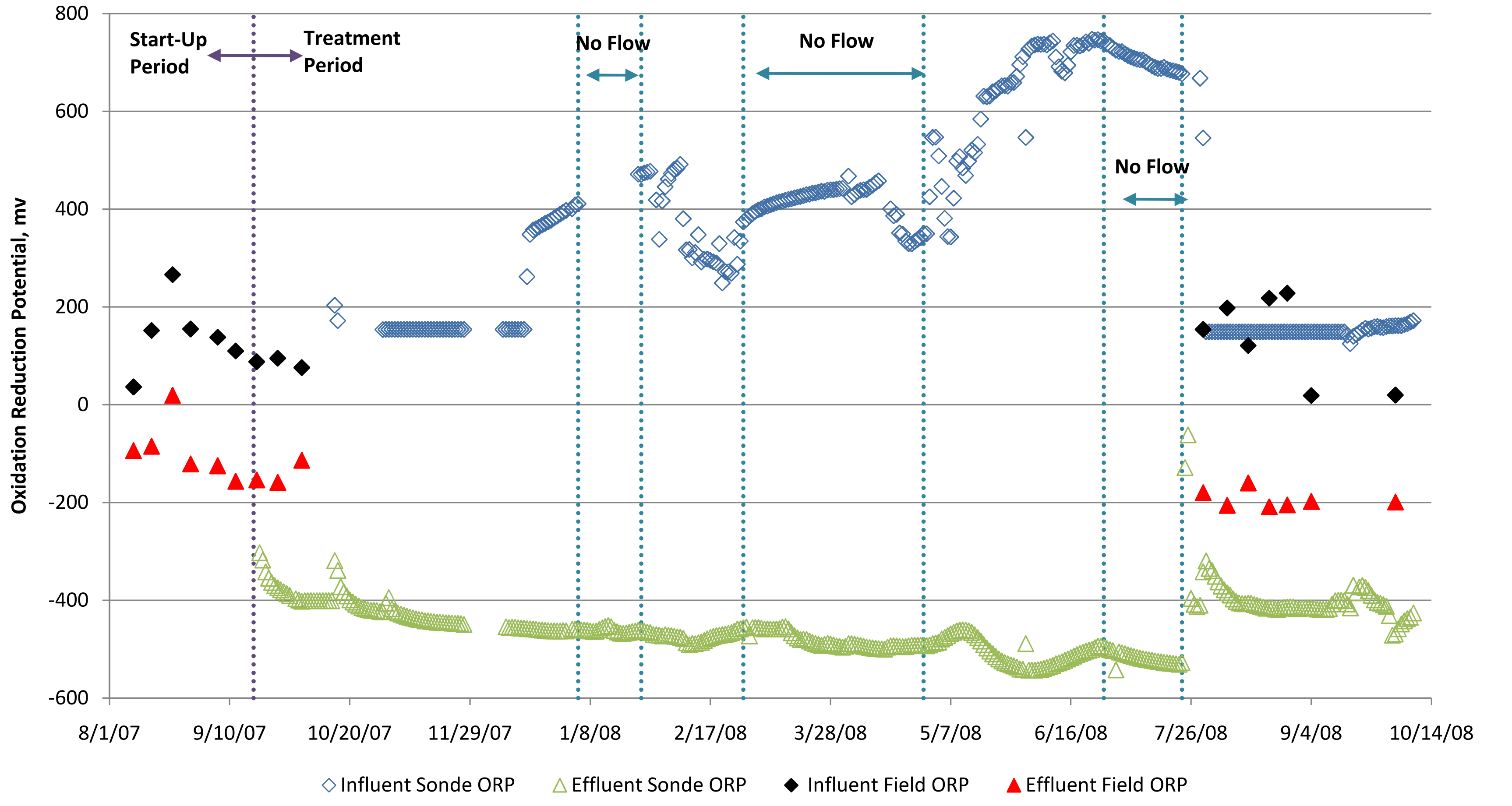
TITLE

BCR Sonde Average Daily Temperature and Field Temperature Measurements

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	5



Golder Associates

Denver, Colorado

TITLE

BCR Average Daily Oxidation-Reduction Potential and Field ORP Measurements

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
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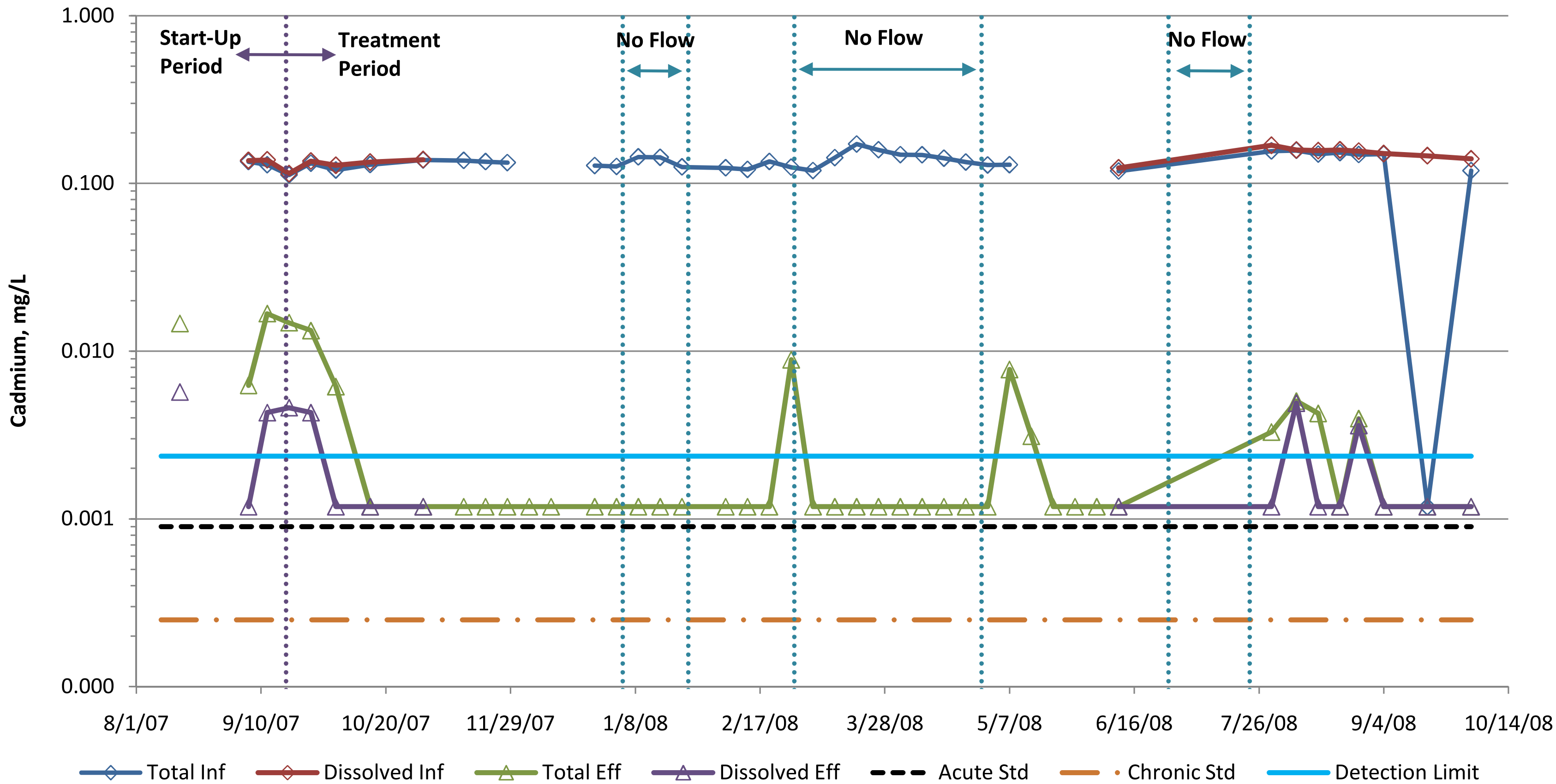
REVIEWED	JJG	FILE NO.		FIGURE NO.	6

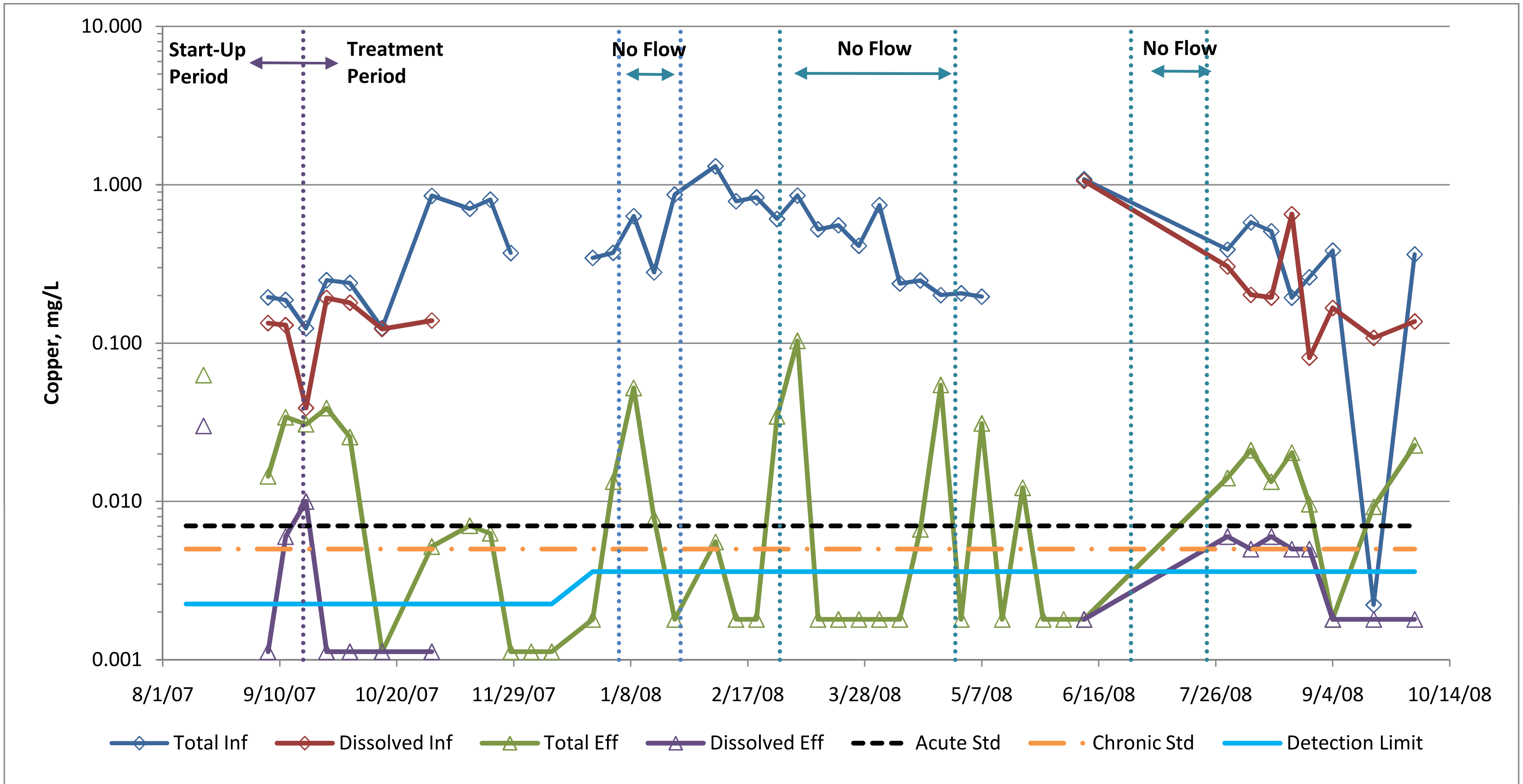


All values below the laboratory detection limit are graphed as one-half the detection limit.

Golder Associates

Denver, Colorado

TITLE: **BCR Cadmium Concentrations**			
CLIENT/PROJECT: **EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT**	DRAWN: PCS	DATE: August-09	JOB NO.: 043-2269
	CHECKED: EPB	SCALE: NA	DWG. NO.:
	REVIEWED: JJG	FILE NO.:	FIGURE NO.: 7



All values below the laboratory detection limit are graphed as one-half the detection limit.

Golder Associates

Denver, Colorado

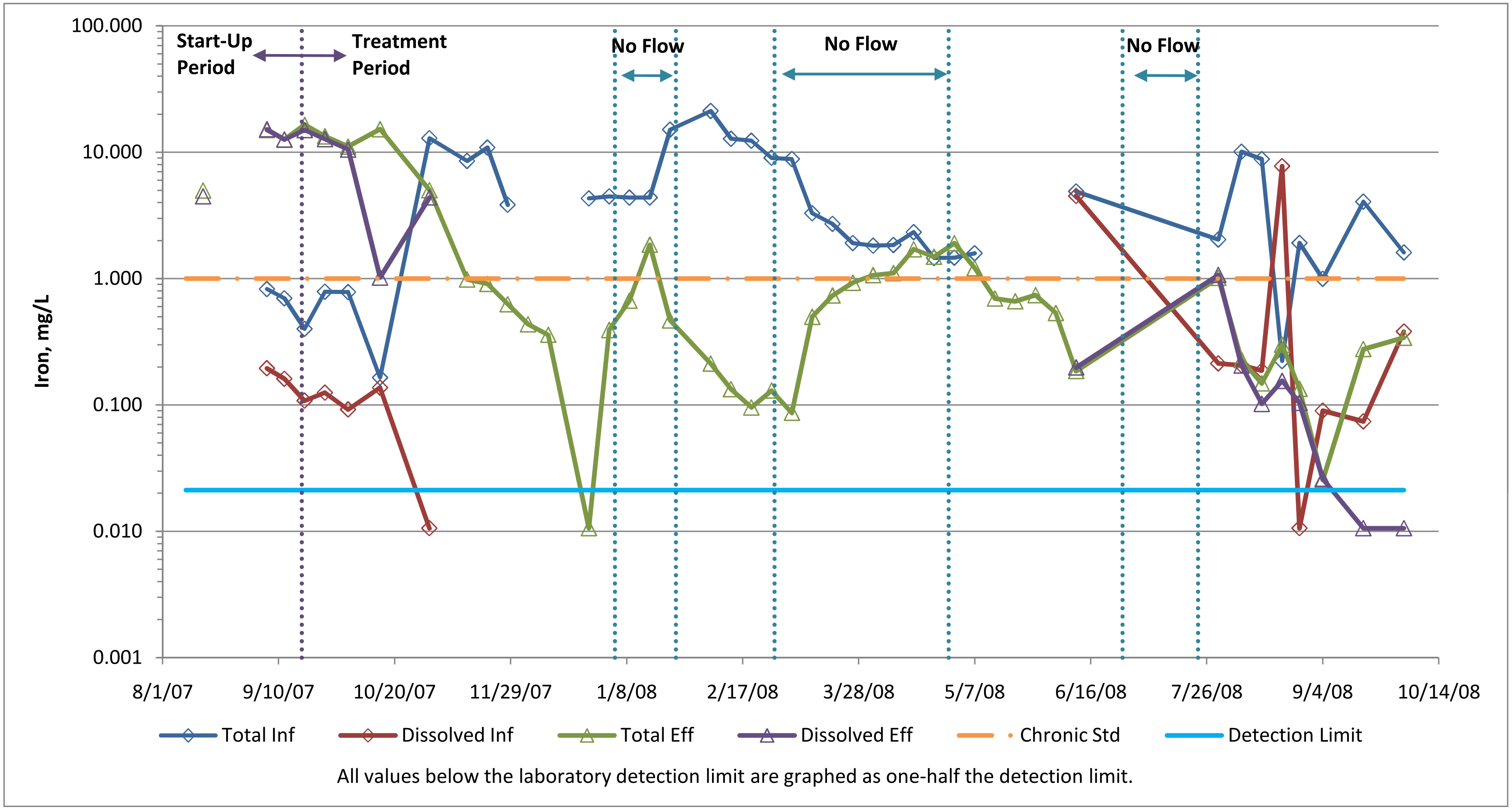
TITLE

BCR Copper Concentrations

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	8



Golder Associates Denver, Colorado	TITLE **BCR Iron Concentrations**				
CLIENT/PROJECT **EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT**	DRAWN	PCS	DATE	August-09	JOB NO. 043-2269
	CHECKED	EPB	SCALE	NA	DWG. NO.
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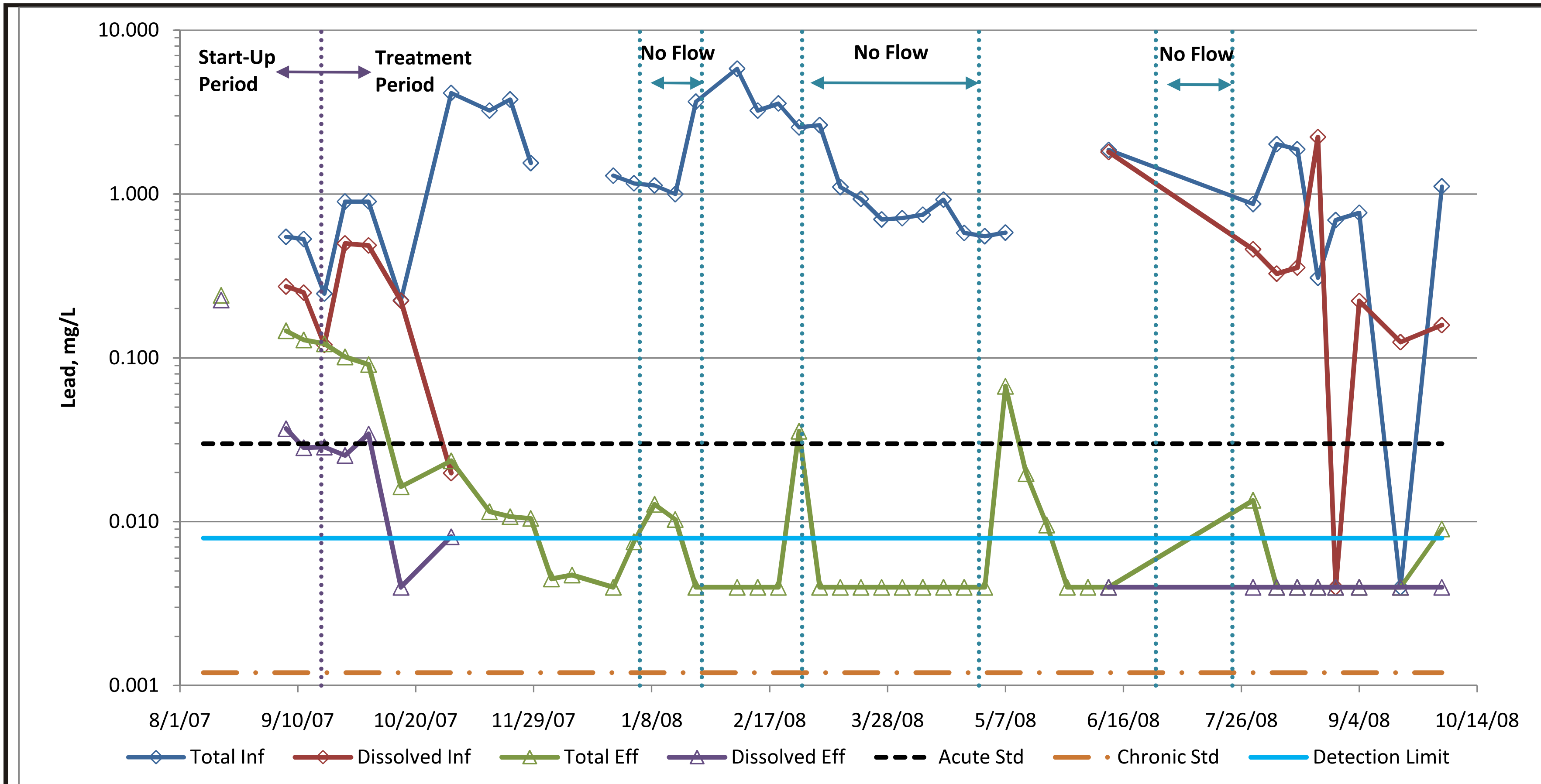


All values below the laboratory detection limit are graphed as one-half the detection limit.

Golder Associates

Denver, Colorado

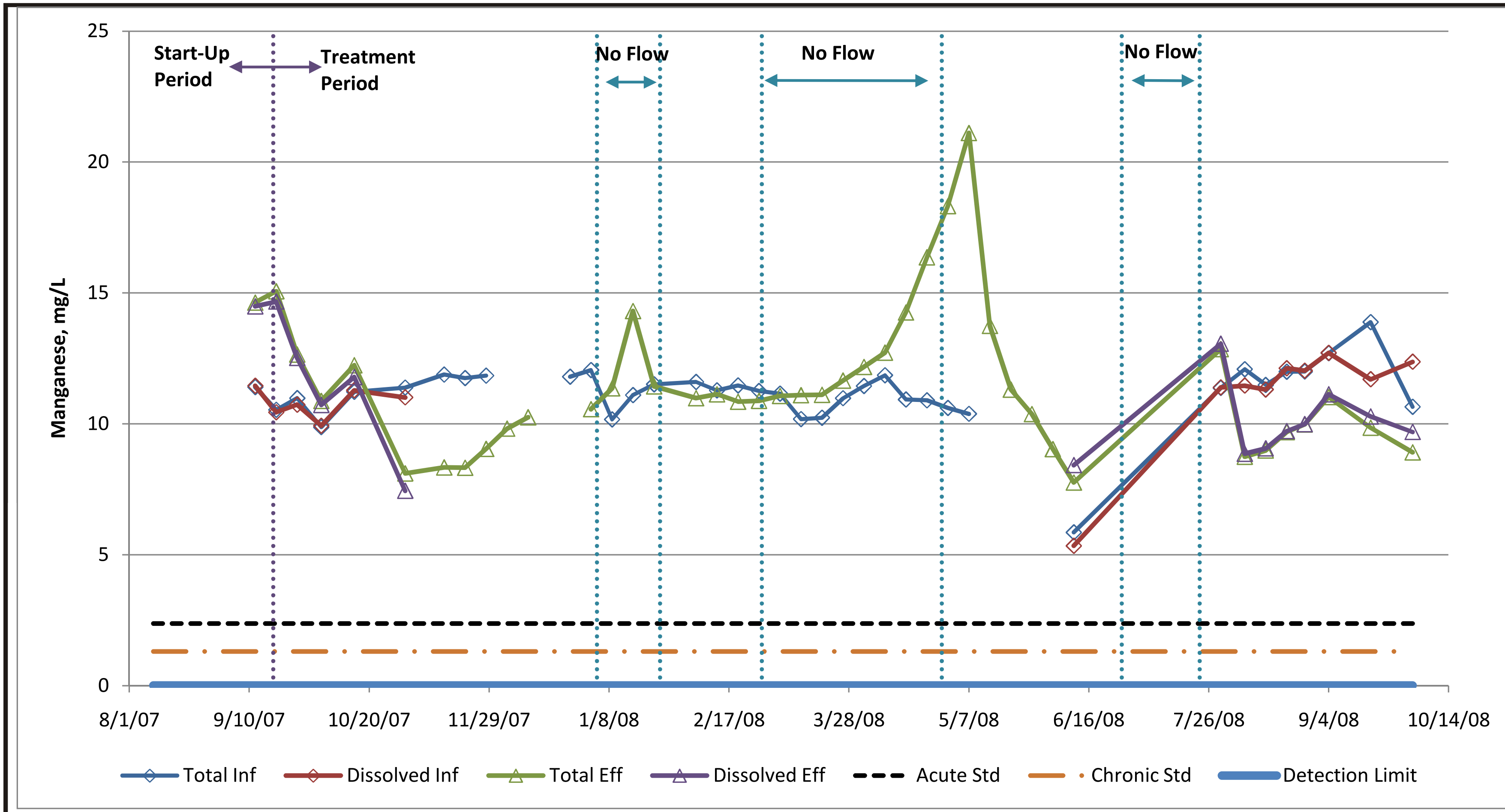
TITLE

BCR Lead Concentrations

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	10



Golder Associates
Denver, Colorado

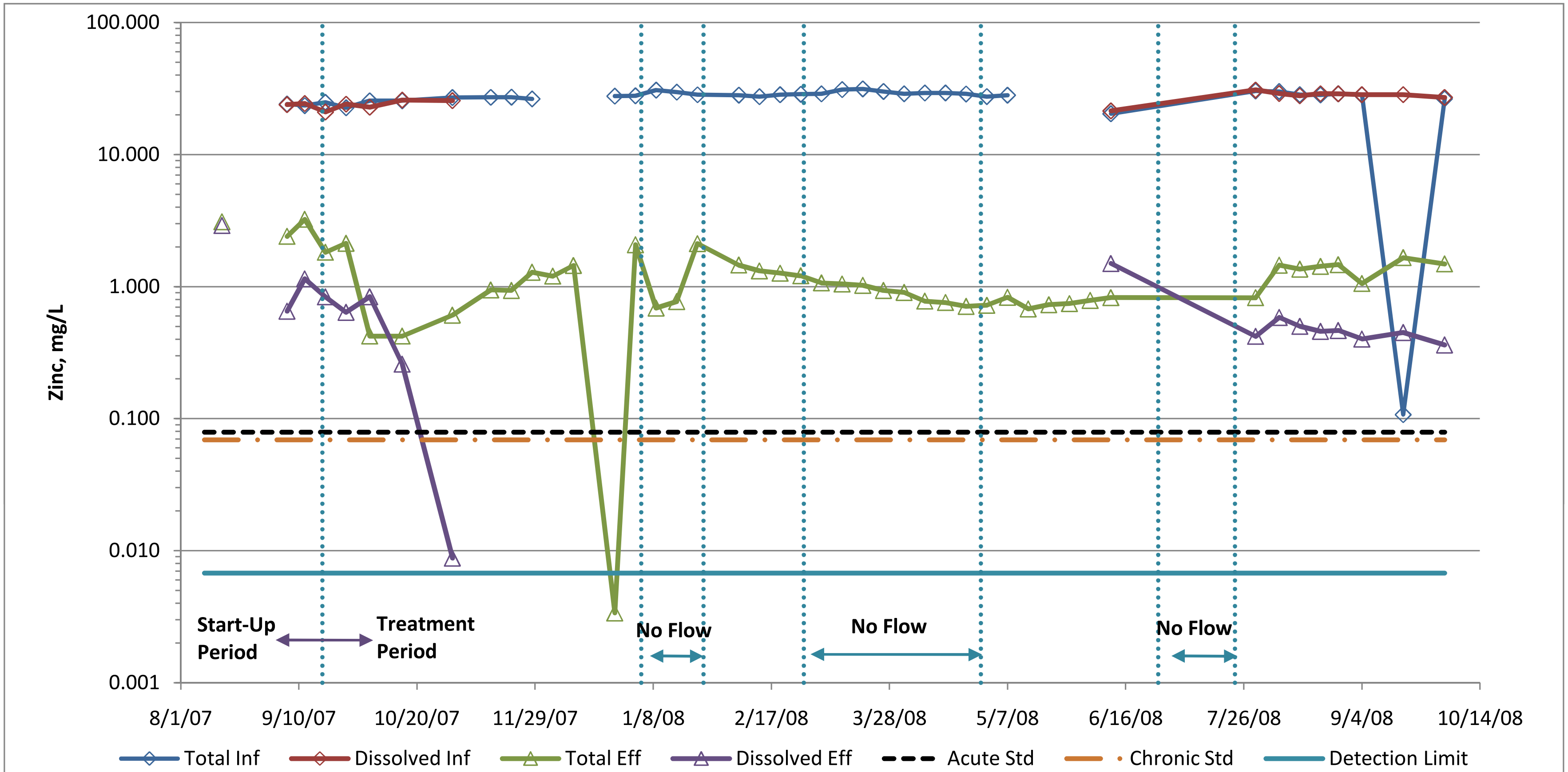
TITLE

BCR Manganese Concentrations

CLIENT/PROJECT

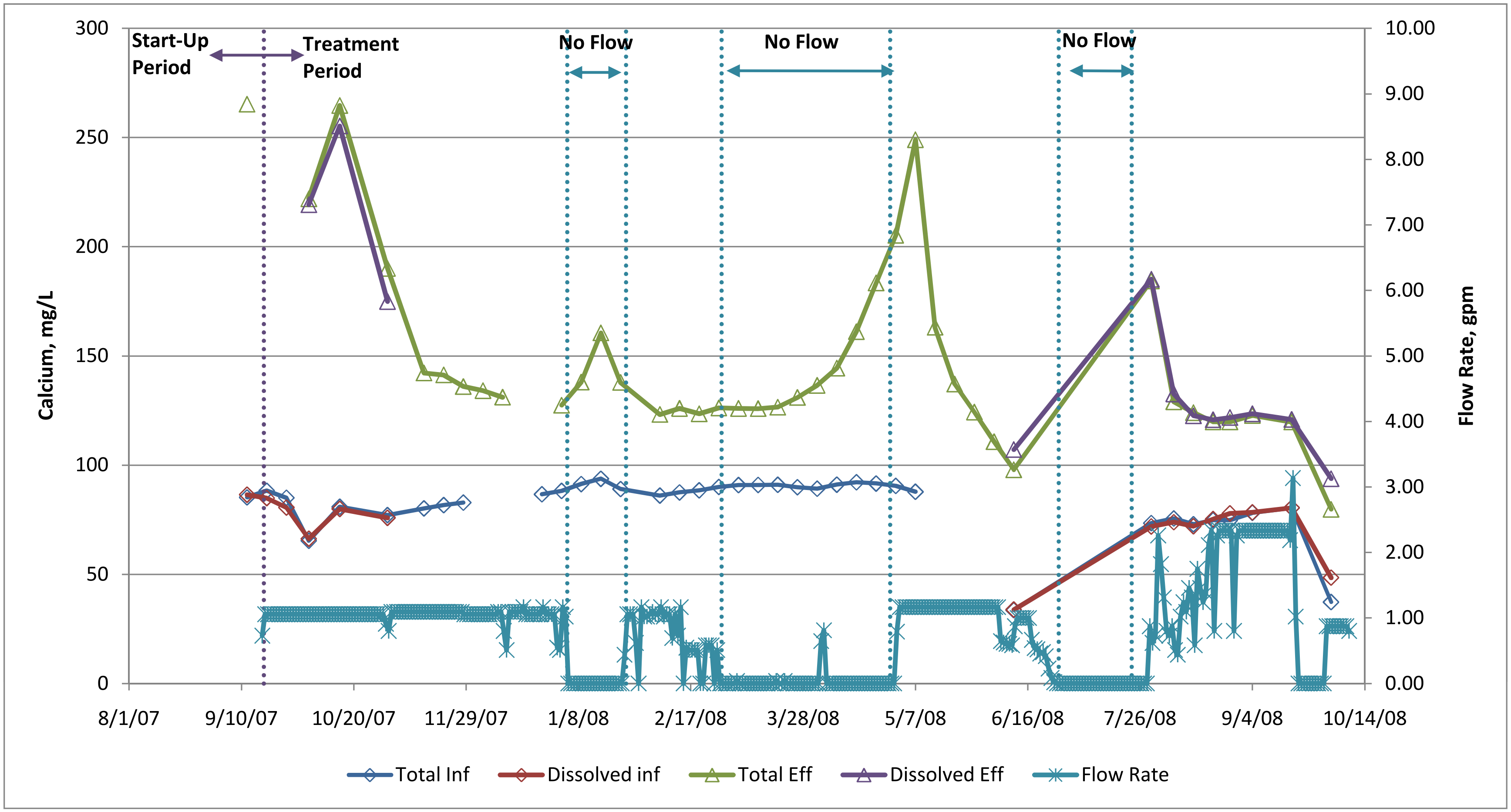
EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	11



All values below the laboratory detection limit are graphed as one-half the detection limit.

Golder Associates, Denver, Colorado	TITLE: **BCR Zinc Concentrations**		
CLIENT/PROJECT: **EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT**	DRAWN: PCS	DATE: August-09	JOB NO.: 043-2269
	CHECKED: EPB	SCALE: NA	DWG. NO.:
	REVIEWED: JJG	FILE NO.:	FIGURE NO.: 12



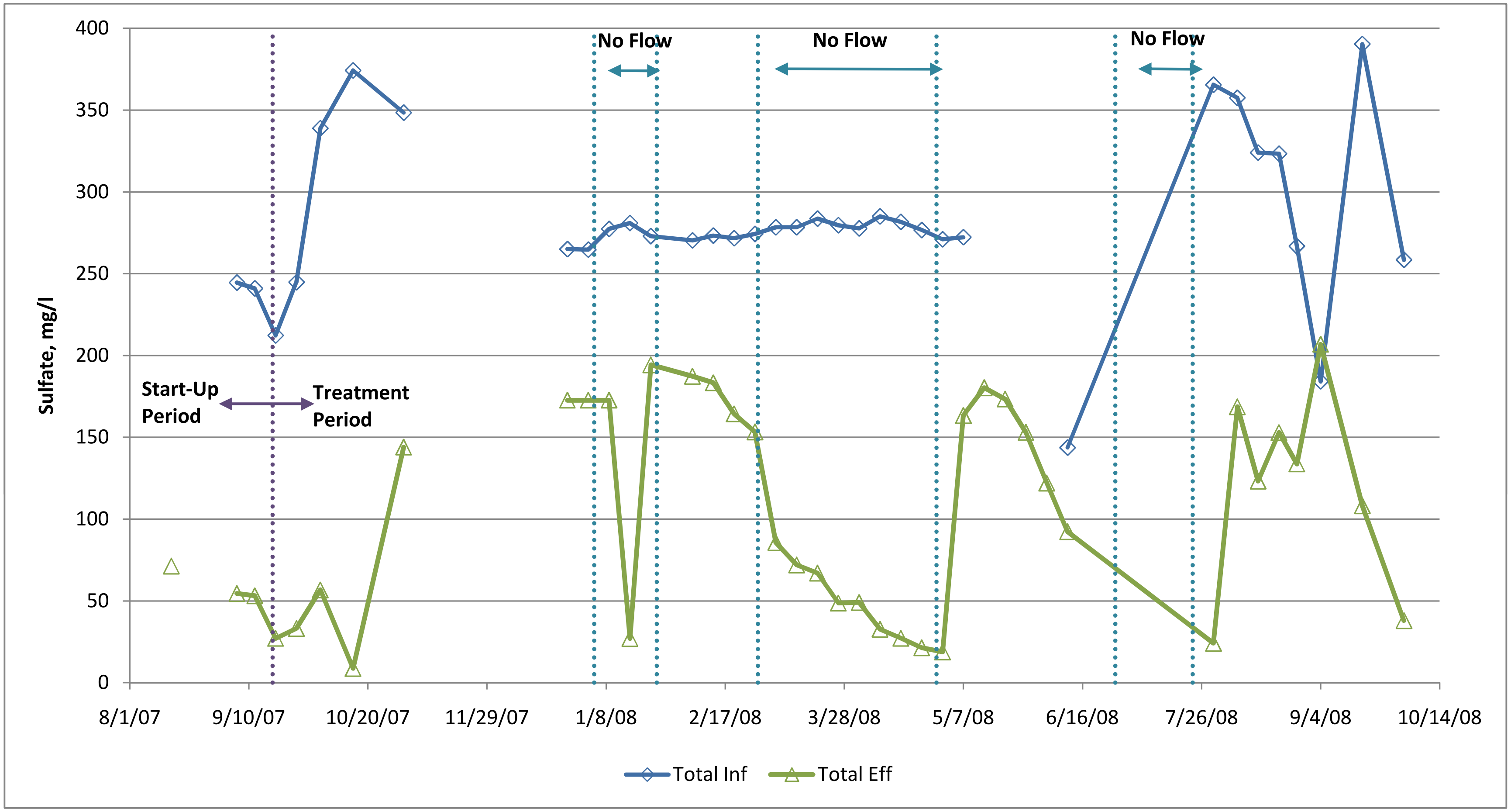
Golder Associates

Denver, Colorado

TITLE					
BCR Calcium Concentrations					
DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	13

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT



Golder Associates

Denver, Colorado

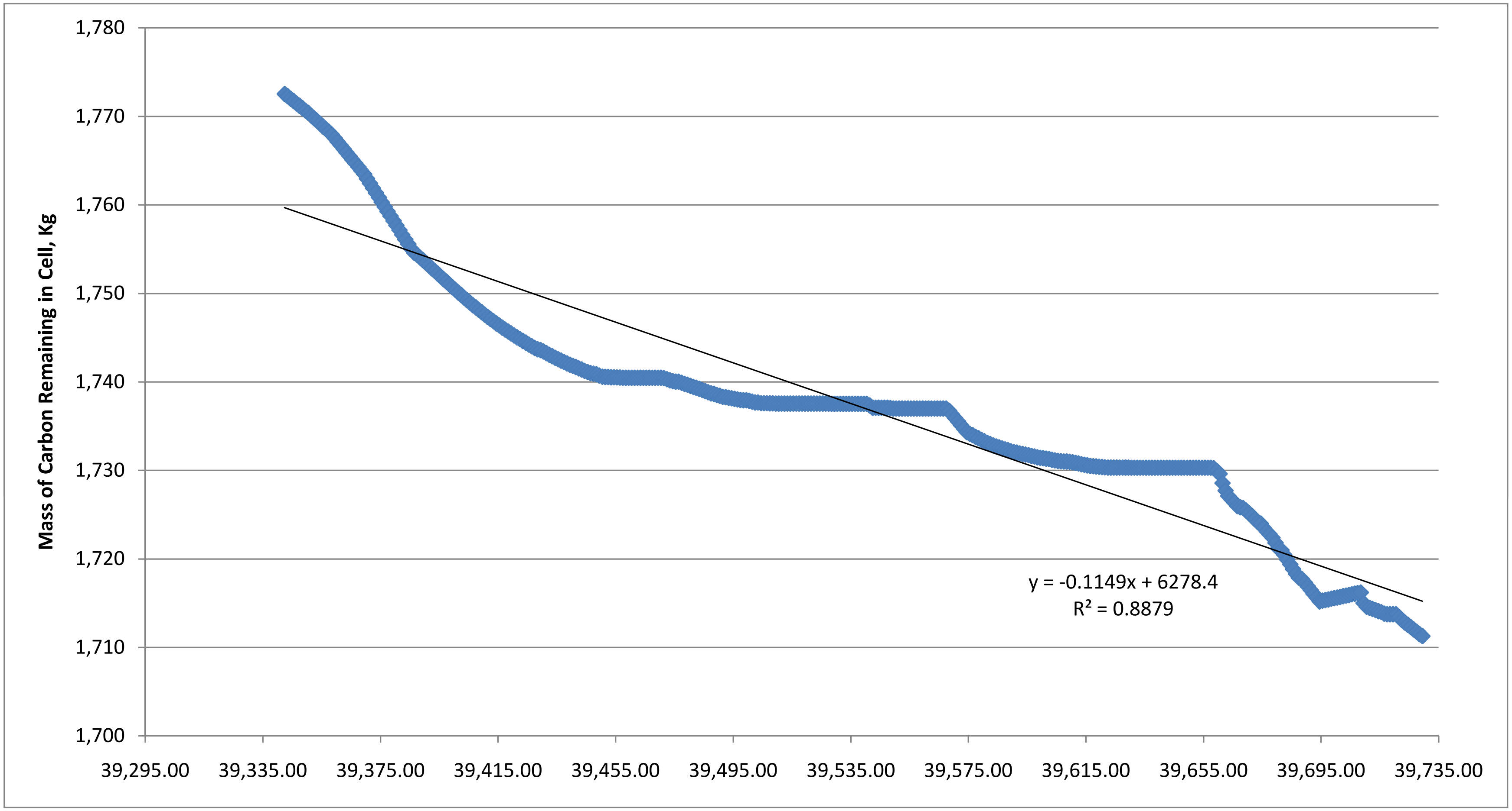
TITLE

BCR Sulfate Concentrations

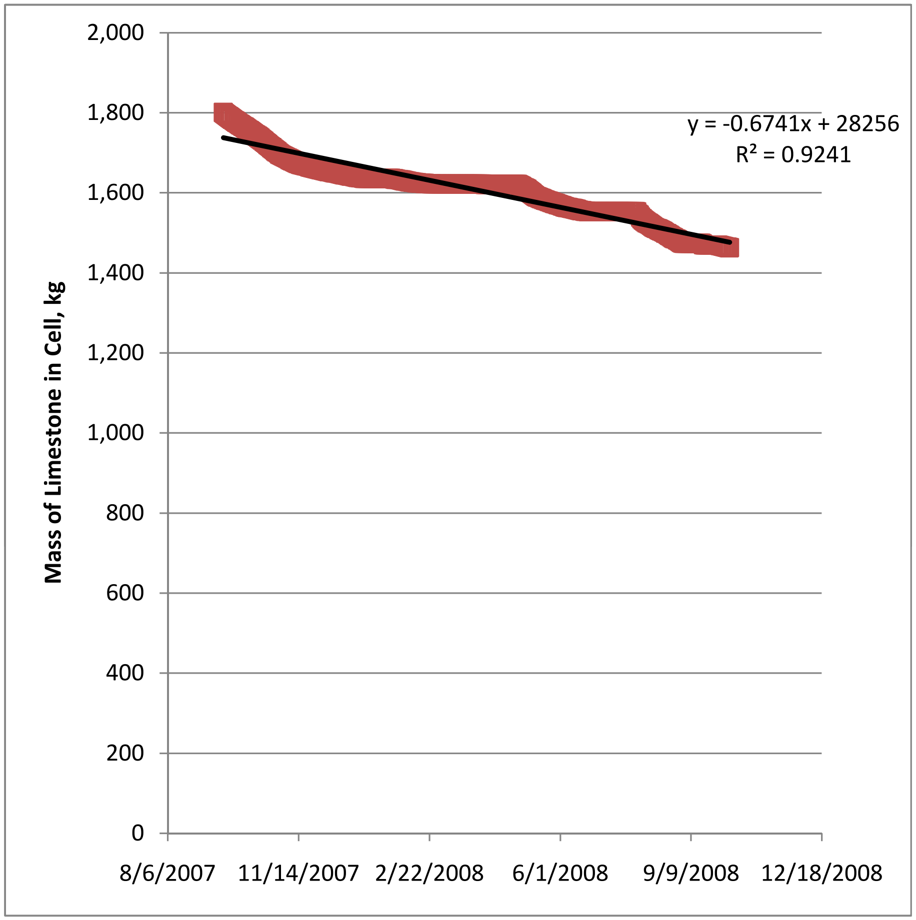
CLIENT/PROJECT

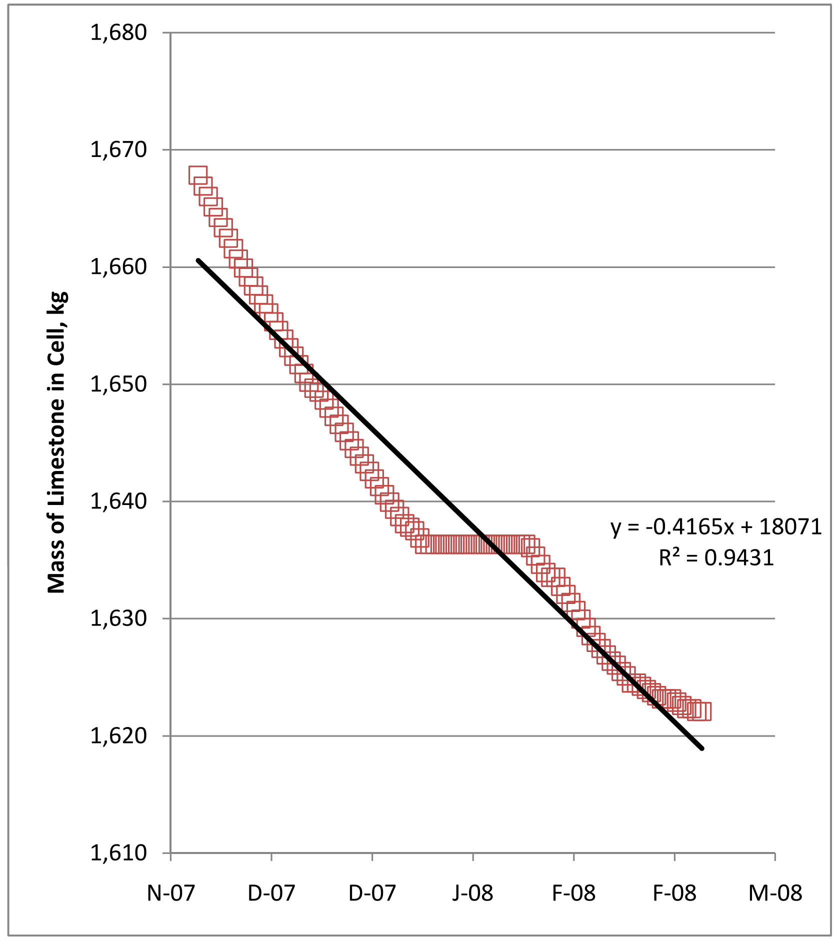
EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	14

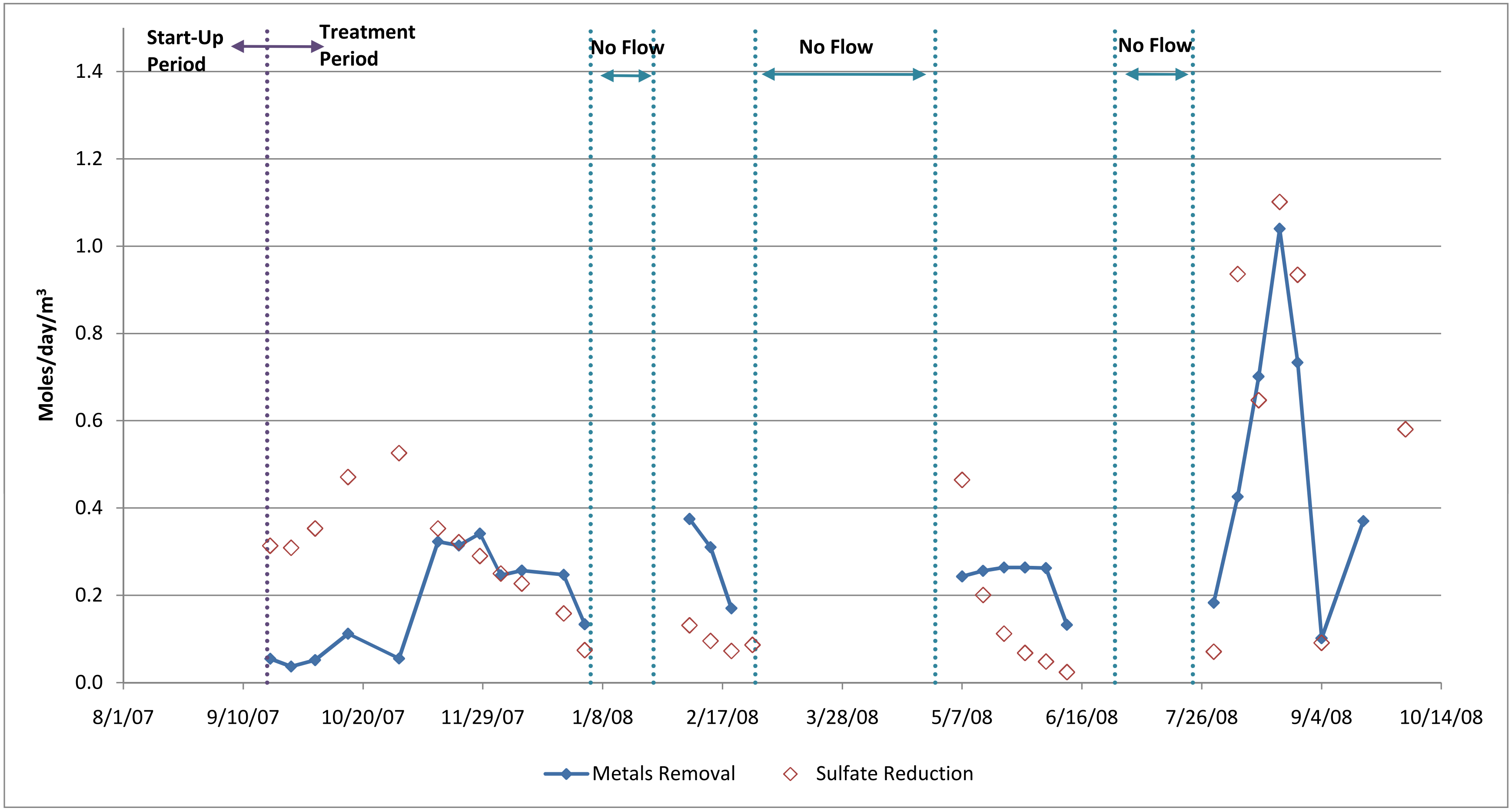


Golder Associates Denver, Colorado	TITLE **Calculated Carbon Mass Remaining in BCR Cell, Based on Flow Rate and Sulfate Concentrations**		
CLIENT/PROJECT **EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT**	DRAWN **PCS**	DATE **August-09**	JOB NO. **043-2269**
	CHECKED **EPB**	SCALE **NA**	DWG. NO.
	REVIEWED **JJG**	FILE NO.	FIGURE NO. **15**





Golder Associates, Denver, Colorado	TITLE: **Calculated Limestone Mass Remaining in BCR Cell, Based on Flow Rate and Calcium Concentrations**				
CLIENT/PROJECT: **EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT**	DRAWN: **PCS**	DATE: **August-09**		JOB NO.: **043-2269**	
	CHECKED: **EPB**	SCALE: **NA**		DWG. NO.	
	REVIEWED: **JJG**	FILE NO.		FIGURE NO.: **16**	



Golder Associates
Denver, Colorado

TITLE

BCR Molar Metal and Sulfate Removal Rates (Cadmium, Copper, Iron, Lead, and Zinc)

CLIENT/PROJECT

EPA STANDARD MINE PILOT SCALE PASSIVE TREATMENT

DRAWN	PCS	DATE	August-09	JOB NO.	043-2269
CHECKED	EPB	SCALE	NA	DWG. NO.	
REVIEWED	JJG	FILE NO.		FIGURE NO.	17

APPENDIX A

DESCRIPTION OF PILOT DESIGN AND CONSTRUCTION WITH PHOTOGRAPHS

1.0 PILOT SYSTEM LAYOUT AND CONSTRUCTION

1.1 BCR Sizing

Water quality samples were collected from the Level 1 Adit from 1996 to 2001. The average and maximum metal concentrations from this dataset are provided in Table A-1. The Level 1 Adit discharges continuously. The maximum concentrations were used as the design basis water quality for the Pilot system. Based on the maximum concentrations, a flow rate of 1 gallon per minute (gpm), and a metals loading rate of 0.3 moles/day/m^3 of substrate, a required volume of 14 cubic yards (CY) of organic substrate was calculated. Due to freezing concerns, the BCR layout included below-grade construction and an insulating cover.

The BCR substrate mixture included wood chips, cow manure, hay, and limestone. Table A-2 presents a summary of the substrate ingredients and used in the BCR. Approximately 47 CY of substrate were mixed and installed in the BCR, resulting in a constructed pore volume of approximately 4,750 gallons, which translates to a hydraulic retention time of 79 hours (3.3 days) at a flow of 1 gpm. The installed volume of substrate (47 CY) is greater than the design volume (14 CY) because the installed volume includes the substrate required to fill the sideslopes of the cell.

1.2 APC

The initial APC Pilot sizing was for a surface area of 4,800 ft^2, which was considered impracticable given the available area at the Site. Consequently, the constructed APC area was field-fit and the final area of the cell was approximately 900 ft^2.

1.3 Chitin Design

The chitin reactor was designed to operate with a 12-hour retention time, based on the recommendations of Rachel Brennan (Personal correspondence). The reactor was sized to be housed in a 1,500 gallon septic tank, and included a mixture of Chitorem^{tm} and coarse sand. As constructed, the Chitin reactor was filled with 2,500 pounds of Chitorem^{tm} material well-mixed with 10,000 pounds of coarse sand. This mixture comprised the substrate of the chitin reactor. The chitin reactor was designed to operate similarly to the BCR; the reactor would receive influent at the surface of the substrate. Water would flow vertically through the reactor to perforated PVC effluent collection pipes located in the bottom of the reactor. A non-perforated vertical standpipe set the water level in the cell to a fixed elevation. Flow was designed to be discharged from this standpipe directly to Elk Creek via a gravity pipeline.

1.4 BCR Construction

The Pilot BCR was constructed as a downward flow vertical reactor. The BCR is comprised of three distinct zones: the bottom zone is a 6 inch (15 centimeter)-thick limestone drainage layer, the middle zone is a 3 foot (91 centimeter)-thick organic substrate layer, and the top zone consists of 6” (15 centimeters) of standing water. BCR construction photos are included at Attachment 1. Detailed descriptions of construction activities follow.

Excavations. The Pilot BCR was located near the Level 1 Adit at the Site. The BCR excavation was completed with a bottom footprint of 170 square feet (15.8 square meters) and a top-of-berm area of about 1,100 square feet (102 square meters). An effluent collection pipeline was installed as a horizontal run from the center of the cell to the south side of the BCR wall. The excavation floor and side slopes were compacted using a hand operated mechanical compactor.

Geosynthetics. A layer of six-ounce protective geotextile was overlaid on the final excavated grades. A Permalon™ PLY X-210R impermeable liner was set above the geotextile. A Permalon™ pipe boot was installed to allow the effluent collection pipeline to penetrate the liner. The pipe boot was installed using Fab™ Tape and approximately 50 lbs. of bentonite to seal the area of the liner penetration. Finally, a six-ounce geotextile layer was laid on top of the permalon liner to protect the floor of the BCR cell.

Effluent Collection Piping. Two-inch diameter perforated HDPE DR 17 pipe was set on the floor of the BCR to form an X pattern. Non-perforated two-inch diameter HDPE pipe and fittings were placed in the center of the cell to connect the perforated pipes to the non-perforated effluent collection pipeline. All HDPE pipe connections were made with a butt fusion welder. The HDPE pipe was covered with a layer of 3/4-inch (19 mm) limestone gravel. The gravel was placed in the cell using an excavator and hand-rakes to create an even, level surface.

Substrate. Pilot cell substrate included a mixture of hay, limestone, wood chips, and animal manure (Table A-2). Substrate components were delivered to the Site trailer located on Kebler Pass Road, in proximity to the Site access road. The substrate components were mixed on top of a plastic liner using a skid-steer loader. The mixed substrate was loaded into a dump truck and transported to the Pilot BCR area. The mixed substrate was briefly stockpiled in the vicinity of the BCR before being placed in the cell using an excavator. Additionally, a bacterial inoculum was used from another EPA/Golder treatability study conducted at the Elizabeth Mine site in Vermont from 2005 to 2006 (Smart, 2008). These bacteria were contained in a 55 gallon (208 liter) non-metallic drum that treated two different MIWs at the Elizabeth Mine. Afterwards, the drum was drained and shipped to the Golder laboratory facilities in Lakewood, Colorado (Golder Lab). A new batch of substrate containing the same ingredients as the Pilot BCR was mixed and placed in a 55-gallon (208 liter) drum at the Golder Lab. This fresh batch of substrate was inoculated with Elizabeth Mine substrate. The new drums were filled with water from the Standard Mine, covered and incubated at the Golder Lab to allow the bacteria to adapt to the new MIW. This inoculated substrate was added to the fresh substrate placed in the BCR cell during construction.

1.5 Piping and Flow Control System Construction

Prior to Pilot construction, MIW generated in the Level 1 Adit was discharged via uncontrolled surface flow from the mouth of the adit to Elk Creek. As part of the Pilot construction, new pipelines and flow control structures were installed to convey MIW from the adit into the BCR cell. The influent delivery system includes a storage tank and influent pump, whose circuit is controlled by an electric timer. The pump operation time would then be set to deliver a daily flow of 1 gpm. The pump and influent storage tank is located near the BCR, an influent pipeline delivers MIW from the adit to the storage tank. From the storage tank, MIW is pumped into the BCR and excess flow to the storage tank flows to Elk Creek via an overflow gravity pipeline. Due to concerns of suspended sediments and iron possibly clogging the influent pipeline, an infiltration gallery and sediment basin was constructed at the adit.

A pump was included in the system layout in order to allow more precise deliver of the 1 gpm design flow rate. With limited knowledge of the Site, it was also unclear whether the BCR could be fed by gravity flow.

The infiltration gallery consists of a cast-in-place concrete basin lined with a geosynthetic membrane. The infiltration gallery is approximately 2 feet (0.6 meters) long by 4 feet (1.2 meters) wide by 2 feet (0.6 meters) deep. The gallery is filled with pea gravel to prevent freezing and partially filter sediment before it reaches the pipes. Two perforated two-inch diameter HDPE pipes were laid horizontally across the bottom of the infiltration gallery. A one-foot layer of inert three-quarter-inch diameter inert gravel was placed over the perforated pipes. Finally, two four -inch diameter schedule 40 PVC pipes were installed near the top of the concrete basin. The perforated HDPE pipes were connected to the BCR influent pipelines which delivered MIW to the influent storage tank. The white PVC pipes, installed as overflow pipes, run directly to Elk Creek from the infiltration gallery. Under typical operating conditions, the BCR influent pipelines would collect all the MIW discharged from the adit. The overflow pipes would receive MIW only during peak flow conditions, or if the influent pipes became clogged. Two influent and two overflow pipes were installed to provide system redundancy and minimize the potential for system failure due to clogged pipes.

The 2-inch diameter influent pipes connect the infiltration gallery to the influent storage tank. Flanged fittings transition from HDPE to Schedule 40 PVC pipe, which connects to the surge tank via bulkhead fittings installed on the tank sidewall near the tank bottom. Two Schedule 40 PVC overflow pipes were installed to allow gravity flow from the influent storage tank to Elk Creek. These pipes were installed using bulkhead fittings near the top of the storage tank, located on the sidewall opposite the influent pipelines. Thus, the influent storage tank is designed to be continuously flushed with fresh MIW to avoid stagnant conditions.

The severe winter climate of the Site required burying pipes and storage tank as deep as practical to provide freeze protection. Influent and overflow pipes were buried several feet below the ground surface from the infiltration gallery to the discharge point in Elk Creek. The pipelines were installed by excavating a pipe trench using an excavator, placing the pipe, and backfilling the pipe with excavation material. Typically, pipe trenches were excavated to a depth of at least three feet below the prevailing ground surface.

The installed surge tank is a 500 gallon capacity plastic tank. Size was selected based on providing a reservoir for the influent BCR pump to draw down in cases of low flow conditions. Significant tank features include influent and effluent pipes, and a four-inch PVC pump casing installed through the roof of the tank. This casing provides a conduit between the surge tank and the monitoring shed, and allows for easy installation and maintenance of the influent pump and monitoring equipment.

Raw MIW is pumped into the top of the BCR cell and flows vertically downward to the perforate collection pipes at the bottom of the cell. BCR effluent water flows from the collection pipes into the effluent pipe which runs horizontally underneath the BCR cell (via a pipe boot liner penetration), and enters an effluent water control unit located underneath the monitoring shed. The effluent water control unit includes a flanged transition fitting from HDPE to two-inch diameter PVC pipe, a two-inch diameter ball valve, vertical two-inch pipe connected to four-inch pipe via a flexible rubber connector fastened with hose clamps, four-inch diameter PVC pipe, and a tee fitting (anti-siphon). The flexible rubber hose clamps allow the four-inch diameter pipe to slip over the two-inch diameter pipe. The water level of the BCR cell can be adjusted by loosening the rubber connection, adjusting the position of the four-inch pipe, and then tightening the connectors. This water level control system allows the water level of the BCR to be adjusted by approximately 6 inches.

BCR effluent spills from the tee fitting of the effluent water level control unit into a plastic five-gallon bucket which functions as a flow distribution box. The bucket has two bulkhead fittings that are connected to pipelines which deliver the BCR effluent to either the APC or directly to Elk Creek. Flow through these pipelines is controlled via two-inch diameter PVC ball valves installed adjacent to the bulkhead fittings.

1.7 APC and MRB Construction

APC construction began in August 2007 and was completed in September 2008 due to the shortened construction seasons. The footprints of three APC cells and a MRB cell were excavated into waste rock material approximately 35 feet southeast of the BCR. The excavated APC cells had bottom floor footprints of approximately 10 feet by 15 feet. The excavation was lined with a Permalon™ PLY X-210R impermeable liner. The APC influent pipeline consists of a buried two-inch diameter PVC pipe running from the BCR effluent water level control unit (5 gallon bucket) to the southwest corner of the APC, where it enters the APC via a pipe boot. The pipeline was designed to terminate near the bottom of the APC cell, where it would be submerged under a foot of water to prevent freezing. The water level and flow between each APC cell is controlled by earthen berms, with spill points to direct water flow. Approximately 12 inches of soil was placed in the APC cells and two of the cells were planted with wetland plants (Water Sedge and Blue-joint Reedgrass).

1.8 Chitin reactor Construction

Chitin reactor construction occurred from July 23 to July 25, 2008. Representatives from EPA, JRW Bioremediation, and Golder provided direction and construction support to Gunnison Valley Contractors Inc. The downflow chitin reactor was constructed using a 1,500 gallon plastic septic tank that was subsequently buried. A network of perforated collection pipes was installed in the bottom of the tank, and overlain with ¾ -inch diameter gravel to facilitate effluent collection. Coarse sand (10,000 lbs.) was mixed with Chitorem™ (2,500 lbs.) at a ratio of about 1:1 by volume, and placed in the tank above the gravel layer. The Chitorem™/sand mixture essentially filled the septic tank up to the manhole lids with an approximate media volume of 1,400 gallons. Bulkhead fittings were used to connect influent and effluent pipelines to the reactor. Figure A-1 presents a flow diagram of the constructed chitin reactor.

During chitin construction, a the BCR effluent flow distribution box was modified to accept another pipe to the chitin reactor. A two-inch schedule (SCH.) 40 PVC gravity pipeline was installed from the distribution box to the chitin influent bulkhead fitting. This trench was installed approximately four feet below grade, and backfilled to provide freeze protection. A two-inch SCH. 40 PVC effluent pipeline was installed from the chitin reactor effluent bulkhead to a discharge point in Elk Creek. This pipeline was backfilled with approximately one foot of cover. The discharge point was located below the surface water level of Elk Creek to provide freeze protection. Attachment 1 provides photographs of the construction activities.

1.9 Construction Challenges

The high altitude and remote location of the Site presented logistical challenges during construction. Due to lingering snow pack, the Site was not accessible by road until late June 2007. In 2008, the Site access roads were impassable until late July; even in a typical four-wheel drive vehicle, travel time from the Kebler Pass Road to the Site was about 45 minutes. Transporting construction equipment and materials took significantly longer. Additionally, transportation concerns were complicated by off-highway dump truck and other heavy equipment traffic related to the ongoing removal actions being conducted at the Site. Pilot construction activities had to be carefully planned not to interfere with the removal actions. Finally, the remote location of the Site made material procurement difficult. A simple trip to the hardware store would take at least two hours. Efforts were made to minimize shopping trips.

Positioning of Pilot construction materials and equipment were a constant concern. The amount of level space available near the adit limited efficient material stockpiling and maneuvering of construction equipment. Stockpiles were frequently moved several times before being used for their intended purposes. The Pilot construction site was typically congested with equipment, materials, and personnel.

REFERENCES

Smart, P., D. Reisman, J. Gusek, E. Hathaway. "Case Studies – Bench Scale Biochemical Reactor Results from Two Sites at the Elizabeth Mine, Vermont." Proceedings of 2008 National Meeting of the American Society of Mining and Reclamation, Richmond, VA, June 14-19, 2008. Published by ASMR, 3134 Montavesta Rd., Lexington KY 40502.

TABLES

TABLE A1
Historic Adit Water Quality and Design Criteria
Standard Mine Pilot Passive Treatment system

Parameter	Units	Design Value	Average Value
pH	s.u.	3.3	5.1
Aluminum, dissolved	mg/L	1.84	0.81
Copper, dissolved	mg/L	0.87	0.49
Iron, dissolved	mg/L	2.33	1.15
Lead, dissolved	mg/L	1.53	0.90
Manganese, dissolved	mg/L	11.20	8.69
Zinc, dissolved	mg/L	32.00	24.04
Flow	gpm	1	NA

Notes:

Design values in the above table are maximum concentration measured at the mine between 1999-2006. The average values were taken from the same dataset. Data were provided by the EPA.

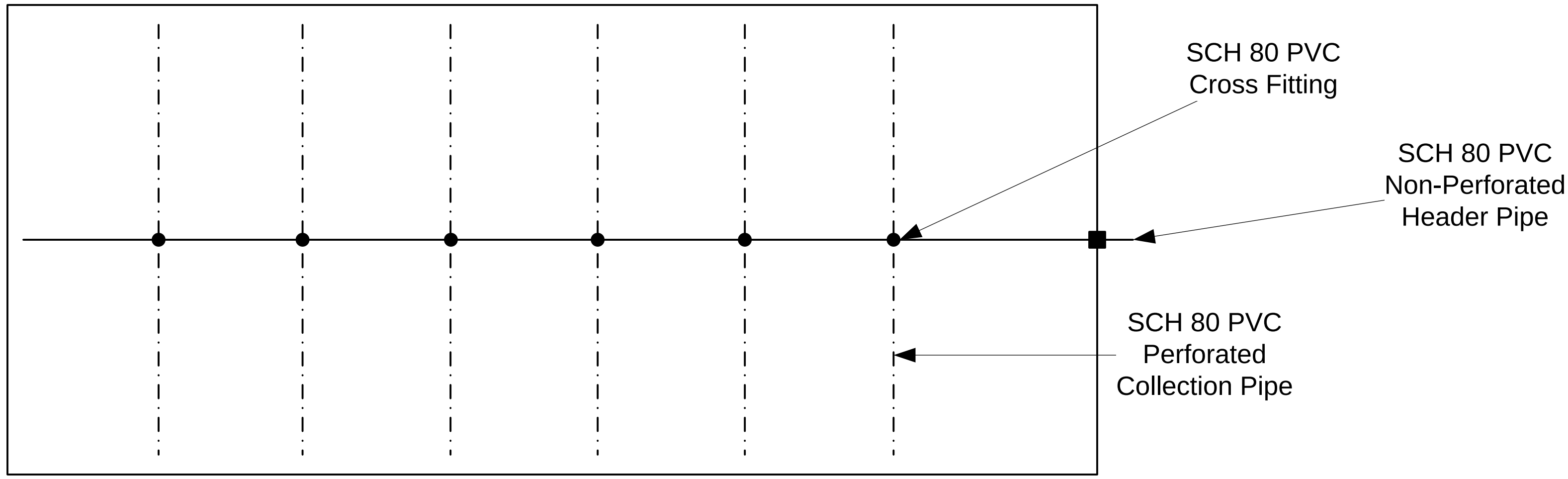
Table A2
Bioreactor Substrate Quantities
Standard Mine Pilot Treatment System

Substrate Component	Recipe	Ordered Weight Units	Ordered Wt. Unit	Source
Manure	10.0%	0.86	tons	Lost Miner Ranch, 45090 US Highway 50, Gunnison, CO (Gary Hausler, owner, 970-209-9515) - manure is 6 miles east of Gunnison, next to highway.
Wood Chips	50.0%	4.3	tons	On-site. Pine and Spruce sources.
Limestone Screenings	30.0%	2.6	tons	Colorado Lime Company, Salida CO 719-539-3525
Hay/alfalfa	10.0%	0.86	tons	Gunnison Auto Feed & Supply 970-641-5331
Total	100.0%	8.6	tons	NA

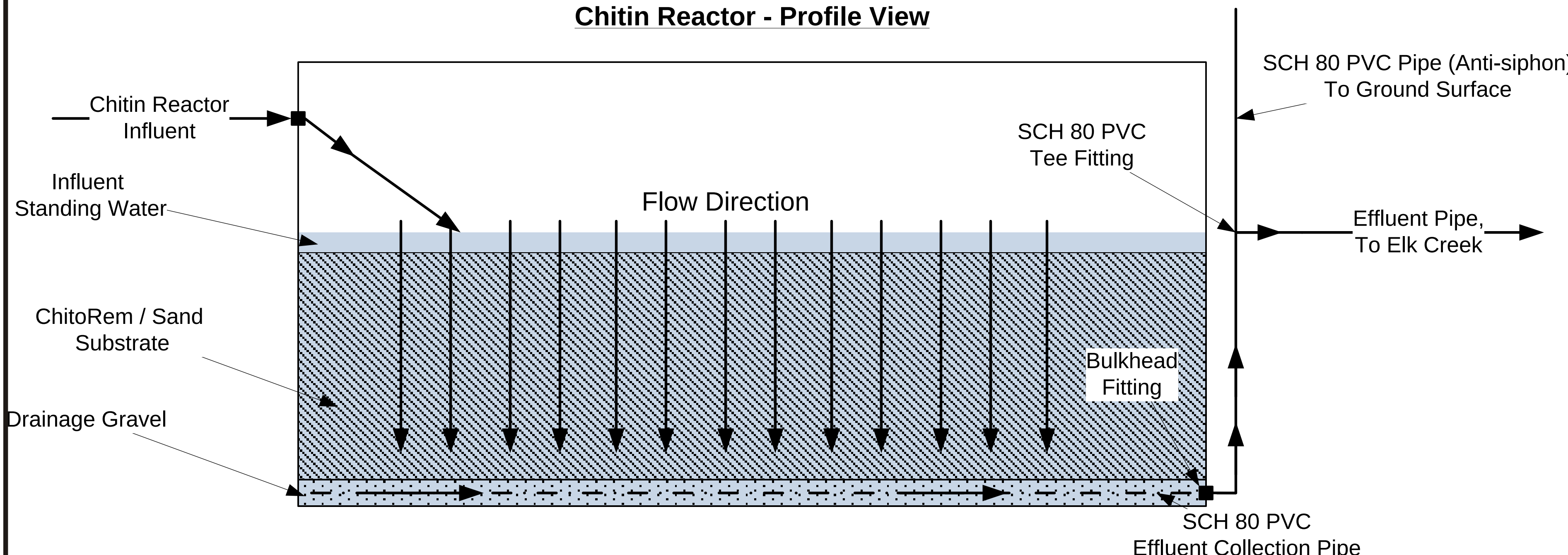
Note:
NA - not applicable

FIGURES

Chitin Reactor – Plan View



Chitin Reactor - Profile View



Golder Associates

Denver, Colorado

TITLE

ChitoRem Pilot System Conceptual Design

CLIENT/PROJECT

Standard Mine Pilot Passive Treatment System

DRAWN	PCS	DATE	4/16/2009	JOB NO.	043-2269
CHECKED	PCS	SCALE	Not to Scale	DWG. NO.	
REVIEWED	JJG	FILE NO.	J:\04JOBS\043-2269 EPA GSA II\Standard Mine\WP\Final ORD Report_2008\Appendix A\ 0432269 RptDRFT StndrdMn AppA 14APRIL09.vsd	FIGURE NO.	A1

ATTACHMENT

CONSTRUCTION PHOTOS

Standard Mine Pilot Passive Treatment System Construction Photographs

INSTALLATION OF BCR EFFLUENT PIPE	
COMPACTED PILOT BCR EXCAVATION	
GEOTEXTILE INSTALLED IN PILOT CELL	

PERMALON LINER AND EFFLUENT PIPELINE INSTALLED IN BCR CELL	
INSTALLING BCR EFFLUENT COLLECTION PIPE	
PLACING DRAINAGE GRAVEL IN BCR CELL	

Standard Mine Pilot Passive Treatment System Construction Photographs

INSTALLED DRAINAGE GRAVEL	
MIXING BCR SUBSTRATE	
SUBSTRATE PLACEMENT IN CELL	

BCR EFFLUENT COLLECTION PIPE (FOR SCALE) ATOP STOCKPILED SUBSTRATE MIXTURE	
ADDITION OF BACTERIAL INOCULUM TO PARTIALLY FILLED BCR CELL	
COMPLETED BCR BEING FILLED WITH MIW	

FINAL GRADING OF SUBSTRATE	
ADIT AND MIW DISCHARGE	

INFILTRATION GALLERY CONSTRUCTION	
INFILTRATION GALLERY	
INFLUENT PIPELINES AT INFILTRATION GALLERY	

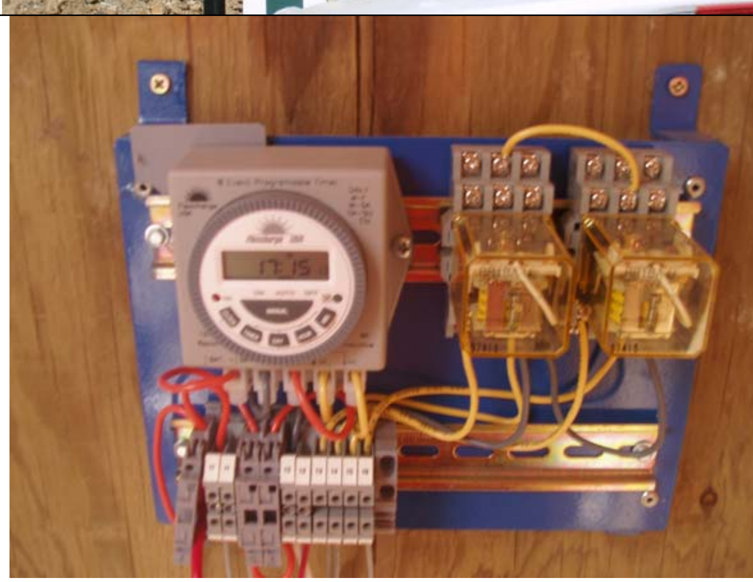
OVERFLOW PIPELINES ENTERING INFILTRATION GALLERY	
INFILTRATION GALLERY WITH GRAVEL FILTER	
FUNCTIONING INFILTRATION GALLERY, WITH OVERFLOW PIPES (WHITE)	

INFLUENT PIPES ENTERING THE SURGE TANK	
SURGE TANK TIMBER FRAME AND BCR EFFLUENT STANDPIPE	
SURGE TANK AND EFFLUENT STANDPIPE	

BACKFLILLING EFFLUENT VAULT	
APC INFLUENT PIPELINE (BLACK), APC BYPASS PIPELINE TO ELK CREEK(WHITE)	
BCR EFFLUENT STANDPIPE AND FLOW DISTRIBUTION	

2007 BCR EFFLUENT FLOW DISTRIBUTION (RETROFITTED IN 2008)	
MONITORING SHED INSTALLED ABOVE SURGE TANK AND BCR EFFLUENT WATER LEVEL CONTROL UNIT	
INFLUENT PUMP ON TOP OF SURGE TANK	

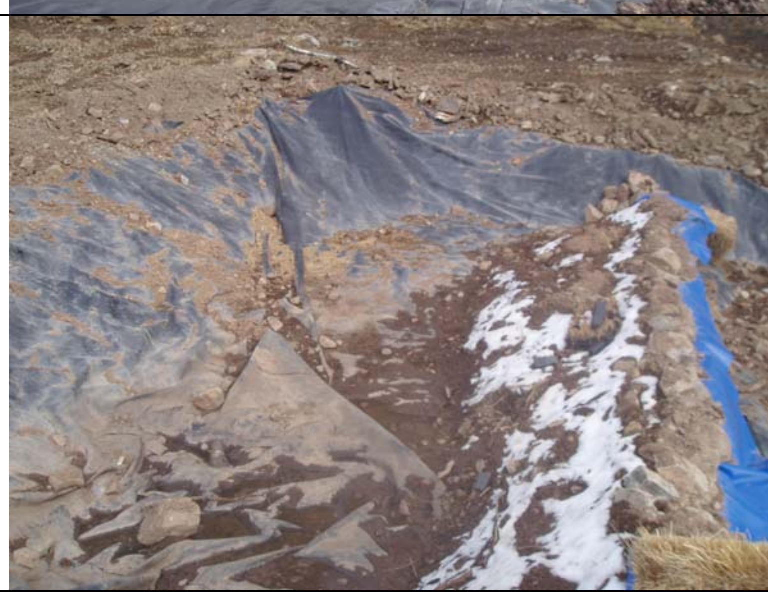
Standard Mine Pilot Passive Treatment System Construction Photographs

BCR EFFLUENT FLOW DISTRIBUTION BENEATH MONITORING SHED	
INSTALLING SOLAR PANELS	
INFLUENT PUMP TIMER AND ELECTRICAL CONTROLS	

Standard Mine Pilot Passive Treatment System Construction Photographs

INSULATED MONITORING SHED WITH INSTALLED SATELITE TRANSMITTERS AND HEAT DUMP – OCTOBER 2007	
MONITORING SHED AND SOLAR ARRAYS – OCTOBER 2007	
COMPLETED BCR AND MONITORING SHED – OCTOBER 2007	

INTERIOR OF MONITORING SHED – ISCO SAMPLERS AND HEAT DUMP, OCTOBER 2007	
APC FOOTPRINT EXCAVATION	
INSTALLING GEOTEXTILE IN APC	

PLACING LINER IN APC	
SOIL IN APC CELL #2, BACKFILL BEING PLACED ON TOP OF BERMS TO ANCHOR LINER	
APC CELL 1 OCTOBER 2008	

Standard Mine Pilot Passive Treatment System Construction Photographs

APC CELL 2 OCTOBER 2008	
APC CELL 3 OCTOBER 2008	
MRB CELL, OCTOBER 2008, STORMWATER PRESENT IN MRB	

APC RETROFIT JULY 2008 – INSTALLING GEOTEXTILE ABOVE HAY BALE BERMS	
PLACING LINER ATOP GEOTEXTILE	

APC RETROFIT COMPLETED	
COMPLETED APC	
INFLUENT INFILTRATION GALLERY WITH COMPLETED RETROFIT	

Standard Mine Pilot Passive Treatment System Construction Photographs

COMPLETED PILOT PTS – SEPTEMBER 2008 (NOTE SNOW DEPTH/LOCATION POLES)	
BCR EFFLUENT DISTRIBUTION SYSTEM, RETROFITTED JULY 2008	
CHITIN REACTOR, INSTALLED JULY 2008	

APPENDIX B

FROZEN SAMPLE ANALYSIS

FROZEN SAMPLE ANALYSES

The collection and storage of samples in the autosamplers throughout the winter months raised the possibility that samples would be collected and would then potentially freeze for several weeks or months prior to retrieval and laboratory analysis. In order to investigate the potential effects of freezing on samples for metal analysis, influent and effluent split samples were intentionally frozen and then analyzed.

On September 19, 2007, unpreserved and unfiltered influent and effluent samples were collected and transported back to the EPA Laboratory. Each sample was split at the laboratory into an unfrozen and a frozen sample. The unfrozen influent and effluent samples were analyzed for total and dissolved metals by EPA Method 6010B. The frozen samples were placed in a freezer and frozen for one month without preservative. After a month, the frozen samples were thawed and analyzed for total and dissolved metals by EPA Method 6010B.

The purpose of this analysis was to determine if frozen samples would impact the laboratory analyses of target metals. Laboratory results for frozen and unfrozen sample are presented below in Tables B1-B4. Data validation criteria for field duplicates were used to compare the frozen and unfrozen samples. The frozen and unfrozen sample laboratory concentrations were compared using relative percentage differences (RPDs). For all analytes present at concentrations greater than or equal to five times the quantitation limit, the RPD must be less than or equal to 30% RPD (US EPA 2008). RPDs are calculated according to the following formula:

$$\%RPD = \left|\frac{A - B}{A + B}\right| \times 200$$

where A is the concentration of the primary laboratory result per analyte and B is the corresponding duplicate result. For all analytes present at concentrations less than five times the quantitation limit, the absolute difference must be less than or equal to twice the sample quantitation limit. Data validation of quality assurance samples was limited to metals analysis of the six contaminants of concern. The data quality analysis and associated data flags are provided in Table B1. The results of the frozen and unfrozen sample laboratory analyses are inconsistent; some frozen sample concentrations are higher than concentrations reported for the unfrozen sample (e.g., influent total copper, cadmium, and zinc), while other reported concentrations were lower for the frozen sample than for the unfrozen sample (e.g., influent dissolved iron, effluent iron). In the effluent dissolved samples (Table B2), the concentrations of cadmium, copper, lead, and zinc were above the detection limit in the unfrozen sample and below the detection limit in the frozen sample. In general, the dissolved concentrations decreased in the frozen sample which may be due to metals coming out of solution. This is particularly evident for effluent dissolved iron (Table B2) which decreased from 15 mg/L to 1 mg/L from the unfrozen to the frozen sample. Corresponding increases in total concentrations were consistently observed in influent total results (Table B3) but not in the effluent total results (Table B4). The results of these sample comparisons indicate that freezing of samples may have an impact on metal analysis. Further investigation is recommended.

Laboratory Results for Unfrozen and Frozen BCR Samples Collected September 19, 2007
Standard Mine Pilot Passive Treatment System

Table B1									
Influent Dissolved Concentrations									
Target Analyte	**Units**	**Practical Quantitation Limit**	**Detection Limit**	**BCR Influent**	**BCR Influent Frozen**	**Are both concentrations greater than 5 times the PQL?**	**RPD**	**Is Abs. Diff ≤ 2 PQL?**	**Data Flag[1]**
Cd	mg/L	0.0075	0.0024	0.11	0.14	YES	17		
Cu	mg/L	0.0115	0.0036	0.039	0.25	NO	NA	NO	J
Fe	mg/L	0.0668	0.021	0.11	*0.021*	NO	NA	YES	U
Mn	mg/L	0.021	0.0066	10.4	10.9	YES	4.1		
Pb	mg/L	0.0251	0.0080	0.12	*0.008*	NO	NA	NO	UJ
Zn	mg/L	0.0213	0.0067	21.0	23.4	YES	11		

Table B2									
Effluent Dissolved Concentrations									
Target Analyte	**Units**	**Practical Quantitation Limit**	**Detection Limit**	**BCR Effluent**	**BCR Effluent Frozen**	**Are both concentrations greater than 5 times the PQL?**	**RPD**	**Is Abs. Diff ≤ 2 PQL?**	**Data Flag[1]**
Cd	mg/L	0.0075	0.0024	0.0046	*0.0024*	NO	NA	YES	U
Cu	mg/L	0.0115	0.0036	0.010	*0.0036*	NO	NA	YES	U
Fe	mg/L	0.0668	0.021	15	1.0	YES	**174**		J
Mn	mg/L	0.021	0.0066	15	13	YES	14		
Pb	mg/L	0.0251	0.0080	0.029	*0.0080*	NO	NA	YES	U
Zn	mg/L	0.0213	0.0067	0.84	*0.0067*	NO	NA	NO	UJ

Table B3									
Influent Total Concentrations									
Target Analyte	**Units**	**Practical Quantitation Limit**	**Detection Limit**	**BCR Influent**	**BCR Influent Frozen**	**Are both concentrations greater than 5 times the PQL?**	**RPD**	**Is Abs. Diff ≤ 2 PQL?**	**Data Flag[1]**
Cd	mg/L	0.0075	0.0024	0.11	0.13	YES	18		
Cu	mg/L	0.0115	0.0036	0.12	0.38	YES	**102**		J
Fe	mg/L	0.0668	0.021	0.40	1.9	YES	**130**		J
Mn	mg/L	0.021	0.0066	11	11	YES	4.7		
Pb	mg/L	0.0251	0.0080	0.25	0.82	YES	**108**		J
Zn	mg/L	0.0213	0.0067	21.0	25.1	YES	18		

Table B4									
Effluent Total Concentrations									
Target Analyte	**Units**	**Practical Quantitation Limit**	**Detection Limit**	**BCR Effluent**	**BCR Effluent Frozen**	**Are both concentrations greater than 5 times the PQL?**	**RPD**	**Is Abs. Diff ≤ 2 PQL?**	**Data Flag[1]**
Cd	mg/L	0.0075	0.0024	0.015	0.0071	NO	NA	YES	
Cu	mg/L	0.0115	0.0036	0.031	0.061	NO	NA	NO	J
Fe	mg/L	0.0668	0.021	16.5	14.3	YES	14		
Mn	mg/L	0.021	0.0066	15.1	13.8	YES	8.9		
Pb	mg/L	0.0251	0.0080	0.12	0.10	NO	15	YES	
Zn	mg/L	0.0213	0.0067	2.6	1.9	YES	**34**		J

Notes:

The above data quality analysis was performed according to EPA Inorganic Data Validation Functional Guidelines (EPA 2008)

RPD = relative percent difference.

Shaded RPD values are greater than 30%.

Frozen samples were frozen for one month prior to laboratory analysis.

Samples not detected at concentrations at or above the laboratory detection limit are shown in italics as the detection limit.

NA = Not applicable; the sample result was less than 5 times the value of the practical quantitation limit (PQL) and therefore the RPD value is not valid.

[1] - J - value is an estimate due to an RPD >30% or an absolute difference less than or equal to twice the value of the PQL.
U - value was not detected above the laboratory detection limit. All non-detect values were in the frozen samples.

APPENDIX C

SONDE AND YSI FIELD PARAMETER DATA

Appendix C

Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
9/18/2007						
9/19/2007	6.4	88	9.5			
9/20/2007				6.3	-303	8.4
9/21/2007				6.3	-318	8.1
9/22/2007				6.3	-342	8.8
9/23/2007				6.3	-355	8.7
9/24/2007				6.3	-364	8.6
9/25/2007				6.3	-370	8.5
9/26/2007	6.1	95	5.2	6.3	-375	8.3
9/27/2007				6.4	-379	8.2
9/28/2007				6.4	-383	8.1
9/29/2007				6.4	-387	8.0
9/30/2007				6.4	-391	7.9
10/1/2007						
10/2/2007				6.5	-397	7.6
10/3/2007				6.5	-400	7.6
10/4/2007	7.1	76	4.8	6.4	-402	7.5
10/5/2007				6.4	-401	7.6
10/6/2007				6.4	-401	7.6
10/7/2007				6.4	-401	7.6
10/8/2007				6.4	-401	7.6
10/9/2007				6.4	-401	7.6
10/10/2007				6.4	-401	7.6
10/11/2007				6.4	-401	7.6
10/12/2007				6.4	-401	7.6
10/13/2007				6.4	-401	7.6
10/14/2007				6.4	-401	7.6
10/15/2007	6.4	203.2	4.2	6.7	-319	6.7
10/16/2007	6.8	172	4.2	6.7	-339	7.3
10/17/2007				6.7	-372	7.1
10/18/2007				6.7	-383	7.1
10/19/2007				6.8	-391	7.0
10/20/2007				6.8	-399	6.9
10/21/2007				6.8	-404	6.9
10/22/2007				6.8	-408	6.8
10/23/2007				6.9	-412	6.6
10/24/2007				6.9	-415	6.5
10/25/2007				6.9	-417	6.5
10/26/2007				6.9	-419	6.4

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Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
10/27/2007				6.9	-421	6.4
10/28/2007				6.9	-421	6.4
10/29/2007				6.9	-421	6.3
10/30/2007				6.9	-423	6.2
10/31/2007	6.7	154	4.0	6.9	-424	6.2
11/1/2007	6.7	154	4.0	7.0	-406	6.2
11/2/2007	6.7	154	4.0	7.0	-394	6.0
11/3/2007	6.7	154	4.0	7.0	-417	5.8
11/4/2007	6.7	154	4.0	7.0	-423	5.6
11/5/2007	6.7	154	4.0	7.1	-426	5.5
11/6/2007	6.7	154	4.0	7.1	-429	5.4
11/7/2007	6.7	154	4.0	7.1	-431	5.3
11/8/2007	6.7	154	4.0	7.1	-433	5.2
11/9/2007	6.7	154	4.0	7.2	-435	5.1
11/10/2007	6.7	154	4.0	7.2	-436	5.0
11/11/2007	6.7	154	4.0	7.2	-438	5.0
11/12/2007	6.7	154	4.0	7.2	-439	4.9
11/13/2007	6.7	154	4.0	7.2	-440	4.9
11/14/2007	6.7	154	4.0	7.2	-442	4.9
11/15/2007	6.7	154	4.0	7.2	-442	4.8
11/16/2007	6.7	154	4.0	7.2	-443	4.8
11/17/2007	6.7	154	4.0	7.3	-444	4.7
11/18/2007	6.7	154	4.0	7.3	-445	4.7
11/19/2007	6.7	154	4.0	7.3	-445	4.6
11/20/2007	6.7	154	4.0	7.3	-446	4.6
11/21/2007	6.7	154	4.0	7.3	-446	4.6
11/22/2007	6.7	154	4.0	7.3	-446	4.5
11/23/2007	6.7	154	4.0	7.3	-447	4.5
11/24/2007	6.7	154	4.0	7.3	-447	4.4
11/25/2007	6.7	154	4.0	7.3	-447	4.3
11/26/2007	6.7	154	4.0	7.3	-448	4.2
11/27/2007	6.7	154	4.0	7.3	-449	4.2
11/28/2007						
11/29/2007						
11/30/2007						
12/1/2007						
12/2/2007						
12/3/2007						
12/4/2007						

Appendix C

Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
12/5/2007						
12/6/2007						
12/7/2007						
12/8/2007						
12/9/2007						
12/10/2007	6.7	154	4.0			
12/11/2007	6.7	154	4.0	7.4	-454	3.7
12/12/2007	6.7	154	4.0	7.4	-456	3.7
12/13/2007	6.7	154	4.0	7.4	-455	3.8
12/14/2007	6.7	154	4.0	7.4	-455	3.7
12/15/2007	6.7	154	4.0	7.3	-456	3.6
12/16/2007	6.7	154	4.0	7.3	-457	3.5
12/17/2007	6.7	154	4.0	7.3	-457	3.5
12/18/2007	7.1	262	3.2	7.3	-458	3.4
12/19/2007	7.4	348	2.5	7.3	-458	3.3
12/20/2007	7.5	358	2.5	7.4	-459	3.3
12/21/2007	7.5	360	2.5	7.4	-459	3.3
12/22/2007	7.5	364	2.1	7.4	-461	3.3
12/23/2007	7.5	367	2.1	7.4	-461	3.2
12/24/2007	7.5	371	2.2	7.4	-462	3.2
12/25/2007	7.5	374	2.2	7.4	-462	3.1
12/26/2007	7.5	377	1.9	7.4	-463	3.1
12/27/2007	7.5	382	1.8	7.4	-463	3.1
12/28/2007	7.5	386	1.5	7.4	-463	3.0
12/29/2007	7.5	390	1.6	7.4	-463	3.0
12/30/2007	7.5	394	1.8	7.4	-462	3.0
12/31/2007	7.5	397	1.8	7.4	-463	3.0
1/1/2008						
1/2/2008	7.5	401	1.7	7.4	-459	3.0
1/3/2008	7.5	409	2.2	7.4	-460	2.9
1/4/2008	7.5	411	2.2	7.4	-460	2.8
1/5/2008				7.4	-461	2.7
1/6/2008				7.4	-461	2.7
1/7/2008				7.4	-462	2.7
1/8/2008				7.4	-463	2.7
1/9/2008				7.4	-464	2.7
1/10/2008				7.4	-463	2.8
1/11/2008				7.4	-460	2.5
1/12/2008				7.4	-456	2.5

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Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
1/13/2008				7.4	-454	2.5
1/14/2008				7.4	-452	2.5
1/15/2008				7.4	-454	2.8
1/16/2008				7.4	-462	2.9
1/17/2008				7.4	-465	2.9
1/18/2008				7.4	-467	2.8
1/19/2008				7.4	-468	2.8
1/20/2008				7.4	-467	2.8
1/21/2008				7.4	-466	2.8
1/22/2008				7.4	-464	2.8
1/23/2008				7.4	-463	2.8
1/24/2008	7.5	472	2.6	7.4	-462	2.8
1/25/2008	7.5	471	2.6	7.4	-463	2.7
1/26/2008	7.5	474	2.6	7.5	-464	2.7
1/27/2008	7.5	476	2.6	7.5	-465	2.7
1/28/2008	7.5	478	2.6	7.5	-466	2.8
1/29/2008				7.5	-470	2.7
1/30/2008	7.5	419	2.5	7.5	-471	2.7
1/31/2008	7.4	338	2.5	7.5	-471	2.8
2/1/2008	7.5	417	2.5	7.5	-473	2.8
2/2/2008	7.5	446	2.4	7.5	-470	2.8
2/3/2008	7.5	461	2.4	7.5	-472	2.8
2/4/2008	7.5	473	2.5	7.5	-473	2.8
2/5/2008	7.5	481	2.4	7.5	-474	2.9
2/6/2008	7.5	484	2.4	7.5	-475	2.9
2/7/2008	7.5	492	2.4	7.5	-476	2.9
2/8/2008	7.4	380	2.4	7.5	-478	2.8
2/9/2008	7.3	317	2.4	7.5	-487	2.8
2/10/2008	7.3	317	2.5	7.5	-491	2.8
2/11/2008	7.2	300	2.5	7.5	-489	2.8
2/12/2008	7.3	311	2.5	7.5	-489	2.8
2/13/2008	7.3	348	2.4	7.5	-487	2.8
2/14/2008	7.2	292	2.4	7.5	-486	2.8
2/15/2008	7.2	297	2.3	7.5	-483	2.8
2/16/2008	7.1	298	2.3	7.5	-479	2.8
2/17/2008	7.1	295	2.3	7.5	-476	2.8
2/18/2008	7.1	292	2.3	7.5	-474	2.8
2/19/2008	7.0	290	2.3	7.5	-473	2.8
2/20/2008	7.2	330	2.2	7.5	-472	2.8

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Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
2/21/2008	6.7	249	2.2	7.5	-471	2.8
2/22/2008	6.8	272	2.2	7.5	-470	2.8
2/23/2008	6.8	272	2.1	7.5	-468	2.8
2/24/2008	6.7	269	2.1	7.5	-467	2.8
2/25/2008	7.3	342	2.0	7.5	-464	2.7
2/26/2008	6.8	287	2.1	7.5	-459	2.5
2/27/2008	7.3	335	2.0	7.5	-459	2.7
2/28/2008	7.3	374	2.1	7.5	-457	2.4
2/29/2008	7.3	379	2.1	7.5	-455	2.4
3/1/2008	7.3	386	2.1	7.5	-473	2.8
3/2/2008	7.3	391	2.2	7.5	-456	2.3
3/3/2008	7.3	395	2.2	7.5	-456	2.3
3/4/2008	7.3	399	2.2	7.5	-456	2.3
3/5/2008	7.3	401	2.1	7.6	-457	2.3
3/6/2008	7.3	405	2.1	7.6	-459	2.3
3/7/2008	7.3	406	2.1	7.6	-459	2.3
3/8/2008	7.3	409	2.1	7.6	-459	2.3
3/9/2008	7.3	411	2.1	7.6	-459	2.3
3/10/2008	7.3	413	2.1	7.6	-459	2.3
3/11/2008	7.3	415	2.0	7.6	-459	2.3
3/12/2008	7.3	416	2.0	7.5	-455	2.3
3/13/2008	7.3	418	1.9	7.4	-454	2.3
3/14/2008	7.3	420	1.9	7.4	-459	2.2
3/15/2008	7.4	421	1.9	7.5	-467	2.2
3/16/2008	7.3	423	1.9	7.5	-473	2.2
3/17/2008	7.4	425	1.9	7.5	-477	2.2
3/18/2008	7.4	426	1.9	7.5	-481	2.2
3/19/2008	7.4	427	1.9	7.4	-480	2.2
3/20/2008	7.4	430	1.9	7.3	-480	2.2
3/21/2008	7.4	431	1.9	7.4	-484	2.2
3/22/2008	7.4	433	1.9	7.4	-487	2.2
3/23/2008	7.4	434	1.9	7.4	-489	2.2
3/24/2008	7.4	435	1.9	7.4	-491	2.2
3/25/2008	7.4	437	1.9	7.4	-493	2.2
3/26/2008	7.4	436	1.9	7.4	-491	2.2
3/27/2008	7.3	439	1.9	7.3	-488	2.2
3/28/2008	7.3	439	1.9	7.3	-490	2.2
3/29/2008	7.3	440	1.9	7.3	-492	2.2
3/30/2008	7.4	441	1.9	7.3	-494	2.2

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Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
3/31/2008	7.3	442	1.9	7.3	-495	2.2
4/1/2008	7.4	443	1.9	7.3	-496	2.2
4/2/2008				7.3	-495	2.2
4/3/2008	6.8	468	2.0	7.2	-489	2.2
4/4/2008	6.8	425	2.1	7.3	-489	2.2
4/5/2008	6.9	430	2.2	7.3	-490	2.1
4/6/2008	6.9	436	2.2	7.3	-491	2.1
4/7/2008	6.9	439	2.2	7.3	-493	2.1
4/8/2008	6.9	440	2.2	7.3	-494	2.1
4/9/2008	7.0	440	2.1	7.3	-495	2.1
4/10/2008	7.0	445	2.2	7.3	-497	2.1
4/11/2008	7.0	449	2.2	7.3	-498	2.1
4/12/2008	7.0	454	2.1	7.4	-498	2.1
4/13/2008	7.0	458	2.1	7.4	-499	2.1
4/14/2008				7.4	-500	2.1
4/15/2008				7.4	-500	2.1
4/16/2008				7.3	-496	2.0
4/17/2008	7.1	401	1.9	7.3	-493	2.0
4/18/2008	7.1	386	1.8	7.3	-493	2.0
4/19/2008	7.1	389	1.9	7.3	-494	2.0
4/20/2008	7.1	351	1.9	7.3	-494	2.0
4/21/2008	7.1	349	1.9	7.3	-495	2.0
4/22/2008	7.1	335	1.8	7.3	-495	2.0
4/23/2008	7.1	330	1.8	7.2	-493	1.9
4/24/2008	7.1	329	1.7	7.2	-492	1.9
4/25/2008	7.1	334	1.7	7.2	-492	1.9
4/26/2008	7.0	338	1.6	7.2	-492	1.8
4/27/2008	7.0	342	1.6	7.2	-492	1.8
4/28/2008	7.0	350	1.5	7.2	-493	1.7
4/29/2008	7.0	350	1.5	7.2	-493	1.7
4/30/2008	6.1	425	2.0	7.2	-492	1.7
5/1/2008	4.9	547	2.4	7.2	-489	1.6
5/2/2008	4.9	547	2.3	7.2	-487	1.6
5/3/2008	5.1	509	2.3	7.2	-486	2.0
5/4/2008	5.5	446	2.5	7.2	-479	2.7
5/5/2008	5.9	381	2.7	7.2	-476	2.7
5/6/2008	6.1	344	2.7	7.2	-472	2.7
5/7/2008	6.1	343	2.8	7.2	-469	2.7
5/8/2008	5.5	422	2.7	7.2	-465	2.7

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Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
5/9/2008	5.0	498	2.6	7.2	-463	2.7
5/10/2008	4.9	508	2.6	7.3	-461	2.6
5/11/2008	5.0	484	2.6	7.3	-461	2.6
5/12/2008	5.1	469	2.7	7.4	-461	2.6
5/13/2008	4.9	498	2.6	7.4	-463	2.6
5/14/2008	4.7	521	2.5	7.5	-466	2.6
5/15/2008	4.7	516	2.5	7.5	-471	2.5
5/16/2008	4.6	533	2.4	7.5	-477	2.5
5/17/2008	4.2	584	2.4	7.6	-483	2.5
5/18/2008	3.8	631	2.2	7.6	-491	2.5
5/19/2008	3.9	630	2.0	7.6	-498	2.4
5/20/2008	3.9	631	1.8	7.6	-504	2.4
5/21/2008	4.1	640	1.6	7.6	-510	2.4
5/22/2008	4.2	643	1.8	7.6	-515	2.3
5/23/2008	4.4	648	2.0	7.6	-520	2.3
5/24/2008	4.6	652	2.1	7.6	-524	2.3
5/25/2008	4.7	653	2.1	7.7	-527	2.2
5/26/2008	4.6	651	2.2	7.7	-530	2.2
5/27/2008	4.5	660	2.1	7.7	-532	2.2
5/28/2008	4.5	659	2.0	7.7	-534	2.1
5/29/2008	4.5	672	2.0	7.7	-537	2.1
5/30/2008	4.4	696	2.0	7.7	-541	2.1
5/31/2008	4.2	712	2.0	7.7	-542	2.1
6/1/2008	4.9	547	2.4	7.2	-489	1.6
6/2/2008	4.2	727	2.0	7.7	-543	2.0
6/3/2008	4.1	734	2.2	7.7	-543	2.0
6/4/2008	4.1	736	2.2	7.7	-543	2.0
6/5/2008	4.1	738	2.2	7.7	-542	2.0
6/6/2008	4.2	737	2.1	7.7	-541	2.0
6/7/2008	4.2	738	1.9	7.8	-540	2.0
6/8/2008	4.2	736	1.9	7.8	-538	2.0
6/9/2008	4.2	741	2.0	7.8	-536	2.0
6/10/2008	4.2	744	2.0	7.8	-534	2.0
6/11/2008	4.1	711	2.3	7.8	-530	1.9
6/12/2008	4.0	691	3.0	7.8	-528	1.9
6/13/2008	4.1	682	2.9	7.8	-526	1.9
6/14/2008	4.1	679	2.9	7.8	-523	1.9
6/15/2008	4.1	694	3.2	7.8	-520	2.0
6/16/2008	4.0	722	2.9	7.8	-517	2.0

Appendix C
Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08
Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
6/17/2008	4.0	735	2.1	7.8	-514	2.0
6/18/2008	4.1	736	2.0	7.8	-511	2.1
6/19/2008	4.1	734	1.9	7.8	-509	2.1
6/20/2008	4.2	737	1.7	7.8	-506	2.0
6/21/2008	4.3	742	1.6	7.8	-504	2.0
6/22/2008	4.3	740	1.6	7.8	-502	2.0
6/23/2008	4.4	748	1.4	7.8	-501	2.0
6/24/2008	4.4	746	1.2	7.7	-497	1.9
6/25/2008	4.4	747	1.2	7.6	-494	1.7
6/26/2008	4.5	744	1.3	7.7	-494	1.7
6/27/2008	4.5	743	1.5	7.7	-496	1.7
6/28/2008	4.6	738	1.7	7.7	-499	1.7
6/29/2008	4.6	735	1.9	7.7	-501	1.7
6/30/2008	4.6	730	2.2	7.7	-503	1.8
7/1/2008	4.6	725	2.5	7.7	-543	2.0
7/2/2008	4.6	723	2.9	7.7	-506	2.1
7/3/2008	4.7	722	3.3	7.7	-508	2.2
7/4/2008	4.7	718	3.7	7.7	-510	2.4
7/5/2008	4.7	714	4.0	7.7	-512	2.6
7/6/2008	4.7	712	4.3	7.7	-513	2.8
7/7/2008	4.7	709	4.6	7.7	-515	3.1
7/8/2008	4.8	707	4.9	7.7	-517	3.3
7/9/2008	4.8	705	5.0	7.7	-518	3.5
7/10/2008	4.8	705	5.2	7.7	-520	3.7
7/11/2008	4.8	701	5.3	7.7	-521	3.8
7/12/2008	4.8	697	5.3	7.7	-522	4.0
7/13/2008	4.9	693	5.3	7.7	-523	4.1
7/14/2008	4.9	690	5.2	7.7	-524	4.3
7/15/2008	4.9	688	5.2	7.7	-525	4.4
7/16/2008	4.9	688	5.2	7.7	-526	4.5
7/17/2008	4.9	690	5.2	7.7	-527	4.6
7/18/2008	4.9	687	5.2	7.7	-528	4.7
7/19/2008	5.0	685	5.2	7.7	-529	4.8
7/20/2008	5.0	683	5.1	7.7	-529	4.9
7/21/2008	5.0	681	5.2	7.7	-530	5.0
7/22/2008	5.0	680	5.2	7.7	-531	5.1
7/23/2008	5.0	677	5.2	7.7	-527	5.2
7/24/2008				6.2	-129	9.8
7/25/2008				6.1	-62	7.2

Appendix C

Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
7/26/2008				7.4	-396	3.6
7/27/2008				7.4	-409	3.9
7/28/2008				7.4	-413	4.1
7/29/2008	5.0	668	5.3	7.4	-410	4.4
7/30/2008	5.3	546	5.1	6.8	-342	4.4
7/31/2008	6.4	149	4.4	6.4	-320	4.4
8/1/2008	6.4	149	4.4	6.4	-335	4.6
8/2/2008	6.4	149	4.4	6.5	-339	5.1
8/3/2008	6.4	149	4.4	6.5	-351	5.1
8/4/2008	6.4	149	4.4	6.5	-362	5.1
8/5/2008	6.4	149	4.4	6.6	-371	4.9
8/6/2008	6.4	149	4.4	6.6	-379	4.9
8/7/2008	6.4	149	4.4	6.6	-385	4.9
8/8/2008	6.4	149	4.4	6.7	-389	5.0
8/9/2008	6.4	149	4.4	6.7	-397	4.9
8/10/2008	6.4	149	4.4	6.7	-403	5.0
8/11/2008	6.4	149	4.4	6.7	-405	5.1
8/12/2008	6.4	149	4.4	6.7	-407	5.1
8/13/2008	6.4	149	4.4	6.7	-407	5.2
8/14/2008	6.4	149	4.4	6.6	-406	5.2
8/15/2008	6.4	149	4.4	6.7	-406	5.2
8/16/2008	6.4	149	4.4	6.6	-409	5.2
8/17/2008	6.4	149	4.4	6.7	-410	5.2
8/18/2008	6.4	149	4.4	6.7	-412	5.2
8/19/2008	6.4	149	4.4	6.7	-414	5.2
8/20/2008	6.4	149	4.4	6.7	-416	5.2
8/21/2008	6.4	149	4.4	6.7	-415	5.3
8/22/2008	6.4	149	4.4	6.7	-415	5.2
8/23/2008	6.4	149	4.4	6.7	-418	5.2
8/24/2008	6.4	149	4.4	6.7	-418	5.2
8/25/2008	6.4	149	4.4	6.7	-417	5.3
8/26/2008	6.4	149	4.4	6.7	-415	5.3
8/27/2008	6.4	149	4.4	6.7	-414	5.3
8/28/2008	6.4	149	4.4	6.7	-413	5.3
8/29/2008	6.4	149	4.4	6.8	-414	5.3
8/30/2008	6.4	149	4.4	6.7	-417	5.3
8/31/2008	6.4	149	4.4	6.8	-417	5.4
9/1/2008	6.4	149	4.4	6.8	-416	5.4
9/2/2008	6.4	149	4.4	6.8	-416	5.4

Appendix C

Biochemical Reactor Average Daily Sonde Measurements 9/18/08 through 10/2/08

Standard Mine Pilot Scale Passive Treatment System Crested Butte, CO

	BCR Influent Sonde			BCR Effluent Sonde		
Date	pH	ORP	Temperature	pH	ORP	Temperature
9/3/2008	6.4	149	4.4	6.8	-416	5.4
9/4/2008	6.4	149	4.4	6.8	-416	5.4
9/5/2008	6.4	149	4.4	6.8	-416	5.4
9/6/2008	6.4	149	4.4	6.8	-418	5.4
9/7/2008	6.4	149	4.4	6.8	-419	5.4
9/8/2008	6.4	149	4.4	6.8	-418	5.4
9/9/2008	6.4	149	4.4	6.8	-419	5.4
9/10/2008	6.4	149	4.4	6.8	-417	5.9
9/11/2008	6.4	149	4.4	6.8	-408	6.0
9/12/2008	6.4	149	4.4	6.8	-401	6.0
9/13/2008	6.4	149	4.4	6.8	-400	6.0
9/14/2008	6.4	149	4.4	6.9	-400	5.9
9/15/2008	6.4	149	4.4	6.9	-401	5.9
9/16/2008	6.7	142	5.0	6.8	-408	5.7
9/17/2008	6.8	125	4.6	6.5	-416	5.7
9/18/2008	6.50	140	4.6	6.4	-369	5.7
9/19/2008	6.50	144	4.6	6.4	-385	5.7
9/20/2008	6.5	148	4.5	6.5	-373	5.7
9/21/2008	6.5	152	4.6	6.5	-370	5.8
9/22/2008	6.5	156	4.6	6.5	-374	5.8
9/23/2008	6.5	154	4.5	6.5	-380	5.8
9/24/2008	6.6	157	4.5	6.5	-390	5.8
9/25/2008	6.5	159	4.6	6.5	-399	5.7
9/26/2008	6.6	160	4.6	6.5	-404	5.7
9/27/2008	6.6	158	4.5	6.5	-406	5.7
9/28/2008	6.6	158	4.6	6.5	-409	5.7
9/29/2008	6.6	160	4.6	6.5	-412	5.6
9/30/2008	6.6	161	4.6	6.4	-431	5.7
10/1/2008	6.6	161	4.6	6.2	-471	6.0
10/2/2008	6.6	162	4.5	6.2	-469	6.1
10/3/2008	6.6	162	4.5	6.2	-458	6.1
10/4/2008	6.6	162	4.5	6.3	-449	6.1
10/5/2008	6.7	164	4.3	6.3	-442	6.0
10/6/2008	6.7	166	4.2	6.3	-438	6.0
10/7/2008	6.7	169	4.1	6.3	-435	5.9
10/8/2008	6.7	172	4.1	6.3	-426	5.8
max	7.5	747.7	9.5	7.8	-61.8	9.8
min	3.8	76.0	1.2	6.1	-543.0	1.6
average	6.3	378.0	3.2	7.2	-453.8	3.9

APPENDIX D

FIELD INFORMATION FORMS AND CHAIN OF CUSTODY FORMS

US EPA/ETSC-Cincinnati Lab

Mail Location CHL 5995 Center Hill Ave.
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

Client/Reporting Information		Invoice Information	
Company Name: Golder Associates		Company Name: Same as Client	
Address: 44 Union Blvd Suite 300		Address:	
City: Lakewood State: Co Zip: 80228		City: State: Zip:	
Contact: Tom Rutkowski	E-mail: trutkowski@golder.com	Contact:	E-mail:
Phone Number: 303.980.0540	Fax Number: 303.985.2080	Phone Number:	Fax Number:
Sampler's Name:	Sampler's Name: Chris Myers		
File Number: 063-2269	Project Name: Standard Mine pilot		

PARAMETERS/CONTAINER TYPE: Sulfide

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER	Sulfide								COMMENTS
SMP-EF-082207	c	N/A	8/22/07	1415	G	1		X					X								
SMP-EF-082207X	c	N/A	8/22/07	1415	G	1		X					X								
SMP-IN-082207	c	N/A	8/22/07	1500	G	1		X					X								
SMP-IN-082207X	c	N/A	8/22/07	1500	G	1		X					X								

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge)
Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL = Oil/Organic Liquid, O=Other

RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
[signature]	8/23/07	0700	A. Pashea	8-23-07	7:40
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RECEIVED AT LAB BY:	DATE:	TIME:	SHIPPED VIA: AIRBILL:	SEAL #: SEAL DATE:	

Gunnsion WWTP Laboratory

Gunnison County Wastewater Treatment Plant
524 County Rd 32 Gunnison, CO 81230

CHAIN OF CUSTODY RECORD

Client/Reporting Information	Invoice Information
ame: Golder Associates	Company Name: Same as Reporting
44 Union Blvd Suite 300	Address:
Lakewood State: CO Zip: 80228	City: State: Zip:
Tom Rutkowski E-mail: trutkowski@golder.com	Contact: E-mail:
n: 303.980.0540 Fax Number: 303.985.2080	Phone Number: Fax Number:
ame: Sampler's Name: Chris Myers	phase 0003
: 043-2269 Project Name: Standard Mine Pilot	

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C=Composite G=Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER Na2S2O3	Nitrite/Nitrate	Biochemical Oxygen Demand	E. coli						COMMENTS
SMP-EF-082207	O	N/A	8/22/2007	1415	G	3				1	1	1	1	1	2						
SMP-IN-082207	O	N/A	8/22/07	1500	G	2				1	1	0	1	1							

Number of Preserved Bottles

'Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge) Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

nple Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL = Oil/Organic Liquid, O=Other

ED BY: [signature]	DATE: 8.22.07	TIME: 17:25	RECEIVED BY: [signature]	DATE:	TIME:
ED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
T LAB BY:	DATE:	TIME:	SHIPPED VIA: AIRBILL:	SEAL #: SEAL DATE:	

US EPA/ETSC-Cincinnati Lab

Mail Location CHL 5995 Center Hill Ave.
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

Client/Reporting Information		Invoice Information	
Company Name: Golder Associates		Company Name: Same as Client.	
Address: 44 Union Blvd Suite 300		Address:	
City: Lakewood State: CO	Zip: 80228	City: State:	Zip:
Contact: Tom Rutkowski	E-mail: trutkowski@golder.com	Contact:	E-mail:
Phone Number: 303.980.0540	Fax Number: 303.985.2080	Phone Number:	Fax Number:
Client's Name:	Sampler's Name: Chris Myers		
Project Number: 043-2269	Project Name: Stanford Mine Pilot		

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER	total metals	dissolved metals	pH, alk, acidity	sulfate					COMMENTS
SMP-EF-082207	o	N/A	8/22/07	1415	G	3			2		1		X	X	X	X					
SMP-EF-082207X	o	N/A	8/22/07	1415	G	1			2				X								
SMP-IN-082207	o	N/A	8/22/07	1500	G	3			2		1		X	X	X	X					
SMP-IN-082207X	o	N/A	8/22/07	1500	G	2			2				X								

Number of Preserved Bottles: HCL, NaOH, HNO3, H2SO4, NONE

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge) Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL = Oil/Organic Liquid, O=Other

	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RELINQUISHED BY: [signature]	8/23/07	0800	A. Pasha	8-23-07	7:40
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RECEIVED AT LAB BY:	DATE:	TIME:	SHIPPED VIA: AIRBILL:	SEAL #: SEAL DATE:	

Standard Mine Pilot Field Parameters and Observation Sheet

Date: 8-28-07 **Sampled by:** J. Goedert **Time:** 1630

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	5.9	11.5	2.3	-121 1st	1.81
APC Effluent				2nd	
MRB Effluent				3rd	
Influent	6.2	7.8	0.58	155 4th	7.48
ORP Standard	Standard Value = 270			Always Last	

Sample Site	Odor	Color	Presence of molds/Comments
BCR Effluent	putrid	light green/yellow	None/No Flow in system Sample collected w/peristoltic pump 3-5 feet below standpipe
APC Effluent			
MRB Effluent			
Influent	None	colorless	None/Sample collected by dipping bottles in tank

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

US EPA/ETSC-Cincinnati Lab

Mail Location CHL 5995 Center Hill Ave.
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

Aug 28 07 05:44p

Client/Reporting Information	Invoice Information
Company Name: Golder Associates Inc	Company Name:
Address: 44 Union Blvd Ste 300	Address:
City: Lakewood State: CO Zip: 80228	City: State: Zip:
Contact: Tom Rutkowski E-mail: trutkowski@golder.com	Contact: E-mail:
Phone Number: 303-980-0540 Fax Number: 303-985-2080	Phone Number: Fax Number:
Sampler's Name: Jez Goddert	Sampler's Name:
File Number:	Project Name:

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER	Total Metals	Dissolved Metals	Sulfate, Acidity, alkalinity, pH						COMMENTS
SMP-IN-082807	O	N/A			G	3			2		1		X	X	X						
SMP-EF-082807	O	N/A			G	3			2		1		X	X	X						

Number of Preserved Bottles: HCL, NaOH, HNO3, H2SO4, NONE

JG

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge)
Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL=Oil/Organic Liquid, O=Other

RELINQUISHED BY: Jez Goddert	DATE: 8/28/07	TIME:	RECEIVED BY: JG	DATE:	TIME:
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY: JG	DATE:	TIME:
RECEIVED AT LAB BY:	DATE:	TIME:	SHIPPED VIA: Fed Ex AIRBILL: 8610 4019 5125	SEAL #: SEAL DATE:	

P.3

~~US EPA/ETSC Cincinnati Lab~~

ACZ Laboratories

Mail Location CHL ~~5995 Center Hill Ave. Cincinnati, OH 45224~~

2773 Downhill Dr., Steamboat Springs, CO 80487

CHAIN OF CUSTODY RECORD

Client/Reporting Information	Invoice Information
Company Name: Golder Associates, Inc	Company Name: UOS
Address: 44 Union Blvd Ste 300	Address: 1099 18th St. Ste 710
City: Lakewood, State: CO Zip: 80228	City: Denver State: CO Zip: 80202
Contact: Tom Rutkowski E-mail: trutkowski@golder.com	Contact: Jim Park E-mail: Jim_Park@URSCORP.com
Phone Number: 303-980-0540 Fax Number: 303-985-2080	Phone Number: 303-291-8208 Fax Number: 303-291-8296
Sampler's Name: Jez Goder	Sampler's Name:
File Number: 043-2269	Project Name: Standard Mine Pilot

043-2269 Phase 3

PARAMETERS/CONTAINER TYPE: Sulfide

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER	Sulfide								COMMENTS
SMP-IN-082807	O	N/A	8/28/07	1630	G	1		1					X								
SMP-EF-082807	O	N/A	8/28/07	1625	G	1		1					X								

(Number of Preserved Bottles: HCL, NaOH, HNO3, H2SO4, NONE)

JP

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge)
Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL = Oil/Organic Liquid, O=Other

RELINQUISHED BY: Jez Goder	DATE: 8/29/07	TIME:	RECEIVED BY: JP	DATE:	TIME:
RELINQUISHED BY: JP	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RECEIVED AT LAB BY:	DATE:	TIME:	SHIPPED VIA: Fed Ex AIRBILL: 8610 4019 5136	SEAL #: SEAL DATE:	

Return Address: UOS 1099 18th Ste 710 Denver, CO 80202

H:\Sandy\COC\attachment 1 EPA COC.xls\BLANK COC

Aug 28 07 06:44p

p.4

To: Tom Rutkowski

Fr: Jerry

Date: 9-9-07

Fax: 303-985-2080

Here is the field data from this week's sampling event. The EPA lab can't accept Saturday delivery, so I will send the samples out tomorrow.

Also, the Gunnison Lab said they need 1 liter for BOD + Nitrate/nitrite

Standard Mine Pilot Field Parameters and Observation Sheet

Date: 9/06/07 **Sampled by:** Jercy Goedert **Time:** 1245

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	5.6	12.0	2.6	-125 1st	1.46
APC Effluent				2nd	
MRB Effluent				3rd	
Influent	6.3	8.0	0.63	138 4th	7.42
ORP Standard	Standard Value = 207			Always Last	

Sample Site	Odor	Color	Presence of molds/Comments
BCR Effluent	Foul	pale yellow	On 9/5/07 1500 hrs w/ 4" Freeboard in cell the discharge valve was opened Pumps are sett up in recirc Mode
APC Effluent			
MRB Effluent			
Influent	None	Clear	

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

... Laboratory

Gunnison County Wastewater Treatment Plant
524 County Rd 32 Gunnison, CO 81230

CHAIN OF CUSTODY RECORD

Client/Reporting Information	Invoice Information
Company Name: Golder Assoc Inc	Company Name: UOS
Address: 44 Union Blvd Ste 300	Address: 1099 18th St, Ste 710
City: Lakewood State: CO Zip: 80228	City: Denver State: CO Zip: 80202
Contact: Tom Rutkowski E-mail: trutkowski@golder.com	Contact: Jerry Goeder E-mail:
Phone Number: 303-980-0540 Fax Number: 303-985-2080	Phone Number: 303-291-8215 Fax Number: 303-291-8296
Sampler's Name: Jerry Goeder	Sampler's Name:
File Number: 043-2269	Project Name: Standard Mine Pilot — 043-2269 Phase 3

PARAMETERS/CONTAINER TYPE

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER: Na2S2O3	Nitrite/Nitrate	Biochemical Oxygen Demand	E. coli						COMMENTS
SMP-IN-090607	O	N/A	9/06/07	1300	G	3				1	1	1	X	X	X						
SMP-EF-090607	O	N/A	9/06/07	1245	G	3				1	1	1	X	X	X						

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge) Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL = Oil/Organic Liquid, O=Other

	DATE:	TIME:		DATE:	TIME:
RELINQUISHED BY: Jerry Goeder	9/6/07	1540	RECEIVED BY:		
RELINQUISHED BY:			RECEIVED BY:		
RECEIVED AT LAB BY:			SHIPPED VIA: AIRBILL:	SEAL #: SEAL DATE:	

H:\Sandy\COC\attachment 2 GUNNY WWTP COC.xls\BLANK

US EPA/ETSC-Cincinnati Lab

Mail Location CHL 5995 Center Hill Ave.
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

Client/Reporting Information	Invoice Information
Company Name: Golder Assoc, INC	Company Name: UOS
Address: 44 Union Blvd Ste 300	Address: ~~6 710~~ 1099 18th St. Ste 710
City: Lakewood State: CO Zip: 80228	City: Denver State: CO Zip: 80202
Contact: Tom Rutkowski E-mail: trutkowski@golder.com	Contact: Jerry Goedert E-mail:
Phone Number: 303-980-0540 Fax Number:	Phone Number: 303-291-8215 Fax Number: 303-291-8296
Sampler's Name: Jerry Goedert	Sampler's Name:
File Number: 043-2269	Project Name: Standard Mine Pilot — 043-2269 phase 3

PARAMETERS/CONTAINER TYPE: Total Metals; Dissolved Metals; Sulfate, acidity, alkalinity, pH

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER	Total Metals	Dissolved Metals	Sulfate, acidity, alkalinity, pH						COMMENTS
SMP-IN-090607	O	NA	9/06/07	1300	G	3			2		1		X	X	X						
SMP-EF-090607	O	NA	9/06/07	1245	G	3			2		1		X	X	X						

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge)
Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL=Oil/Organic Liquid, O=Other

	DATE:	TIME:		DATE:	TIME:
RELINQUISHED BY: Jerry Goedert	9/06/07	0900	RECEIVED BY:		
RELINQUISHED BY:			RECEIVED BY:		
RECEIVED AT LAB BY:			SHIPPED VIA: Fed Ex AIRBILL: 8610 4019 5037	SEAL #: SEAL DATE:	

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UOS URS Operating Services, Inc.
1099 18th Street, Suite 710, Denver, CO 80202

SHIP TO: [illegible]

CHAIN OF CUSTODY RECORD

PROJECT NO./NAME: [illegible] / [illegible]

SITE MANAGER: [illegible]

SAMPLER'S SIGNATURE: [illegible]

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	Number of Containers	[illegible]						REMARKS
[illegible]	9/06/02	1300		X		1	1						
EF-090602	9/06/02	1245		X		1	1						

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]	[illegible]	[illegible]	[illegible]				
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE	TIME	REMARKS: AIRBILL NUMBER: [illegible]	

[illegible]

DN 5209

White - Original to Accompany Samples Yellow - UOS Main Office Pink - UOS Field Office

To: Tom Butkowski

FR: Jerry Goedert

Date: 9/21/07

Fax 303-985-2080

Standard Mine Pilot Field Parameters and Observations

Date: 9/19/07 **Sampled by:** A Longworth **Time:** 10:30

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	5.7	10.3	1900	-154 1st	0.64
APC Effluent				2nd	
MRB Effluent			~~570~~	3rd	
Influent	6.4	9.5	570	88 4th	4.04
ORP Standard	Standard Value = 202			Always Last	

Sample Site	Odor	Color	Presence of molds/Comments
BCR Effluent	H_2S	Yellow	Foam on surface
APC Effluent			
MRB Effluent			
Influent	None	Yellow	very pale yellow.

Please Fax field sheet to Jim Gusek/Tom Rutkowski at Golder Associates at Fax No. 303-985-2080

To: Tom Rutkowski / Pat Smart

Fr: Jerry Goedert

Date: 9/26/07

Fax 303-985-2080

Standard Mine Pilot Field Parameters and Observations

Date: 9/26/07 **Sampled by:** Jerry Goodet **Time:** 0930

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	5.8	7.9	1.74	-159 1st	0.37
APC Effluent	Cell 2 Cell 3	13.3 9.8	1.67 1.24	47 112 2nd	
MRB Effluent		6.3	0.23	115 3rd	
Influent	6.1	5.2	0.59	95 4th	7.45
ORP Standard	Standard Value = 200			Always Last	

Sample Site	Odor	Color	Presence of molds/Comments
BCR Effluent	Less Putrid than Previous	light Yellow Brown	ISCO readout pH 6.3 Temp 8.3°C ORP -373 Sp. C x0.002 OyData 11.2 O2 Data 0.9
APC Effluent			APC has a small amt of ice & ~200 gal in 1st cell only. Water is near top of boot pipe
MRB Effluent			
Influent	None	clear	

connected power to ISCO & communicators came on

Please Fax field sheet to Jim Gusek/Tom Rutkowski at Golder Associates at Fax No. 303-985-2080

Solid yellow/green light on left. Blinking orange light on right - turns green periodically

US EPA/ETSC-Cincinnati Lab

Mail Location CHL 5995 Center Hill Ave.
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

Sep 26 07 03:52p

Client/Reporting Information	Invoice Information
Company Name: Golder Assoc. Inc	Company Name: UOS
Address: 44 Union Blvd Ste 300	Address: 1099 18th St. Ste 710
City: Lakewood State: CO Zip: 80228	City: Denver State: CO Zip: 80202
Contact: Tom Rutkowski E-mail: trutkowski@golder.com	Contact: Jerry Goedert E-mail: Jerry_Goedert@URSCORP.com
Phone Number: 303-980-0540 Fax Number: 303-985-2080	Phone Number: 303-291-8215 Fax Number: 303-291/8296
Sampler's Name: Jey Goody	Sampler's Name:
File Number: 043-2269	Project Name: Standard Mine Pilot

043-2269 Phase 3

PARAMETERS/CONTAINER TYPE

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER	Total Metals	Dissolved Metals	Sulfate, alkalinity, acidity pH						COMMENTS
SMP-IN-092607	O	N/A	9/26/07	1000	G	3			2		1		X	X	X						
SMP-EF-092607	O	N/A	9/26/07	0945	G	3			2		1		X	X	X						

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge)
Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL = Oil/Organic Liquid, O=Other

RELINQUISHED BY: Jey Goody	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RECEIVED AT LAB BY:	DATE:	TIME:	SHIPPED VIA: Fed Ex AIRBILL: 8610 4019 5055	SEAL #: SEAL DATE:	

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p.3

Sep 26 07 03:53p

UOS

URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: ACZ

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 043-2269/Standard Mine Pilot

SITE MANAGER / PHONE NUMBER: Goedert

SAMPLER'S SIGNATURE: [signature]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/GRAB	REMARKS	Number of Containers	Sulfide					TAG NUMBERS
1)	SMP-IN-092607	9/26/07	1000	G		1	X					
2)	SMP-EF-092607	9/26/07	0945	G		1	X					
3)												
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[signature]			
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE	TIME

AIRBILL NUMBER: Fed Ex
LAB REMARKS: 8610 4019 5066

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

Return Address UOS
1099 18th St. Ste 710
Denver CO 80202

DN

P.4

FAX COVER SHEET

To: Tom Rutkowski

Date: 10-8-07

Fax #: 303-985-2080

From: Jerry Goedert

Phone #:

Subject:

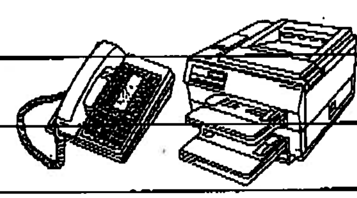
No. of Pages (including this one) 4

Sender:

If this Fax is not received in full or in good condition, please call (303) 296-3523.

NOTES:

Tom: Sorry for the delay in sending the forms



URS OPERATING SERVICES, INC. ▯ 1099 18TH ST., STE 710 ▯ DENVER, CO ▯ 80202-1908
PHONE (303) 296-3523 ▯ FAX (303) 291-8296

Standard Mine Pilot Field Parameters and Observations

Date: 10/4/07 Sampled by: Jerry Goedert Time: 0815

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	6.3	6.5	1.4	-114 1st	1.25
APC Effluent	1st cell 2nd 3rd cell	2.5 1.7 0.9	1.29 1.05 0.91	2nd	
MRB Effluent		3.4	0.58	3rd	
Influent	7.1	4.8	0.59	76 4th	7.71
ORP Standard	Standard Value = 201			Always Last	

Sample Site	Odor	Color	Presence of molds/Comments
BCR Effluent	Foul	light yellow/brown	No discharge
APC Effluent	1st cell		water height 3" below top of pipe ice present in each cell
MRB Effluent			small amt of water discharge ice present
Influent	None	Colorless	Surge tank TOW 5.5' BTOP Tank btm 8.5' BTOP

Program ISCO effluent to remove "

Please Fax field sheet to Jim Gusek/Tom Rutkowski at Golder Associates at Fax No. 303-985-2080

10/08/07 15:57 FAX ☑003

Gunnison WWTP Laboratory

Gunnison County Wastewater Treatment Plant
524 County Rd 32 Gunnison, CO 81230

CHAIN OF CUSTODY RECORD

Client/Reporting Information	Invoice Information
Company Name: Golder Assoc. INC	Company Name: UOS
Address: 44 Union Blvd, Ste 300	Address: 1099 18th St, Ste 710
City: Lakewood State: CO Zip: 80228	City: Denver State: CO Zip: 80202
Contact: Tom Rutkowski E-mail: trutkowski@golder.com	Contact: Jerry Goedert E-mail: Jerry_Goedert@URSCORP.com
Phone Number: 303-980-0540 Fax Number: 303-985-2080	Phone Number: 303-291-8215 Fax Number: 303-291-8296
Sampler's Name:	Sampler's Name: Jerry Goedert 043-2269 Phase 3
File Number: 043-2269 Project Name: Standard Mine Pilot	

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER: Na2S2O3	Nitrite/Nitrate	Biochemical Oxygen Demand	E. coli							COMMENTS
SMP-IN-100407	O	N/A	10/4/07		G	~~2~~				1	1	~~1~~	X	X	~~X~~							
SMP-EF-100407	O	N/A	10/4/07		G	3				1	1	1	X	X	X							

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge) Standard TAT: (15 working days) Rush TAT: (3 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL=Oil/Organic Liquid, O=Other

RELINQUISHED BY: Jerry Goedert	DATE: 10/4/07	TIME: 1430	RECEIVED BY: [signature]	DATE: 10-4-07	TIME: 345
RELINQUISHED BY:	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RECEIVED AT LAB BY:	DATE:	TIME:	SHIPPED VIA: AIRBILL:	SEAL #: SEAL DATE:	

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[redacted]

US EPA/ETSC-Cincinnati Lab

Mail Location CHL 5995 Center Hill Ave.
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

10/08/07 15:58 FAX

004

Client/Reporting Information

Company Name: Golder Assoc. Inc
Address: 44 Union Blvd Ste 300
City: Lakewood State: CO Zip: 80228
Contact: Tom Rutkowski E-mail: TrutKowski@golder.com
Phone Number: 303-980-0540 Fax Number: 303-985-2080
Sampler's Name: Jay Gordon
Sampler's Name:
File Number: 043-2269
Project Name: Standard Mine Pilot

Invoice Information

Company Name: UOS
Address: 1099 18th St. Ste 710
City: Denver State: CO Zip: 80202
Contact: Jerry Goedert E-mail: Jerry_Goedert@urscorp.com
Phone Number: 303-291-8215 Fax Number: 303-291/8236
043-2269 Phase 3

PARAMETERS/CONTAINER TYPE — **COMMENTS**

SAMPLE IDENTIFICATION (30 Characters or less)	Matrix (Sample Type)	Regulatory Program	Date Sampled	Time Sampled	C-Composite G-Grab	Total Containers	HCL	NaOH	HNO3	H2SO4	NONE	OTHER	Total Metals	Dissolved Metals	Sulfate, alkalinity, acidity, pH						COMMENTS
SMP-IN-100407	O	N/A	10/4/07	0930	G	3			2		1		X	X	X						
SMP-EF-100407	O	N/A	10/4/07	0900	G	3			2		1		X	X	X						

(Number of Preserved Bottles: HCL, NaOH, HNO3, H2SO4, NONE)

Regulatory Program: N=NPDES, R=RCRA, D=Drinking Water, SL=503 Sludge, O=Other

(Please note if non-standard turnaround. Rush & Emergency subject to additional charge)
Standard TAT: (15 working days) Rush TAT: (5 working days) Emergency TAT: (3 working days)

Matrix (Sample Type): DW=Drinking Water, GW=Ground Water, WW=Waste Water, W=Wipe, S=Solid/Soil, SL=Sludge, A=Air, OL = Oil/Organic Liquid, O=Other

RELINQUISHED BY: Jay Gordon	DATE: 10/8/07	TIME: 1100	RECEIVED BY: JG	DATE:	TIME:
RELINQUISHED BY: JG	DATE:	TIME:	RECEIVED BY:	DATE:	TIME:
RECEIVED AT LAB BY:	DATE:	TIME:	SHIPPED VIA: Fed Ex AIRBILL: 8610 4019 5088	SEAL #:	SEAL DATE:

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10/08/07 15:59 FAX 005

UOS	URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: ACZ	*CHAIN OF CUSTODY RECORD*

PROJECT NUMBER / PURCHASE ORDER NUMBER: 043-2269/Standard Mine Pilot

SITE MANAGER / PHONE NUMBER: Goedert

SAMPLER'S SIGNATURE: [signature]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/GRAB	REMARKS	Number of Containers	Sulfide					TAG NUMBERS
1)	SMP-IN-100407	10/4/07	0930	G		1	X					
2)	SMP-EF-100407	10/4/07	0900	G		1	X					
3)												
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[signature]	10/8/07	1100	[signature]

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[signature]			

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE	TIME
[signature]					

OTHER INFORMATION:

AIRBILL NUMBER: 8610 4019 5077

LAB REMARKS:

Return Address UOS 1099 18th St. Ste 710 Denver CO 80202

White – Original to Accompany Samples   Yellow - UOS Chemist   Pink - UOS Project Manager   DN

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 7/30/08 Sampled by: Jan Christner/UOS Time: ________

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	6.0	11.87	0.568	-180 * ~~1~~ 2ND	1.33
Chitin Effluent	8.07	12.35	1.688	—	1.74
APC Effluent	—	—	—	— 2nd	—
MRB Effluent	—	—	—	— 3rd	—
Influent	5.88	13.44	0.430	154.9 118* ~~4th~~ 1ST	7.12
ORP Standard	Standard Value = —			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	Sulfur	brown	
Chitin Effluent	Old fish	—	
APC Effluent			
MRB Effluent			
Influent	—	Light Brown	

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

* ORP meter YSI was showing wild jumps in value. * value was taken on 7/31/08 using an individual meter.

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 8/14/08 Sampled by: Chris Myers/UOS Time: ____________

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	7.2	10	0.744	-160 1st	—
Chitin Effluent	—	—	—	—	—
APC Effluent	—	—	—	— 2nd	—
MRB Effluent	—	—	—	— 3rd	—
Influent	6.0	9.5	0.626	121 1st	
ORP Standard	Standard Value = ________			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	Rotten eggs	Brown/ Light Brown	
Chitin Effluent			
APC Effluent			
MRB Effluent			
Influent	None	Light Yellow Light Brown	

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 8/14/08 Sampled by: Chris Myers/UOS Time: ____________

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	7.2	10	0.744	-160 1st	—
Chitin Effluent	—	—	—	—	—
APC Effluent	—	—	—	— 2nd	—
MRB Effluent	—	—	—	— 3rd	—
Influent	6.0	9.5	0.626	12.1 1st	
ORP Standard	Standard Value = ______			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	Rotten eggs	Brown/ Light Brown	
Chitin Effluent			
APC Effluent			
MRB Effluent			
Influent	None	Light Yellow Light Brown	

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

FAX

Attention: Tom Rutkowski and Pat Smart

Fax #: 303-985-2080

From: Shelby Frail (UOS)

Tom and Pat,

Attached are all the COCs from the three sampling rounds that have been conducted at the Standard Mine and the parameter sheet from the 8/7/08 sampling event. There were some technical difficulties that day and I had to go back on 8/8/08 to obtain DO values. I was not able to obtain a DO value for the Chitorem. Also, I did not realize there was specific order for sampling ORP, so I started at the BCR influent, to the effluent, and my last sample was at the Chitorem. I'll be sample again tomorrow, hopefully all the kinks are worked out and it should go smoothly. If you have any questions let me know.

Thank you,

Shelby

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 8/7/08 **Sampled by:** Shelby Frail **Time:** 1030- 1330

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)	
BCR Effluent	6.8	7.5°C	777 µS	-206 RmV 1st	3.28 mg/L	= sampled on 8/8/08
Chitin Effluent	8.2	13.1°C	1387 µs	-140 mV	None	= could not get DO
APC Effluent	—	—	—	— 2nd	—	
MRB Effluent	—	—	—	— 3rd	—	
Influent	6.6	6.8°C	652 µS	198 RmV 4th	7.23 mg/L	= Sampled on 8/8/08
ORP Standard	Standard Value = ______			Always Last		

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	Sulfur	Clear	
Chitin Effluent	Fish smell	Clear	
APC Effluent	—	—	
MRB Effluent	—	—	
Influent	None	Reddish/light Brown	

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

UOS	URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	**SHIP TO:** [illegible]

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: [illegible]

SITE MANAGER / PHONE NUMBER: [illegible]

SAMPLER'S SIGNATURE: [illegible]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	[illegible]						TAG NUMBERS
1)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	1						[illegible]
2)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	1						[illegible]
3)													
4)													
5)													
6)													
7)													
8)													
9)													
10)													
11)													
12)													
13)													
14)													
15)													

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]	[illegible]	[illegible]	[illegible]
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE	TIME

AIRBILL NUMBER:
LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN [illegible]

UOS	URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: [illegible]	CHAIN OF COSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: [illegible]

SITE MANAGER / PHONE NUMBER: [illegible]

SAMPLER'S SIGNATURE: [illegible]

TURNAROUND REQUESTED:

SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	[illegible]	[illegible]	[illegible]			TAG NUMBERS
1) [illegible]	[illegible]	[illegible]	G	[illegible]	3	1	1	1			
2) [illegible]	[illegible]	[illegible]	G	[illegible]	3	1	1	1			
3)											
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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
[illegible]	[illegible]	[illegible]	[illegible]	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE / TIME / AIRBILL NUMBER: / LAB REMARKS:

White - Original to Accompany Samples   Yellow - UOS Chemist   Pink - UOS Project Manager

DN [illegible]

UOS URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: [illegible]	***CHAIN OF CUSTODY RECORD***

PROJECT NUMBER / PURCHASE ORDER NUMBER: [illegible]

SITE MANAGER / PHONE NUMBER: [illegible]

SAMPLER'S SIGNATURE: [illegible]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers						TAG NUMBERS
1)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
2)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]		
3)												
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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)		
[illegible]	[illegible]	[illegible]	[illegible]		
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)		
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE	TIME

OTHER INFORMATION:

AIRBILL NUMBER:
LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN [illegible]

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: [illegible]

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: [illegible]

SITE MANAGER / PHONE NUMBER: [illegible]

SAMPLER'S SIGNATURE: [illegible]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	[illegible]	[illegible]	[illegible]			TAG NUMBERS
1)	[illegible]	[illegible]	1040	[illegible]	[illegible]	3	1	1	1			[illegible]
2)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	1	1			[illegible]
3)	[illegible]	[illegible]	1330	[illegible]	[illegible]	[illegible]	1	1	1			[illegible] 90, 91
4)												
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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]	[illegible]	[illegible]	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE	TIME

AIRBILL NUMBER:
LAB REMARKS:

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: [illegible]

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: [illegible]

SITE MANAGER / PHONE NUMBER: [illegible]

SAMPLER'S SIGNATURE:

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	[illegible]	[illegible]	[illegible]	[illegible]		TAG NUMBERS
1)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	1	[illegible]	1		
2)	[illegible]	[illegible]	1105	[illegible]	[illegible]	[illegible]	1	1	1	1		
3)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	1	1	1		
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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]	[illegible]	[illegible]	

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]			

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE	TIME
[illegible]					

OTHER INFORMATION: [illegible]

AIRBILL NUMBER:
LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN [illegible]

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: [illegible]

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: [illegible]

SITE MANAGER / PHONE NUMBER: [illegible]

SAMPLER'S SIGNATURE: [illegible]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	[illegible]	[illegible]	[illegible]			TAG NUMBERS
1)	B[illegible]_INF	7/[illegible]/02	12[illegible]	Grab	[illegible]	3	1	1	1			[illegible]
2)	[illegible]_EFF	7/[illegible]/02	12[illegible]	Grab	[illegible]	3	1	1	1			[illegible]
3)	[illegible]_EFF	7/[illegible]/02	[illegible]	Grab	[illegible]	3	1	1	1			[illegible]
4)												
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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]	7/[illegible]	[illegible]	[illegible]
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]			
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE	TIME

AIRBILL NUMBER: [illegible]
LAB REMARKS:

Aug 20 08 05:29p p.9

UOS

URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO:

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER:

SITE MANAGER / PHONE NUMBER:

TURNAROUND REQUESTED:

SAMPLER'S SIGNATURE:

SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers						TAG NUMBERS
1)											
2)											
3)											
4)											
5)											
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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature) DATE TIME	AIRBILL NUMBER: LAB REMARKS:

White - Original to Accompany Samples   Yellow - UOS Chemist   Pink - UOS Project Manager

DN

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: [illegible]

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: [illegible]

SITE MANAGER / PHONE NUMBER: [illegible]

SAMPLER'S SIGNATURE: [illegible]

TURNAROUND REQUESTED:

SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	[illegible]						TAG NUMBERS
1) [illegible]	7/21/08	[illegible]	Comp.	[illegible]	1	1						[illegible]
2)												
3)												
4)												
5)												
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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]	[illegible]	[illegible]	

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE	TIME

OTHER INFORMATION:

AIRBILL NUMBER:
LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN [illegible]

FAX

Attention: Tom Rutkowski

Fax #: 303-985-2080

From: Shelby Frail (UOS)

Tom,

Attached are all the COC's including the ones from the samples I collected yesterday and a copy of the field parameter form. I tried emailing you a scanned copy of these, but the file was too large for my email server to send out. So, I darkened them on a photo copy machine and am trying to refax them. Hopefully, this will work. If not send me an email and I'll try something else. Ahh the joys of working in the field!!!

Here's a brief rundown on the samples taken so far. For the 8/7/08 samples the COC form to ACZ for the sulfide analysis is missing, but you should have already received those results. I must have forgotten to rip off the carbon copy when I mailed it. If you really need it I am sure ACZ can fax me a copy.

Sulfate samples were not collect on 7/30/08 because we did not have the correct preservatives and samples were not collect from the Chitorem effluent last week because there was no flow to the tank due to a clog in one of the pipes.

Let me know if you need anything else.

Thank you,

Shelby

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 8-21-08 **Sampled by:** Shelley Thi **Time:** Start 0920 End 1130

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	6.9	6.7°C	712 MS	-209 RmV 1st	.89 mg/L
Chitin Effluent	7.3	7.3°C	1295 MS	-199 RmV	1.28 mg/L
APC Effluent				2nd	
MRB Effluent				3rd	
Influent	6.6	5.8°C	616 MS	21 8 RmV 4th	6.61 mg/L
ORP Standard	Standard Value = 183			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	Sulfur "rotten eggs"	Clear ~~light~~ SF Brown	
Chitin Effluent	"Fish smell"	Clear	
APC Effluent			
MRB Effluent			
Influent	no odor	light Brown	

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: Souhail Al-Abed
USEPA/ETSC - Cincinnati Mail Code CHL
5995 Center Hill Ave
Cincinnati OH 45224

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: URS.36548232.00003
Golder: 043-2269 Phase 003

SITE MANAGER / PHONE NUMBER: Tom Rutkowski
(303) 980-0540

SAMPLER'S SIGNATURE:

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/GRAB	REMARKS	Number of Containers	Total Metals	Dissolved Metals	Alkalinity, Acidity, Sulfate, pH			TAG NUMBERS
1)	SMCHIT-EFF082108	08-21-08	1115	Grab	Chitorom Effluent	3	1	1	1			033226, 227, 228
2)	SMBCR-EFF082108	08-21-08	1010	Grab	BCR Effluent	3	1	1	1			033229, 230, 231
3)	SMBCR-INF082108	08-21-08	1025	Grab	BCR Influent	3	1	1	1			033232, 233, 234
4)												
5)												
6)												
7)												
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10)												
11)												
12)												
13)												
14)												
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8-21-08

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[signature]	8-21-08	1300	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE TIME

AIRBILL NUMBER:
LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7441

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: ACZ Labs
2773 Downhill Dr
Steamboat Springs, CO 80487

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 31548232.00003

SITE MANAGER / PHONE NUMBER: Jan Christner 720-810-0759

SAMPLER'S SIGNATURE: Shelley Frain

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/GRAB	REMARKS	Number of Containers	Sulfide					TAG NUMBERS
1)	SMCHIT-EFF082108	08/21/08	0925	Grab	Chiloram Effluent	1	1					
2)	SMBCR-EFF082108	08/21/08	1005	Grab	BCR Effluent	1	1					
3)	SMBCR-INF082108	08/21/08	1025	Grab	BCR Influent	1	1					
4)												
5)												
6)												
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11)												
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SF 8/21/08

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
Shelley Frain	8/21/08	1300		
RELINQUISHED BY: (Signature) SF	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE / TIME / AIRBILL NUMBER: / LAB REMARKS:

White - Original to Accompany Samples   Yellow - UOS Chemist   Pink - UOS Project Manager

DN 7437

Aug 22 08 08:15a p.5

UOS URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: Gunnison WWTP	*CHAIN OF CUSTODY RECORD*

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jim Christner 720-810-0759

SAMPLER'S SIGNATURE:

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Nitrite / Nitrate	E. Coli	BOD	Ammonia		TAG NUMBERS
1)	SMCHIT-EFF082108	08/21/08	~1115	Grab	CHit Effluent	4	1	1	1	1		
2)	SMBCR-EFF082108	8/21/08	1005	Grab	BCr EFFluent	4	1	1	1	1		
3)	SMBCR-INF082108	8/21/08	1025	Grab	BCR Influent	2	1		1			
4)												
5)												
6)												
7)												
8)												
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10)												
11)												
12)												
13)												
14)												
15)												

SF 8/21/08

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
Shelley [illegible]	8-21-08	1445	[illegible]	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE TIME AIRBILL NUMBER: LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7438

Aug 22 08 08:16a P.6

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: ACZ Labs
2773 Downhill Dr
Steamboat Spgs, CO 80487

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jan Christner 770.910.0759

TURNAROUND REQUESTED:

SAMPLER'S SIGNATURE:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Sulfide					TAG NUMBERS
1)	SMBCR-INF081408	8/14/08	08:10	G	BCR Influent	1	1					032100
2)	SMBCR-EFF081408	8/14/08	08:45	G	BCR Effluent	1	1					033224
3)												
4)												
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6)												
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CM 8/14/08

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
	8/14/08	12:30	FedEx	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE / TIME / AIRBILL NUMBER: / LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7110

Aug 22 08 08:17a p.7

UOS	URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: Souhal Al-Abed USEPA / ETSC-Cincinnati Mail Code CHL 5995 Center Hill Ave Cincinnati, OH 45224	CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: UOS - 36548232.00003 Golder - 043-2269 Phase 0003

SITE MANAGER / PHONE NUMBER: Jan Christner Tom Patkowski: 303-980-0540

SAMPLER'S SIGNATURE: [signature]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Total Metals	Dissolved Metals	Alkalinity, Acidity, pH, Sulfate			TAG NUMBERS
1)	SMBCR-INF081408	8/14/08	08:20	G	BCR Influent	3	1	1	1			
2)	SMBCR-EFF081408	8/14/08	08:45	G	BCR Effluent	3	1	1	1			
3)												
4)												
5)												
6)												
7)												
8)												
9)			CM 8/14/08									
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
[signature]	8/14/08	17:10	FedEX	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE TIME AIRBILL NUMBER: LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7112

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: Gunnison WWTP

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548732.00003

SITE MANAGER / PHONE NUMBER: Jan Christner 770 810.0[illegible]

SAMPLER'S SIGNATURE: [signature]

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Bod	Nitrite/Nitrate	E. Coli	Ammonia		TAG NUMBERS
1)	SMBCR-INF081408	8/14/08	08:20	G	BCR Influent	2	1	1				
2)	SMBCR-EFF081408	8/14/08	08:45	G	BCR Effluent	4	1	1	1	1		
3)												
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
[signature]	8/14/08	13:25	[signature] 8-14-08	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE / TIME / AIRBILL NUMBER: / LAB REMARKS:

White - Original to Accompany Samples   Yellow - UOS Chemist   Pink - UOS Project Manager

DN 7111

Aug 22 08 08:19a P.9

UOS	URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: Souhail Al-Abed USEPA/ETSC-Cincinnati Mail Code CHL 5995 Center Hill Ave. Cincinnati, OH 45224	**CHAIN OF CUSTODY RECORD**

PROJECT NUMBER / PURCHASE ORDER NUMBER: UOS-35548232.00003 Golder 043-2269 Phase 0003

SITE MANAGER / PHONE NUMBER: Jan Christner/UOS Tom Rutkowski/Golder Assoc. (303) 980-0540

SAMPLER'S SIGNATURE: Shelley Frail

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Total Metals	Dissolved Metals	Alkalinity, Acidity, Sulfate, pH			TAG NUMBERS
1)	SMBCR-INF080708	8/7/08	1040	Grab	BCR Influent	3	1	1	1			032083, 84, 85
2)	SMBCR-EFF080708	8/7/08	1105	Grab	BCR Effluent	3	1	1	1			032086, 87, 88
3)	SMCHIT-EFF080708	8/7/08	1330	Grab	Chit Effluent	3	1	1	1			032089, 90, 91
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)			SF									
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
Shelley Frail	8-7-08	1700		
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature) SF	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE / TIME / AIRBILL NUMBER: / LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7113

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: Gunnison WWTP

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jon Christner 720-810-0759

SAMPLER'S SIGNATURE:

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	BOD	Nitrite/Nitrate	E Coli	Ammonia		TAG NUMBERS
1)	SMBCR-INF080708	8/7/08	1040	Grab	BCR Influent	3	1	1	[illegible]	*SF		
2)	SMBCR-EFF080708	8/7/08	1105	Grab	BCR Effluent	~~3~~ 4	1	1	1	1		
3)	SMCHIT-EFF080708	8/7/08	1330	Grab	CHIT Effluent	~~3~~ 4 SF	1	1	1	1		
4)												
5)												
6)												
7)												
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9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
Shelley Tri	8-7-08	16:00	
RELINQUISHED BY: (Signature) SF	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature) SF	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION: Ecoli
* Ammonia samples for both:
SMBCR-EFF080708
SMCHIT-EFF080708

DATE	TIME

AIRBILL NUMBER:
LAB REMARKS:

UOS	URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: Souhail Al-Abed USEPA/ETSC-Cincinnati MailCode CHL 5995 Center Hill Avenue Cincinnati, OH 45224	**CHAIN OF CUSTODY RECORD**

PROJECT NUMBER / PURCHASE ORDER NUMBER: UOS-36548232.00003 Golder 043-2269 Phase 0003	SITE MANAGER / PHONE NUMBER: Tom Rutkowski / Golder Ass. Jan Christner / UOS 303-980-0540	TURNAROUND REQUESTED:
SAMPLER'S SIGNATURE: Jan M Christner		

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Total Metals	Dissolved Metals	Alkalinity, Acidity Sulfate, pH			TAG NUMBERS
1)	BCR_INF	7/30/08	1346	Grab	BCR Influent	3	1	1	1			032064, 65, 66
2)	BCR_EFF	7/30/08	1400	Grab	BCR Effluent	3	1	1	1			032067, 68, 69
3)	CHIT_EFF	7/30/08	1600	Grab	Chit Effluent	3	1	1	1			032071, 72, 73
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)			OTHER INFORMATION:
Jan M Christner	7/31/08	0830				
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)			
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE	TIME	AIRBILL NUMBER: 8575215 75406 LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7107

UOS URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: Gunnison County WWTP	***CHAIN OF CUSTODY RECORD***

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003	SITE MANAGER / PHONE NUMBER: Jen Christner / 720-810-0757
SAMPLER'S SIGNATURE:	

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Nitrate/Nitrite, ~~BOD, E. Coli~~	BOD	E Coli	Ammonia		TAG NUMBERS
1)	BCR_INF073008	7/30/08	1346	Grab	BCR Influent	3	1	1	1			
2)	BCR_EFF073008	7/30/08	1400	Grab	BCR Effluent	~~3~~ 4	1	1	1	1		
3)	CHIT_EFF073008	7/30/08	1600	Grab	CHIT Effluent	~~3~~ 4	1	1	1	1		
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE TIME AIRBILL NUMBER: LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7106

FAX

Attention: Tom Rutkowski/Pat Smart

Fax #: 303-985-2080

From: Shelby Frail

Reference: COC's for the week of 8/25/08

Attached are the COC's from the sampling event on 8/27/08. Let me know if you have any questions.

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 8-27-08 **Sampled by:** Shelby Frail **Time:** 0945

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	6.65	16.04 °C	713 µS	-205 mV 1st	3.47 mg/L
Chitin Effluent	6.99	11.° C	1534 µS	206 mV	2.77 mg/L
APC Effluent	—	—	—	— 2nd	—
MRB Effluent	—	—	—	— 3rd	—
Influent	6.15	8.02°C	605 µS	22 mV 4th	11.15 mg/L
ORP Standard	Standard Value = 208			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	Rotten eggs sulfur	Clear	—
Chitin Effluent	Crab shells	Clear	—
APC Effluent	—	—	—
MRB Effluent	—	—	—
Influent	None	light Brown	—

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

UOS

URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: Souhail Al-Abed
USEPA / ETSC- Cincinnati Mail code CHL
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: UOS 3554 8232.00003
Golder: 043-2269 phase 003

SITE MANAGER / PHONE NUMBER: Tom ~~R...~~ Rutkowski SF (303) 980-0540

SAMPLER'S SIGNATURE: Shelley Train

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers						TAG NUMBERS
1)	SMCHIT-EFF082708	08-27-08	0952	Grab	Chit Effluent	3	1	1	1			033235, 236, 237
2)	SMBCR-EFF082708 SF	08-27-08	1025	Grab	BCR Effluent	3	1	1	1			033238, 239, 240
3)	SMBCR-INF082708 SF	08-27-08	1040	Grab	BCR Influent	3	1	1	1			033241, 242, 243
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
Shelley Train	08/26/08	1200		
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE / TIME / AIRBILL NUMBER: LAB REMARKS:

White - Original to Accompany Samples   Yellow - UOS Chemist   Pink - UOS Project Manager

DN 7446

UOS

URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: Gunnison WWTP

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jon Christner 720-810-0759

SAMPLER'S SIGNATURE: Shelley Train

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Nitrite/Nitrate	E.Coli	BOD	Ammonia		TAG NUMBERS
1)	SMCHIT-EFF082708	08-27-08	1000	Grab	Chit Effluent	4	1	1	1	1		
2)	SMBCR-EFF082708	08-27-08	1025	Grab	BCR Effluent	4	1	1	1	1		
3)	SMBCR-INF082708	08-27-08	1040	Grab	BCR Influent	2	1		1	1		
4)												
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
Shelley Train	8-27-08		[illegible signature]
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE	TIME

AIRBILL NUMBER:
LAB REMARKS:

While - Original to Accompany Samples   Yellow - UOS Chemist   Pink - UOS Project Manager

DN 7442

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: ACZ Labs
2773 Downhill Dr.
Steamboat Springs, CO 80487

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jan Christner 720-810-0759

SAMPLER'S SIGNATURE: Shelley Tracy

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Sulfide					TAG NUMBERS
1)	SMCHIT-EFF082708	08-27-08	1000	Grab	Chit Effluent	1	1					
2)	~~SMCHIT~~ SF											
3)	SMBCR-EFF082708	08-27-08	1025	Grab	BCR Effluent	1	1					
4)	SMBCR-INF082708	08-27-08	1040	Grab	BCR Influent	1	1					
5)												
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

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RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
Shelley Tracy	08-27-08	1300		OTHER INFORMATION:
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE TIME AIRBILL NUMBER: LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7443

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 9/4/2008 **Sampled by:** Shelly Trail **Time:** 0900

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	6.67	5.0°C	0.776 mS/cm	1st	30.8 mg/L
Chitin Effluent	6.96	4.6°C	(1.412 mS/cm) 1412 µS/cm		33.7 mg/L
APC Effluent				2nd	
MRB Effluent				3rd	
Influent	6.15	4.5°C	0.683 mS/cm	4th	36.61 mg/L
ORP Standard	Standard Value = ______			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	sulfur/rotten eggs	Clear	—
Chitin Effluent	Crab Shells	slightly	odor has diminished and the water discharge to the creek is not as
APC Effluent	—	—	Chalky as it has been.
MRB Effluent	—	—	—
Influent	none	Clear w/ particulates	Not the same reddish color the influent has been in the past

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

Sep 04 08 02:25P P.2

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: ACZ Laboratories
2773 Downhill Dr
Steamboat Springs, CO 80487

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jan Christner (720) 810-0759

SAMPLER'S SIGNATURE: Shelley Frai

TURNAROUND REQUESTED:

SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Sulfide					TAG NUMBERS
1) SMCHIT-EFF090408	9-4-08	0841	Grab	Chito Effluent	1	1					
2) SMBCR-EFF090408	9/4/08	0915	Grab	BCR Effluent	1	1					
3) SMBCR-INF090408	9/4/08	0930	Grab	BCR Influent	1	1					
4)											
5)											
6)											
7)											
8)											
9)											
10)											
11)											
12)											
13)											
14)											
15)											

SF

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
Shelley Frai	9/4/08	1130	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE	TIME

AIRBILL NUMBER:
LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7447

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO: Sowhail Al-Abed
USEPA / ETSC-Cincinnati Mail Code CHL
Cincinnati, OH 45224

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: UOS: 3654S232.00003
Golder: 043-2269 phase 003

SITE MANAGER / PHONE NUMBER: Tom Rutkowski
(303) 980-0540

SAMPLER'S SIGNATURE: Shelly Frain

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Total Metals	Dissolved Metals	Alkalinity, Acidity	pH, Sulfate			TAG NUMBERS
1)	SMCHIT-EFF090408	09/04/08	0850	Grab	Chit Effluent	3	1	1	1				033251, ~~SF~~ 033253, 254
2)	SMBCR-EFF090408	9/04/08	0915	Grab	BCR Effluent	~~SF~~ 3	1	1	1				033255, 033256, 033250
3)	SMBCR-INF090408	9/04/08	0930	Grab	BCR Influent	~~SF~~ 3	1	1	1				
4)													
5)													
6)													
7)													
8)													
9)													
10)													
11)													
12)													
13)													
14)													
15)													

SF

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
Shelly Frain	09-04-08	1130	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)

OTHER INFORMATION:

DATE	TIME

AIRBILL NUMBER:
LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN

UOS	URS Operating Services, Inc. 1099 18th Street, STE 710 Denver, CO 80202 303-291-8200	SHIP TO: Gunnison WWTP	*CHAIN OF CUSTODY RECORD*

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jan Christner 720-810-0759

SAMPLER'S SIGNATURE:

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Nitrite/Nitrate	E. Coli	BOD	Ammonia		TAG NUMBERS
1)	SMChit-EFF090408	9/4/08 ~~[illegible]~~		Grab	Chit Effluent	4	1	1	1	1		
2)	SMBCR-EFF090408	9/4/08		Grab	BCR Effluent	4	1	1	1	1		
3)	SMBCR-INF090408	9/4/08		Grab	BCR Influent	32	1	~~1~~ SE	1	~~1~~ SE		
4)												
5)												
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12)												
13)												
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15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	OTHER INFORMATION:
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE TIME / AIRBILL NUMBER: LAB REMARKS:

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN

FAX

Attention: Tom Rutkowski

Fax #: 303-985-2080

From: Shelby Frail

Hi Tom,

Attached is the field parameter form from the 10/02/08 sampling event. Christina and I were unable to obtain DO measurements because our YSI meter would not calibrate. Also, the ORP and pH values we obtained using our meters differed significantly from the measured values on the ISCO samplers for the BCR influent and effluent. I recorded the ISCO readings in the comment sections on the field parameter form. Let me know if you have any questions.

Thank you,

Shelby

URS OPERATING SERVICES, INC. • 1099 18TH ST., STE 710 • DENVER, CO • 80202-1908
PHONE (303) 296-3523 • FAX (303) 291-8296

2008 STANDARD MINE PILOT FIELD PARAMETERS AND OBSERVATION SHEET

Date: 10/2/08 **Sampled by:** Shelby Frail / Christina Progress **Time:** 0930

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	7.6	6.3	0.739	-199 1st	—
Chitin Effluent	7.0	6.9	6.59	-111	—
APC Effluent				2nd	
MRB Effluent				3rd	
Influent	7.1	5.5	0.629	20 4th	—
ORP Standard	Standard Value = 215 mV			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	sulfur		The recorded values for ORP + pH obtained using our meters differed from the readings on the actual Isco-sampler: pH=6.3
Chitin Effluent	fish smell		The Chitorem effluent had an extremely high conductivity and the discharge into the creek was very bubbly + chalky
APC Effluent			
MRB Effluent			
Influent	-	light brown	pH + ORP Reading from the Isco sampler: pH = 6.6 ORP = 160

-468 mV
ORP = ~~160 mV~~

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

3

Standard Mine Pilot Field Parameters and Observations

Date: 8/9/07 **Sampled by:** A Longworth **Time:** 13:00

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (~~mg/L~~) % MG/l
BCR Effluent	5.97	~~7.97~~ 11.70	2.243	-93.7 1st	~~10.2~~ 2.46
APC Effluent	~~6~~	~~7.97~~		2nd	
MRB Effluent				3rd	
Influent	6.54	7.97	0.410	36.6 4th	10.31
ORP Standard 220	Standard Value = 220			Always Last 202.6	

Sample Site	Odor	Color	Presence of molds/Comments
BCR Effluent	Organic	Brown/ Yellow	
APC Effluent			
MRB Effluent			
Influent		slightly turbid (white)	

Please Fax field sheet to Jim Gusek/Tom Rutkowski at Golder Associates at Fax No. 303-985-2080

Standard Mine Pilot Field Parameters and Observation Sheet

Date: 8/15/07 **Sampled by:** Pat Smart **Time:**__________

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L) ppm
BCR Effluent	5.6	15.2	1.83 mS/cm	-85 mV 1st	Ø.8
APC Effluent	Not	Measured		2nd	
MRB Effluent	Not	Measured		3rd	
Influent	5.4Ø	4.87	.382 mS/cm	+152 4th	8.55
ORP Standard	Standard Value = ______			Always Last	

Sample Site	Odor (i.e., sulfur/rotten eggs, manure, hay)	Color (i.e., light brown, dark green)	Presence of molds/Comments
BCR Effluent	moderate manure	brown Strong Tea/cider color	None
APC Effluent	Not	Measured	
MRB Effluent	Not	Measured	
Influent	None	None	

Please Fax field sheet to Tom Rutkowski/Pat Smart at Golder Associates at Fax No. 303-985-2080

Standard Mine Pilot Field Parameters and Observations

Date: 8.22.2007 **Sampled by:** C. Myers **Time:** 14:15

Sample Location	pH	Temp (°C)	Conductivity (mS/cm)	ORP (mV) & Meas. Sequence	Dissolved Oxygen (mg/L)
BCR Effluent	4.84	15.16	1.681	18.9 1st	2.4
APC Effluent				2nd	
MRB Effluent				3rd	
Influent	6.07	10.16	.319	266.6 4th	10.82
ORP Standard	Standard Value = 220 mV			Always Last	

Sample Site	Odor	Color	Presence of molds/Comments
BCR Effluent	Bio-smell, similar to bacteria growth media	Brown, like a black tea	
APC Effluent			
MRB Effluent			
Influent	None	Clear, very little particulate	

Please Fax field sheet to Jim Gusek/Tom Rutkowski at Golder Associates at Fax No. 303-985-2080

APPENDIX E

EPA ORD LABORATORY REPORTS

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Log Sheet
Sample Taken 8/16/2007

Bottle #	Sample Name	Matrix
#1	**BCR Eff 8/16**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Sample Name	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
STD MINE BCR EFF-1	-0.546	0.084	0.026	0.110	0.100	4.470	42.900	0.104	0.259	64.300	0.030	0.834	2.776
STD MINE BCR EFF-2	-0.599	0.024	0.007	0.032	0.035	4.450	43.100	0.037	0.195	63.900	0.016	0.813	2.786
STD MINE BCR EFF-3	-0.586	0.020	0.007	0.031	0.035	4.550	43.100	0.038	0.196	64.300	0.020	0.800	2.803
BCR Eff DM	-0.648	0.027	0.006	0.037	0.030	4.480	47.900	0.039	0.226	74.500	0.014	0.872	2.901

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 16, 2007

Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED CONCENTRATIONS													
BCR Eff DM	0	0.027	0.0057	0.037	0.03	4.48	47.9	0.0387	0.2255	74.5	0.014	0.8716	2.901
TOTAL CONCENTRATIONS													
Std Mine BCR EFF	0.000	0.047	0.015	0.064	0.063	4.989	47.815	0.066	0.241	71.296	0.024	0.906	3.098

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 16, 2007
pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 09/11/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	**BCR Eff**	6.28	9.4	977.6

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Log Sheet
Sample Taken 9/6/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Sample Name	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMP EFF -1	-0.859	0.019	0.006	0.016	0.013	13.700	40.300	0.024	0.133	16.400	-0.019	0.980	2.174
SMP EFF -2	-0.962	0.010	0.005	0.016	0.012	13.400	40.700	0.023	0.132	16.200	0.016	0.992	2.163
SMP EFF -3	-0.913	0.012	0.006	0.017	0.014	13.400	41.000	0.026	0.130	16.500	0.019	0.992	2.153
SMP INF -1	0.107	0.006	0.120	0.014	0.174	0.762	6.960	0.012	0.491	74.500	0.013	0.550	21.640
SMP INF -2	0.095	0.007	0.122	0.014	0.178	0.779	6.960	0.022	0.498	73.600	0.012	0.557	21.890
SMP INF -3	0.088	0.006	0.122	0.014	0.174	0.690	6.750	0.011	0.490	72.000	0.017	0.547	21.650
SMP Eff DM	-1.040	0.013	0.000	0.024	0.002	15.200	45.100	0.027	0.037	18.700	0.007	1.084	0.653
SMP Inf DM	-0.333	0.007	0.137	0.019	0.134	0.195	7.690	0.015	0.273	84.500	0.014	0.615	23.870

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Dilution	Al	As	Cd	Co	Cu	Fe	Mg	Ni	Pb	S	Se	Sr	Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
SMP EFF -1	1.11	0.000	0.021	0.006	0.018	0.014	15.222	44.778	0.027	0.148	18.222	-0.021	1.089	2.416
SMP EFF -2	1.11	0.000	0.011	0.006	0.018	0.013	14.889	45.222	0.026	0.147	18.000	0.018	1.102	2.403
SMP EFF -3	1.11	0.000	0.013	0.007	0.019	0.016	14.889	45.556	0.029	0.144	18.333	0.021	1.103	2.392
SMP INF -1	1.11	0.119	0.007	0.133	0.016	0.193	0.847	7.733	0.013	0.546	82.778	0.014	0.611	24.044
SMP INF -2	1.11	0.106	0.008	0.136	0.016	0.198	0.866	7.733	0.025	0.554	81.778	0.013	0.619	24.322
SMP INF -3	1.11	0.098	0.007	0.136	0.016	0.193	0.767	7.500	0.013	0.545	80.000	0.019	0.607	24.056
SMP Eff DM		0	0.013	0	0.024	0.002	15.2	45.1	0.0266	0.037	18.7	0.007	1.084	0.6527
SMP Inf DM		0	0.007	0.1369	0.019	0.134	0.195	7.69	0.0148	0.2727	84.5	0.014	0.6154	23.87
Average Concentrations														
Sample		Al	As	Cd	Co	Cu	Fe	Mg	Ni	Pb	S	Se	Sr	Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
SMP Eff		0.000	0.015	0.006	0.018	0.014	15.000	45.185	0.027	0.146	18.185	0.006	1.098	2.404
SMP Inf		0.107	0.007	0.135	0.016	0.195	0.826	7.656	0.017	0.548	81.519	0.016	0.612	24.141
Stdev														
Sample		Al	As	Cd	Co	Cu	Fe	Mg	Ni	Pb	S	Se	Sr	Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
SMP Eff		0.000	0.005	0.001	0.001	0.001	0.192	0.390	0.002	0.002	0.170	0.023	0.008	0.012
SMP Inf		0.011	0.001	0.002	0.000	0.003	0.052	0.135	0.007	0.005	1.407	0.003	0.006	0.157

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 09/11/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	**SMP Inf**	6.63	0.4	41.6
2	**SMP Eff**	6.14	12.2	1268.8

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Dilution	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMP Inf-1	**1.11**	0	0.000	0.145	0.018	0.191	0.912	8.211	0.012	0.627	82.778	0.019	0.698	24.756
SMP Inf-2	**1.11**	0	0.000	0.144	0.017	0.197	0.926	8.000	0.012	0.636	83.556	0.006	0.653	25.067
SMP Inf Dup-1	**1.11**	0	0.000	0.149	0.018	0.203	0.846	7.233	0.013	0.638	81.667	0.002	0.604	25.233
SMP Inf Dup-2	**1.11**	0	0.000	0.149	0.017	0.204	0.892	7.078	0.013	0.635	80.444	0.002	0.591	25.378
SMP Eff-1	**1.11**	0	0.013	0.015	0.031	0.031	5.356	40.333	0.037	0.231	67.111	0.011	0.825	3.218
SMP Eff-2	**1.11**	0	0.014	0.011	0.030	0.037	5.422	40.778	0.037	0.229	67.667	0.009	0.818	3.282
SMP Eff Dup-1	**1.11**	0	0.011	0.011	0.030	0.031	4.900	43.111	0.034	0.189	67.111	0.003	0.890	3.260
SMP Eff Dup-2	**1.11**	0	0.012	0.009	0.030	0.026	5.322	47.111	0.033	0.189	68.889	0.007	0.954	3.264
SMP Inf DM		0.000	0.006	0.148	0.017	0.170	0.156	7.650	0.015	0.376	88.900	0.017	0.607	26.040
SMP Eff DM		0.000	0.010	0.000	0.022	0.004	4.960	41.300	0.026	0.055	68.500	0.015	0.857	1.372

Average Concentrations

Sample	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMP Inf	0.000	0.000	0.145	0.017	0.194	0.919	8.106	0.012	0.631	83.167	0.012	0.675	24.911
SMP Inf Dup	0.000	0.000	0.149	0.017	0.204	0.869	7.156	0.013	0.637	81.056	0.002	0.598	25.306
SMP Eff	0.000	0.014	0.013	0.031	0.034	5.389	40.556	0.037	0.230	67.389	0.010	0.821	3.250
SMP Eff Dup	0.000	0.012	0.010	0.030	0.028	5.111	45.111	0.033	0.189	68.000	0.005	0.922	3.262

Stdev

Sample	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMP Inf	0.000	0.000	0.001	0.001	0.004	0.009	0.149	0.000	0.007	0.550	0.009	0.032	0.220
SMP Inf Dup	0.000	0.000	0.000	0.001	0.001	0.033	0.110	0.000	0.002	0.864	0.000	0.009	0.102
SMP Eff	0.000	0.001	0.003	0.001	0.004	0.047	0.314	0.000	0.001	0.393	0.002	0.005	0.046
SMP Eff Dup	0.000	0.001	0.001	0.000	0.004	0.299	2.828	0.000	0.000	1.257	0.002	0.045	0.003

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Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Sample Name	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMP Inf-1	-0.102	-0.002	0.1306	0.016	0.172	0.821	7.39	0.0104	0.5639	74.5	0.017	0.6284	22.28
SMP Inf-2	-0.092	0	0.1298	0.015	0.177	0.833	7.2	0.011	0.5725	75.2	0.005	0.5874	22.56
SMP Inf Dup-1	-0.181	-0.005	0.1345	0.016	0.183	0.761	6.51	0.0119	0.574	73.5	0.002	0.5435	22.71
SMP Inf Dup-2	0.218	-0.005	0.1341	0.015	0.184	0.803	6.37	0.0113	0.5719	72.4	0.002	0.5322	22.84
SMP Eff-1	-0.348	0.012	0.0137	0.028	0.028	4.82	36.3	0.0331	0.2078	60.4	0.01	0.7422	2.896
SMP Eff-2	0.074	0.013	0.0097	0.027	0.033	4.88	36.7	0.0331	0.2061	60.9	0.008	0.7364	2.954
SMP Eff Dup-1	-0.755	0.01	0.0099	0.027	0.028	4.41	38.8	0.0302	0.1703	60.4	0.003	0.8011	2.934
SMP Eff Dup-2	-0.748	0.011	0.0085	0.027	0.023	4.79	42.4	0.0296	0.1698	62	0.006	0.8589	2.938
SMP Inf DM	-0.257	0.006	0.148	0.017	0.170	0.156	7.650	0.015	0.376	88.900	0.017	0.607	26.040
SMP Eff DM	-0.757	0.010	-0.003	0.022	0.004	4.960	41.300	0.026	0.055	68.500	0.015	0.857	1.372

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Log Sheet
Sample Taken 8/22/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Inf Dup**	Aqueous
# 3	**SMP Eff**	Aqueous
# 4	**SMP Eff Dup**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 08/24/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	**SMP Inf**	6.51	0.3	31.2
2	**SMP Eff**	6.28	8.3	863.2

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 6, 2007

Log Sheet	
Sample Taken	9/6/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 6, 2007

Sample Name	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L	
SMP EFF -1	-0.859	0.019	0.006	0.016	0.013	13.700	40.300	0.024	0.133	16.400	-0.019	0.980	2.174	
SMP EFF -2	-0.962	0.010	0.005	0.016	0.012	13.400	40.700	0.023	0.132	16.200	0.016	0.992	2.163	
SMP EFF -3	-0.913	0.012	0.006	0.017	0.014	13.400	41.000	0.026	0.130	16.500	0.019	0.992	2.153	
SMP INF -1	0.107	0.006	0.120	0.014	0.174	0.762	6.960	0.012	0.491	74.500	0.013	0.550	21.640	
SMP INF -2	0.095	0.007	0.122	0.014	0.178	0.779	6.960	0.022	0.498	73.600	0.012	0.557	21.890	
SMP INF -3	0.088	0.006	0.122	0.014	0.174	0.690	6.750	0.011	0.490	72.000	0.017	0.547	21.650	
SMP Eff DM	-1.040	0.013	0.000	0.024	0.002	15.200	45.100	0.027	0.037	18.700	0.007	1.084	0.653	
SMP Inf DM	-0.333	0.007	0.137	0.019	0.134	0.195	7.690	0.015	0.273	84.500	0.014	0.615	23.870	0.972656

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 6, 2007
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED CONCENTRATIONS													
SMP Eff DM	0	0.013	0	0.024	0.002	15.2	45.1	0.0266	0.037	18.7	0.007	1.084	0.6527
SMP Inf DM	0	0.007	0.1369	0.019	0.134	0.195	7.69	0.0148	0.2727	84.5	0.014	0.6154	23.87
TOTAL CONCENTRATIONS													
SMP Eff	0.000	0.015	0.006	0.018	0.014	15.000	45.185	0.027	0.146	18.185	0.006	1.098	2.404
SMP Inf	0.107	0.007	0.135	0.016	0.195	0.826	7.656	0.017	0.548	81.519	0.016	0.612	24.141

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 6, 2007
pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 09/11/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	**SMP Inf**	6.63	0.4	41.6
2	**SMP Eff**	6.14	12.2	1268.8

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Log Sheet
Sample Taken 9/12/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007

Sample Name	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L	Ca mg/L	Mn mg/L
SMP-9/12-INF-AD-1	0.352	0.053	0.1175	0.063	0.181	0.632	6.49	0.0433	0.4884	71.6	0.064	0.5722	20.84	76.81	10.36
SMP-9/12-INF-AD-2	0.352	0.011	0.1147	0.014	0.162	0.609	6.53	0.0153	0.4737	72.9	0	0.5655	21.22	77.56	10.36
SMP-9/12-INF-AD-3	0.341	0.008	0.1165	0.015	0.163	0.645	6.48	0.0154	0.4743	72.4	0.001	0.5756	21.43	75.81	10.07
SMP-9/12-EFF-AD-1	-0.469	0.012	0.0145	0.011	0.031	11.5	31.9	0.0129	0.1141	15.8	0.037	0.966	2.945	238.7	13.16
SMP-9/12-EFF-AD-2	-0.504	0.012	0.0159	0.011	0.031	11.4	32.2	0.0109	0.1181	15.9	0.04	0.9594	2.915	s 231.5	13.17
SMP-9/12-EFF-AD-3	-0.478	0.01	0.0148	0.011	0.03	11.3	32.1	0.0129	0.1153	16.1	0.04	0.9441	2.871	s 226.4	13.18
SMP-9/12-EFF-DM	-0.725	0.012	0.0043	0.015	0.006	12.6	36.9	0.0134	0.0283	21.4	0.046	1.068	1.145	s 231.6	14.49
SMP-9/12-INF-DM	-0.09	0.005	0.1381	0.022	0.13	0.161	7.68	0.0168	0.2501	85.5	0.038	0.6497	24.36	86.49	11.45

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L	Ca mg/L	Mn mg/L
DISSOLVED CONCENTRATIONS															
SMP-9/12-EFF-DM	0	0.012	0.0043	0.015	0.006	12.6	36.9	0.0134	0.0283	21.4	0.046	1.068	1.145	OCR	14.49
SMP-9/12-INF-DM	0	0.005	0.1381	0.022	0.13	0.161	7.68	0.0168	0.2501	85.5	0.038	0.6497	24.36	86.49	11.45
TOTAL CONCENTRATIONS															
SMP Inf 9/12	0.387	0.027	0.129	0.034	0.187	0.699	7.222	0.027	0.532	80.333	0.024	0.635	23.515	85.252	11.404
SMP Eff 9/12	0.000	0.013	0.017	0.012	0.034	12.667	35.630	0.014	0.129	17.704	0.043	1.063	3.234	265.222	14.633

OCR- Outside Calibration Range

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 12, 2007
pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 09/14/07
Normality of HCl =0.104

#	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	5.87	0.4	41.6
2	6.12	10.6	1102.4

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 19, 2007

Log Sheet
Sample Taken 9/19/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 19, 2007

Sample Name	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L	Ca mg/L	Mn mg/L
SMP-9/19-INF-AD-1	0.286	0.05	0.1018	0.074	0.13	0.371	6.97	0.0211	0.2395	64.1	0.072	0.5494	18.56	78.15	9.415
SMP-9/19-INF-AD-2	0.289	0.003	0.1015	0.014	0.102	0.362	7.15	-0.0053	0.2129	64	0.051	0.5505	19.2	79.88	9.517
SMP-9/19-INF-AD-3	0.216	-0.001	0.0997	0.014	0.103	0.348	6.92	-0.0037	0.2136	62.9	0.05	0.5531	18.88	80.34	9.513
SMP-9/19-EFF-AD-1	-0.451	0.003	0.0132	0.006	0.026	14.8	30.2	-0.0893	0.1053	7.95	0.047	0.9891	2.366	OCR	13.45
SMP-9/19-EFF-AD-2	-0.473	0.009	0.0128	0.006	0.029	14.8	30.8	-0.1178	0.1148	8.24	0.049	0.9909	2.396	OCR	13.63
SMP-9/19-EFF-AD-3	-0.482	0.003	0.0139	0.007	0.028	14.9	30.6	-0.1171	0.1092	8.21	0.046	0.9918	2.357	OCR	13.61
SMP-9/19-EFF-DM	-0.73	0.018	0.0046	0.01	0.01	15	32.1	0.0118	0.0286	19.1	0.057	0.9973	0.8368	OCR	14.67
SMP-9/19-INF-DM	-0.139	0.007	0.1143	0.015	0.039	0.108	7.71	0.0154	0.12	74	0.032	0.6106	20.98	84.93	10.44

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 19, 2007
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L	Ca mg/L	Mn mg/L
DISSOLVED CONCENTRATIONS															
SMP-9/19-EFF-DM	0	0.018	0.0046	0.01	0.01	15	32.1	0.0118	0.0286	19.1	0.057	0.9973	0.8368	OCR	14.67
SMP-9/19-INF-DM	0	0.007	0.1143	0.015	0.039	0.108	7.71	0.0154	0.12	74	0.032	0.6106	20.98	84.93	10.44
TOTAL CONCENTRATIONS															
SMP Inf 9/19	0.293	0.020	0.112	0.038	0.124	0.400	7.793	0.008	0.247	70.741	0.064	0.612	20.978	88.285	10.535
SMP Eff 9/19	0.000	0.006	0.015	0.007	0.031	16.481	33.926	0.000	0.122	9.037	0.053	1.101	2.637	0.000	15.070

OCR- Outside Calibration Range

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 19, 2007
pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 09/14/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	SMP Inf 9/19	6.59	0.7	72.8
2	SMP Eff 9/19	6.2	10.3	1071.2

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 27, 2007

Log Sheet	
Sample Taken	9/26/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 27, 2007

Sample Name	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L	Ca mg/L	Mn mg/L
SMP-9/26-INF-AD-1	0.608	-0.002	0.1151	0.015	0.216	0.698	6.58	-0.0054	0.7968	72.5	0.009	0.5744	22.01	74.65	9.712
SMP-9/26-INF-AD-2	0.651	0	0.1201	0.016	0.233	0.713	6.55	-0.0053	0.8078	73.6	0.055	0.5729	22.49	78.65	9.995
SMP-9/26-INF-AD-3	0.622	0.002	0.1208	0.016	0.226	0.716	6.61	-0.0046	0.822	74.2	0.05	0.5784	22.73	76.39	9.937
SMP-9/26-EFF-AD-1	-0.312	0.005	0.0124	0.006	0.035	12.1	23.7	-0.0903	0.0928	9.76	0.046	0.8171	1.646	OCR	11.35
SMP-9/26-EFF-AD-2	-0.367	0.005	0.0118	0.007	0.036	12.1	24	-0.1196	0.0947	10.1	0.054	0.813	1.649	OCR	11.53
SMP-9/26-EFF-AD-3	-0.295	0.004	0.0116	0.004	0.034	12	23.9	-0.13	0.0867	9.97	0.053	0.7952	1.618	OCR	11.28
SMP-9/26-EFF-DM	-0.6	0.008	0.0043	0.009	0.002	12.7	25.1	0.0087	0.0254	23.3	0.044	0.8395	0.639	OCR	12.52
SMP-9/26-INF-DM	-0.07	0.007	0.1359	0.021	0.193	0.125	7.15	0.0173	0.4998	81.6	0.036	0.6207	24.09	80.61	10.73

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 27, 2007
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L	Ca mg/L	Mn mg/L
DISSOLVED METALS CONCENTRATIONS															
SMP-9/26-EFF-DM	0	0.008	0.0043	0.009	0.002	12.7	25.1	0.0087	0.0254	23.3	0.044	0.8395	0.639	OCR	12.52
SMP-9/26-INF-DM	0	0.007	0.1359	0.021	0.193	0.125	7.15	0.0173	0.4998	81.6	0.036	0.6207	24.09	80.61	10.73
TOTAL METALS CONCENTRATIONS															
SMP Inf 9/26	0.697	0.001	0.132	0.017	0.250	0.788	7.311	0.000	0.899	81.593	0.042	0.639	24.900	85.070	10.979
SMP Eff 9/26	0.000	0.005	0.013	0.006	0.039	13.407	26.519	0.000	0.102	11.048	0.057	0.898	1.820	0.000	12.652

OCR - Outside Calibration Range

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 27, 2007
pH and Alkalinity for Standard Mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 09/28/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	SMP Inf 9/26	6.57	0.3	31.2
2	SMP Eff 9/26	6.29	9	936

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 4, 2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 4, 2007

Sample Name	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMP-INF-10/4-AD-1	0.638	0.004	58.9	0.1052	0.013	0.216	0.704	5.4	8.834	0.0066	0.8118	66.5	0.009	0.4365	20.41
SMP-INF-10/4-AD-2	0.592	-0.001	58.59	0.1112	0.012	0.217	0.701	5.4	8.878	0.0057	0.8095	66.1	0.006	0.4386	20.38
SMP-INF-10/4-AD-3	0.657	-0.002	59.08	0.1078	0.013	0.215	0.707	5.42	8.94	0.0052	0.8096	66.4	0.009	0.4417	20.33
SMP-EFF-10/4-AD-1	-0.004	0.003	200.1	0.0056	0.004	0.02	9.97	14.8	9.796	-0.0044	0.0819	12.2	0.007	0.5592	1.929
SMP-EFF-10/4-AD-2	0.013	0	200	0.006	0.005	0.021	10	14.9	9.805	-0.0057	0.0819	12.3	0.008	0.5516	1.929
SMP-EFF-10/4-AD-3	0.006	0.003	199.2	0.005	0.004	0.028	9.99	14.8	9.765	-0.0038	0.0823	12	0.007	0.5406	1.886
INF-10/4-DM	-0.037	0.014	66.3	0.1283	0.032	0.18	0.092	6.39	9.93	0.0152	0.4859	78	0.014	0.4987	22.82
EFF-10/4-DM	-0.406	0.009	219.2	-0.0001	0.012	0	10.5	16.4	10.72	-0.0014	0.0343	13.9	0.008	0.6073	0.8385

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 4, 2007
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED METALS CONCENTRATIONS															
INF-10/4-DM	0	0.014	66.3	0.1283	0.032	0.18	0.092	6.39	9.93	0.0152	0.4859	78	0.014	0.4987	22.82
EFF-10/4-DM	0	0.009	219.2	0	0.012	0	10.5	16.4	10.72	0	0.0343	13.9	0.008	0.6073	0.8385
TOTAL METALS CONCENTRATIONS															
SMP Inf 10/4	0.699	0.001	65.396	0.120	0.014	0.240	0.782	6.007	9.871	0.006	0.900	73.704	0.009	0.488	22.637
SMP Eff 10/4	0.007	0.002	221.963	0.006	0.005	0.026	11.096	16.481	10.876	0.000	0.091	13.519	0.008	0.000	2.127

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 4, 2007
pH and Alkalinity for Standard Mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 10/08/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	**SMP Inf 10/04**	6.62	0.3	31.2
2	**SMP Eff 10/04**	6.4	7.3	759.2

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 4, 2007
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	Inf 10/04-1	20X	16.861	337.221	338.918
	Inf 10/04-2	20X	16.990	339.794	
	Inf 10/04-3	20X	16.987	339.738	
2	Eff 10/04 -1	20X	2.761	55.214	56.706
	Eff 10/04 -2	20X	2.985	59.691	
	Eff 10/04 -3	20X	2.761	55.213	

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 16, 2007

Log Sheet	
Sample Taken	10/16/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 16, 2007

Sample Name	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
10/16-SMP-INF-1	0.058	0.014	72.98	0.1183	0.025	0.114	0.149	7	10.1	0.0154	0.2048	80.1	0.009	0.6027	23.11
10/16-SMP-INF-2	0.004	0	72.88	0.1154	0.024	0.111	0.15	7.01	10.14	0.0223	0.2011	80.3	0.004	0.5922	22.9
10/16-SMP-INF-3	0.017	-0.002	72.67	0.1154	0.023	0.111	0.146	7.02	10.06	0.0149	0.2009	79.5	0.012	0.5922	23.02
10/16-SMP-EFF-1	-0.345	0.002	238	-0.005	0.016	-0.002	13.7	17.6	10.94	0.0041	0.0159	3.97	-0.007	0.6426	0.3859
10/16-SMP-EFF-2	-0.351	-0.003	239.1	-0.0047	0.015	0	13.8	17.9	11.09	0.0038	0.0144	3.98	-0.004	0.6598	0.3733
10/16-SMP-EFF-3	-0.411	-0.005	237.5	-0.0038	0.013	-0.001	13.7	17.8	11.02	0.0043	0.0139	3.98	0.007	0.6465	0.3801
10/16-SMP-INF-DM	-0.086	0.001	79.97	0.1339	0.029	0.123	0.137	7.78	11.28	0.0171	0.2232	93.1	0.012	0.6573	25.88
10/16-SMP-EFF-DM	-0.647	-0.001	255.3	-0.006	0.016	-0.001	1.02	19.2	11.79	0.0044	-0.0009	4.48	0.003	0.6682	0.2588

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 16, 2007
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED METALS CONCENTRATIONS															
10/16-SMP-INF-DM	0	0.001	79.97	0.1339	0.029	0.123	0.137	7.78	11.28	0.0171	0.2232	93.1	0.012	0.6573	25.88
10/16-SMP-EFF-DM	0	0	255.3	0	0.016	0	1.02	19.2	11.79	0.0044	0	4.48	0.003	0.6682	0.2588
TOTAL METALS CONCENTRATIONS															
10/16 SMP INF	0.029	0.005	80.937	0.129	0.027	0.124	0.165	7.789	11.222	0.019	0.225	88.852	0.009	0.662	25.567
10/16 SMP EFF		0.001	264.667		0.016		15.259	19.741	12.241	0.005	0.016	4.419	0.003	0.722	0.422
Highlighted cell < Detection Limit															

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 16, 2007
pH and Alkalinity for Standard Mine samples
Method:310.1 (Potentiometric titration to end point 3.9)

Sample Preparation: None, samples used as received
Data of Analysis: 11/05/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	**SMP Inf 10/16**	6.4	0.3	62.4
2	**SMP Eff 10/16**	6.36	4	832

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 16, 2007
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	SMP Inf 10/16 10X-1	10	37.390	373.903	374.277
	SMP Inf 10/16 10X-2	10	37.434	374.337	
	SMP Inf 10/16 10X-3	10	37.459	374.592	
2	SMP Eff 10/16 5X-1	5	1.953	9.764	8.709
	SMP Eff 10/16 5X-2	5	1.590	7.952	
	SMP Eff 10/16 5X-3	5	1.682	8.409	

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected November 1, 2007

Log Sheet	
Sample Taken	11/1/2007

Bottle #	Sample Name	Matrix
# 1	**SMP Inf**	Aqueous
# 2	**SMP Eff**	Aqueous
# 3	**Elk Creek**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected November 1, 2007

Sample Name	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
11/01-STD MINE-INF-1	7.25	0.014	69.61	0.1238	0.017	0.718	8.65	7.16	10.22	0.0186	3.417	81.6	-0.003	0.5627	24.25
11/01-STD MINE-INF-2	4.73	0.006	68.93	0.123	0.015	0.666	5.93	7.18	10.16	0.0189	3.13	80.9	0.002	0.5556	24.22
11/01-STD MINE-INF-3	18.2	0.05	69.78	0.1248	0.018	0.92	20.3	7.67	10.36	0.0166	4.62	82.5	-0.004	0.5623	24.51
11/01-STD MINE-EFF-1	-0.179	0.003	170.8	-0.0034	0.001	0.004	4.52	12	7.302	-0.0013	0.0226	31.9	0.006	0.4352	0.5727
11/01-STD MINE-EFF-2	-0.177	0	171.2	-0.0033	0	0.003	4.5	12.1	7.3	-0.0025	0.0219	31.9	0.012	0.437	0.542
11/01-STD MINE-EFF-3	-0.206	0.015	171.3	-0.0026	0.002	0.007	4.51	12.1	7.292	-0.0007	0.0191	31.7	0.016	0.446	0.5274
11/01-ELK CREEK-1	-0.212	0.004	172.5	-0.0036	0	0.003	4.54	12.2	7.314	-0.0022	0.0224	31.5	0.002	0.4485	0.5462
11/01-ELK CREEK-2	-0.2	0.011	173.4	-0.0031	0	0.002	4.55	12.3	7.381	-0.0021	0.0151	31.5	-0.002	0.4436	0.5852
11/01-ELK CREEK-3	-0.24	0.002	172.1	-0.0041	-0.001	0.002	4.48	12	7.303	-0.002	0.0185	31.1	0.007	0.4369	0.5791
11/1-STD MINE-INF-DM	-0.266	0.002	75.9	0.1387	0.018	0.139	-0.019	7.35	11.01	0.0169	0.0198	94.3	0.006	0.5991	25.61
11/1-STD MINE-EFF-DM	-0.409	0.002	174.9	-0.0049	-0.001	-0.001	4.39	12.4	7.442	-0.0021	0.0081	39	0.002	0.4471	0.0088
11/01-ELK CREEK-DM	-0.39	0.001	173.8	-0.0058	-0.001	-0.002	4.18	12.3	7.454	-0.003	0.0066	38.9	-0.003	0.447	0.0185

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected November 1, 2007
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED METALS CONCENTRATIONS															
11/1-STD MINE-INF-DM		0.002	75.9	0.1387	0.018	0.139		7.35	11.01	0.0169	0.0198	94.3	0.006	0.5991	25.61
11/1-STD MINE-EFF-DM		0.002	174.9				4.39	12.4	7.442		0.0081	39	0.002	0.4471	0.0088
11/01-ELK CREEK-DM		0.001	173.8				4.18	12.3	7.454		0.0066	38.9		0.447	0.0185
TOTAL METALS CONCENTRATIONS															
11/1 SMP INF	11.178	0.026	77.156	0.138	0.019	0.853	12.919	8.152	11.385	0.020	4.136	90.741	0.001	0.622	27.030
11/1 SMP EFF		0.007	190.111		0.001	0.005	5.011	13.407	8.109		0.024	35.370	0.013	0.488	0.608
11/1 ELK CREEK		0.006	191.852			0.003	5.026	13.519	8.147		0.021	34.852	0.003	0.492	0.634

Highlighted cell < Detection Limit

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected November 1, 2007
pH and Alkalinity for Standard Mine samples
Method:310.1 (Potentiometric titration to end point 3.9)

Sample Preparation: None, samples used as received
Data of Analysis: 11/13/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	11/1 SMP INF	6.47	0.3	31.2
2	11/1 SMP EFF	6.56	4.1	426.4
3	11/1 ELK CREEK	6.87	4.5	468

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected November 1, 2007
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	SMP Inf 11/1 10X-1	10	34.4545	344.54488	348.46
	SMP Inf 11/1 10X-2	10	34.5267	345.26699	
	SMP Inf 11/1 10X-3	10	35.5556	355.55603	
2	SMP Eff 11/1 10X-1	10	14.4703	144.70319	143.96
	SMP Eff 11/1 10X-2	10	14.2469	142.4687	
	SMP Eff 11/1 10X-3	10	14.4716	144.71592	
3	ELK Creek 11/1 10X -1	10	12.6457	126.45657	126.57
	ELK Creek 11/1 10X -2	10	12.7962	127.96169	
	ELK Creek 11/1 10X -3	10	12.5303	125.30292	

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample Name	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMP-INF-TM-12/26/07	1.64	-0.0006	78	0.1149	0.011	0.0098	0.311	3.88	8.04	10.62	0.0091	0.0158	1.164	79.5	0.011	0.6453	24.94
SMP-INF-TM-1/2/08	1.42	-0.0021	79.4	0.1135	0.011	0.0105	0.335	4.03	8.28	10.85	0.0079	0.0129	1.046	79.4	0.046	0.6567	25.09
SMP-INF-TM-1/9/08	2.36	0.0008	82.23	0.1293	0.008	0.0139	0.571	3.94	8.67	9.151	0.0073	0.0106	1.015	83.2	0.005	0.689	27.71
SMP-INF-TM-1/16/08	2.64	0.0023	84.39	0.1287	0.011	0.0159	0.252	3.94	8.9	9.987	0.0064	0.0116	0.8984	84.3	0.011	0.716	26.76
SMP-INF-TM-1/23/08	6.88	0.0031	80.17	0.1127	0.01	0.0153	0.781	13.6	8.62	10.36	0.007	0.0103	3.293	81.9	0.048	0.6736	25.55
SMP-INF-TM-2/6/08	5.18	-0.0023	77.47	0.1114	0.011	0.0202	1.18	19.1	8.31	10.44	0.006	0.0098	5.238	81.1	0.043	0.6476	25.4
SMP-INF-TM-2/13/08	2.88	-0.0052	78.78	0.1089	0.01	0.0196	0.709	11.5	8.32	10.15	0.0059	0.0114	2.907	82	0.009	0.6617	24.69
SMP-INF-TM-2/20/08	3.21	0.0295	79.64	0.1215	0.053	0.0298	0.75	11.1	8.46	10.32	0.0236	0.032	3.215	81.5	0.071	0.6683	25.58
SMP-INF-TM-2/27/08	2.37	0.004	81.03	0.1123	0.013	0.0158	0.548	8.13	8.53	10.13	0.0077	0.0117	2.296	82.3	0.017	0.6813	25.8
SMP-INF-TM-3/5/08	2.56	0.0015	81.8	0.1072	0.01	0.0151	0.771	7.96	8.64	10.04	0.0061	0.0128	2.372	83.5	0.049	0.6857	25.96
SMP-INF-TM-3/12/08	1.03	-0.0016	81.85	0.128	0.008	0.0093	0.471	2.96	8.68	9.164	0.0061	0.0109	0.9926	83.5	0.012	0.6863	27.99
SMP-INF-TM-3/19/08	1.1	-0.0008	81.91	0.1543	0.008	0.0131	0.5	2.44	8.59	9.21	0.0061	0.0101	0.8394	85.1	0.049	0.6856	28.33
SMP-INF-TM-3/26/08	0.702	-0.0038	80.91	0.1427	0.009	0.015	0.371	1.72	8.47	9.881	0.0055	0.0136	0.6296	83.9	0.049	0.6777	27.09
SMP-INF-TM-4/2/08	0.729	-0.0038	80.31	0.1334	0.008	0.0109	0.67	1.64	8.37	10.3	0.0057	0.0095	0.641	83.3	0.049	0.6711	26
SMP-INF-TM-4/9/08	0.708	-0.0022	81.98	0.1332	0.01	0.0098	0.214	1.66	8.51	10.67	0.0052	0.012	0.6726	85.5	0.053	0.6775	26.37
SMP-INF-TM-4/16/08	0.844	-0.0016	82.96	0.1271	0.01	0.0087	0.224	2.1	8.61	9.835	0.0046	0.011	0.8325	84.5	0.005	0.6937	26.39
SMP-INF-TM-4/23/08	0.676	-0.0045	82.44	0.1205	0.009	0.0138	0.181	1.31	8.68	9.808	0.0047	0.0121	0.5208	83	0.01	0.6899	25.93
SMP-INF-TM-4/30/08	0.582	0.0296	81.44	0.1158	0.053	0.0203	0.186	1.32	8.55	9.547	0.0229	0.034	0.4978	81.3	0.075	0.6814	24.78
SMP-INF-TM-5/7/08	0.74	0.0011	79.05	0.1162	0.01	0.0162	0.177	1.43	8.32	9.344	0.007	0.0119	0.5236	81.7	0.012	0.6615	25.37
SMP-INF-TM-6/11/08	1.88	-0.0011	30.28	0.1066	0.058	0.0338	0.977	4.41	3.08	5.269	0.005	0.0074	1.671	43.1	0.008	0.2562	18.35
SMP-EFF-TM-1/2/08	0.058	-0.0004	114.7	0.002	0	0.0108	0.012	0.353	8.67	9.504	0.0012	-0.0002	0.0068	51.8	0.014	0.4841	1.869
SMP-EFF-TM-1/9/08	0.079	0.0012	124.2	0.0009	-0.002	0.0125	0.047	0.601	8.19	10.22	-0.0002	0.002	0.0115	51.8	0.051	0.5358	0.6188
SMP-EFF-TM-1/16/08	0.166	-0.0032	144.5	0.0014	0.004	0.0112	0.007	1.67	11.9	12.88	0.0016	0.0301	0.0093	8.12	0.054	0.6271	0.6941
SMP-EFF-TM-1/30/08	0.043	0.0018	124.1	0.0003	0.001	0.0124	0.002	0.421	9.49	10.29	0.0005	0.0032	0.0018	58.3	0.044	0.5243	1.905
SMP-EFF-TM-2/6/08	-0.058	-0.003	110.9	0.0019	-0.001	0.0302	0.005	0.191	8.74	9.884	0.0004	0.017	0.0022	56.2	0.051	0.5454	1.312
SMP-EFF-TM-2/13/08	-0.022	0.0011	113.4	0.0019	-0.001	0.0152	-0.001	0.12	9.02	10.02	0	0.0034	0.0034	55	0.049	0.5564	1.183
SMP-EFF-TM-2/20/08	-0.048	-0.0044	111.2	0.0008	-0.001	0.0139	-0.001	0.086	8.96	9.763	0.0006	0.0039	0.0019	49.3	0.019	0.5561	1.138
SMP-EFF-TM-2/27/08	0.011	0.036	113.6	0.008	0.055	0.0265	0.031	0.117	9.11	9.795	0.0202	0.0289	0.0321	46	0.091	0.5745	1.086
SMP-EFF-TM-3/5/08	0.054	0.0047	113.4	0.001	0	0.0132	0.093	0.078	9.35	9.96	0.0025	0.0005	0.0045	25.7	0.049	0.5651	0.9588
SMP-EFF-TM-3/12/08	0.062	-0.0014	113.3	0.0017	0.002	0.0127	0	0.449	9.44	9.986	0.0015	0.001	0.0037	21.6	0.057	0.5692	0.9422
SMP-EFF-TM-3/19/08	0.051	0.0036	113.9	0.0006	0	0.013	-0.001	0.661	9.41	10	0.0007	0.0089	0.0034	20.1	0.013	0.5623	0.9203
SMP-EFF-TM-3/26/08	0.028	-0.0038	117.9	0.0016	0	0.0106	0	0.836	9.82	10.49	0.0006	0.0172	0.0002	14.6	0.052	0.5609	0.8415
SMP-EFF-TM-4/2/08	0.007	0.0013	122.9	0.0008	0.003	0.0114	-0.001	0.958	10.2	10.96	0.0008	0.0219	0.0056	14.7	0.049	0.5707	0.8129
SMP-EFF-TM-4/9/08	0.067	0.002	130	0.0015	0.002	0.0109	-0.001	0.996	10.9	11.45	0.001	0.0275	0.0023	9.81	0.012	0.5636	0.6989
SMP-EFF-TM-4/16/08	0.086	-0.0033	145	0.0019	0.005	0.0099	0.006	1.54	11.9	12.83	0.0012	0.0276	0.0049	8.15	0.053	0.6333	0.682
SMP-EFF-TM-4/23/08	-0.03	0.0033	165.1	0.0017	0.003	0.0127	0.049	1.34	13	14.73	0.0004	0.0193	0.0036	6.41	0.054	0.7217	0.638
SMP-EFF-TM-4/30/08	-0.086	-0.0032	184.7	0.0007	0.001	0.0229	0	1.72	14.4	16.49	0.0002	0.0171	0.0049	5.65	0.05	0.8355	0.6501
SMP-EFF-TM-5/7/08	-0.08	0.0264	224.1	0.007	0.032	0.0256	0.028	1.09	15.7	19	0.0152	0.0183	0.0605	49	0.081	0.9694	0.7472
SMP-EFF-TM-5/14/08	0.005	0.003	146.8	0.0028	0.002	0.0186	0.003	0.626	10.1	12.37	0.0018	0.004	0.0177	54.1	0.05	0.634	0.6104
SMP-EFF-TM-5/21/08	0.082	0.0005	123.4	0.0003	-0.001	0.0102	0.011	0.595	8.11	10.18	0.0005	0	0.0086	52	0.009	0.5372	0.6565
SMP-EFF-TM-5/28/08	0.066	-0.0019	111.9	0.0013	-0.001	0.0097	-0.003	0.667	7.42	9.337	0.0002	0	0.0026	45.9	0.05	0.4881	0.6692
SMP-EFF-TM-6/4/08	0.112	0	99.68	0.0009	0	0.0131	-0.002	0.481	6.66	8.133	0.0003	0.0003	0.0003	36.6	0.047	0.435	0.7077
SMP-EFF-TM-6/11/08	0.058	-0.0021	88.11	0.0017	-0.001	0.0093	-0.002	0.167	5.64	6.984	-0.0005	-0.0009	-0.0005	27.7	0.045	0.3918	0.7426
SMP-INF-DM-12/26/07	1.16	-0.0018	86.85	0.1423	0.01	0.0046	0.398	3.64	8.5	11.79	0.0072	0.016	1.186	96.9	-0.01	0.6666	28.15
SMP-INF-DM-1/2/08	0.964	0	86.73	0.1409	0.01	0.0045	0.346	3.57	8.34	11.66	0.0067	0.0148	1.068	97.1	-0.015	0.6808	28.38
SMP-INF-DM-1/9/08	1.02	0.0138	92.63	0.1634	0.038	0.0097	0.534	3	9.06	10.36	0.0196	0.0281	1.064	101	0.007	0.7211	31.86
SMP-INF-DM-1/16/08	0.64	0.0035	93.04	0.1517	0.012	-0.0015	0.243	1.85	9.55	10.92	0.0096	0.015	0.8511	103	-0.013	0.7163	29.7
SMP-INF-DM-1/23/08	3.28	-0.0058	90.22	0.1391	0.011	0.0037	0.812	12.2	9.4	11.58	0.0082	0.013	3.484	99.9	0.013	0.7047	29.22
SMP-INF-DM-2/6/08	5.44	-0.0117	88.49	0.1433	0.011	0.0077	1.35	22	9.22	11.86	0.0078	0.0126	5.817	99.9	-0.014	0.6779	29.59
SMP-INF-DM-2/13/08	3.02	-0.0063	89.14	0.1327	0.009	0.0026	0.791	12.7	8.86	11.33	0.0079	0.0121	3.195	98.2	0.012	0.7007	28.91
SMP-INF-DM-2/20/08	3.32	-0.0078	89.14	0.1402	0.009	0.0023	0.805	11.7	8.52	11.21	0.0073	0.013	3.473	99.2	-0.014	0.713	29.17
SMP-INF-DM-2/27/08	2.5	-0.0046	89.43	0.1335	0.009	0.0039	0.587	8.31	8.59	10.78	0.0076	0.0133	2.496	98.2	-0.014	0.7205	29.36
SMP-INF-DM-3/5/08	2.63	-0.0029	90.14	0.1302	0.008	0.0073	0.822	8.06	8.63	10.62	0.0074	0.0128	2.529	100	0.009	0.7278	29.2
SMP-INF-DM-3/12/08	1.03	-0.0001	90.56	0.1586	0.007	-0.0035	0.501	2.66	8.96	9.322	0.0075	0.0131	1.056	103	0.01	0.7502	31.57
SMP-INF-DM-3/19/08	0.85	0.0036	90.64	0.1812	0.006	0.0011	0.531	2.03	8.3	9.413	0.0077	0.0127	0.8867	103	0.012	0.7643	31.85
SMP-INF-DM-3/26/08	0.569	0.0097	89.7	0.1797	0.026	0.0086	0.384	1.54	8.87	10.01	0.0169	0.0236	0.6844	102	0.025	0.7288	31.43
SMP-INF-DM-4/2/08	0.582	-0.0011	91.27	0.17	0.011	0.0064	0.728	1.54	9	10.55	0.0093	0.0152	0.7014	103	0.017	0.7364	31.09
SMP-INF-DM-4/9/08	0.48	-0.0009	92.3	0.1636	0.01	0.0019	0.23	1.54	8.6	10.73	0.0078	0.0136	0.6783	103	0.015	0.7266	30.63
SMP-INF-DM-4/16/08	0.66	-0.0009	92.44	0.155	0.008	0.0026	0.242	1.95	8.75	9.755	0.0074	0.0132	0.8408	103	0.008	0.7707	30.27
SMP-INF-DM-4/23/08	0.597	-0.0049	92.78	0.1495	0.008	0.0011	0.191	1.28	8.79	9.673	0.0068	0.013	0.5538	101	0.014	0.784	29.71
SMP-INF-DM-4/30/08	0.512	-0.002	91.35	0.1422	0.008	0.0054	0.176	1.28	8.49	9.496	0.0068	0.0126	0.5115	101	0.013	0.7808	28.83
SMP-INF-DM-5/7/08	0.619	-0.0008	88.91	0.1494	0.008	0.0026	0.192	1.42	8.37	9.476	0.0069	0.0127	0.554	98.7	0.009	0.7592	29.82
SMP-INF-DM-6/11/08	1.52	-0.0037	33.82	0.1238	0.01	-0.0007	1.06	4.51	3.02	5.343	0.0045	0.0092	1.805	52.5	0.006	0.2839	21.4
SMP-EFF-DM-1/2/08	-0.11	-0.0036	137.8	0.0013	-0.003	-0.0004	0.001	0.326	9.78	10.35	-0.0006	0.0441	0.0062	69.3	0.011	0.5927	2.611
SMP-EFF-DM-1/9/08	-0.024	-0.001	135.2	0.0029	-0.005	-0.001	-0.005	0.558	8.09	9.785	-0.0008	-0.0019	0.0033	92.3	0.019	0.6138	1.087
SMP-EFF-DM-1/16/08	-0.055	0.0188	156.8	0.0055	0.031	0.006	0.013	1.55	12	12.26	0.0089	0.0392	0.0182	17.5	0.01	0.7168	1.021
SMP-EFF-DM-1/30/08	-0.023	0.0003	136.6	0.0014	-0.001	-0.0018	0.002	0.352	9.69	9.981	0.0015	0.0006	0.005	69.3	-0.018	0.6182	2.618
SMP-EFF-DM-2/6/08	-0.138	0.0035	121.9	0.0005	-0.004	0.0118	-0.002	0.071	9.01	9.65	0.0004	0.0147	-0.0012	55.7	0.006	0.64	0.648
SMP-EFF-DM-2/13/08	-0.127	-0.0014	123.8	0.001	-0.004	0.0016	-0.003	0.044	9.21	9.724	-0.0003	0.0014	-0.0012	53.5	0.006	0.6392	0.5187
SMP-EFF-DM-2/20/08	-0.108	0.0035	122	0.0016	-0.005	0.0046	-0.003	0.036	9.2	9.549	-0.0006	0.0013	-0.0014	44.4	0.009	0.64	0.5419
SMP-EFF-DM-2/27/08	-0.158	0.0007	123.3	0.0019	-0.005	0.002	-0.006	0.041	9.22	9.409	-0.0014	0.0004	-0.0015	36.9	0.003	0.6453	0.5443
SMP-EFF-DM-3/5/08	-0.025	0.0029	125.6	0.001	-0.004	0.0069	-0.002	0.076	9.63	9.88	-0.001	-0.001	0.0015	30.8	-0.016	0.6646	1.569
SMP-EFF-DM-3/12/08	0.038	0.0006	124.8	0.0018	-0.004	-0.0018	-0.004	0.39	9.61	9.786	-0.0007	0.0007	0.0033	29.5	0.01	0.6616	1.575
SMP-EFF-DM-3/19/08	0.024	0.0011	124.8	0.0005	-0.002	-0.0007	-0.005	0.68	9.59	9.791	-0.0013	0.0103	0.0038	26.7	0.012	0.6524	1.503
SMP-EFF-DM-3/26/08	0.005	0.0004	128.4	0.0007	-0.002	0.0015	-0.006	0.854	10	10.16	-0.0011	0.0168	-0.0001	37.7	0.015	0.6579	1.432
SMP-EFF-DM-4/2/08	-0.047	0.017	133.8	0.0046	0.027	0.0095	0.012	0.979	10.4	10.62	0.0084	0.0357	0.0136	35.4	0.017	0.6544	1.259
SMP-EFF-DM-4/9/08	-0.022	0.0001	143.1	0.0022	-0.001	0.002	-0.005	1.02	11	11.17	0.0004	0.0222	0.0032	28	0.017	0.6694	1.195
SMP-EFF-DM-4/16/08	-0.058	-0.0028	159.5	0.0015	-0.001	0.0013	-0.005	1.6	12.1	12.55	-0.0006	0.0246	0.0001	22.3	0.019	0.7293	1.162
SMP-EFF-DM-4/23/08	-0.184	0.0015	183.6	0.0014	-0.002	0.0028	-0.006	0.263	13.5	14.55	-0.0001	0.0169	-0.0004	5.88	0.013	0.8544	0.9955
SMP-EFF-DM-4/30/08	-0.203	-0.0002	201.5	0.0026	-0.002	-0.0029	-0.005	0.324	14.5	16.05	-0.0009	0.013	0.0017	5.17	0.015	0.9576	0.9061
SMP-EFF-DM-5/7/08	-0.259	-0.0002	241.8	0.0016	-0.005	-0.0009	-0.005	0.734	15.8	18.37	-0.001	-0.0026	0.0075	56.4	0.016	1.094	0.8604
SMP-EFF-DM-5/14/08	-0.088	-0.0008	157.4	0.0021	-0.005	0.0032	-0.006	0.544	10	11.75	-0.0008	-0.0016	0.0041	91.8	0.012	0.7222	0.9642
SMP-EFF-DM-5/21/08	-0.028	-0.0038	134.6	0.0014	-0.004	-0.0034	-0.006	0.585	8.03	9.898	-0.0014	-0.0017	0.0005	86.3	0.012	0.6253	1.037
SMP-EFF-DM-5/28/08	0.052	0.0264	137.2	0.0054	0.038	0.0287	0.016	0.896	9.25	11.21	0.0157	0.0172	0.0185	57	0.074	0.5989	1.257
SMP-EFF-DM-6/4/08	0.03	0.0057	122.9	-0.0005	0.005	0.0113	-0.003	0.619	8.23	9.893	0.0037	0.0006	0.0017	41.9	0.047	0.5379	1.308
SMP-EFF-DM-6/11/08	0.029	0.0028	107.1	-0.0021	0.001	0.0132	-0.003	0.198	6.88	8.422	0.0023	-0.0013	0.0027	30	0.041	0.4781	1.495

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample		Al	As	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	Ni	Pb	S	Se	Sr	Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
SMP-INF-TM-12/26/07	**12/26/2008**	1.82	0.00	86.67	0.13	0.01	0.01	0.35	4.31	8.93	11.80	0.01	0.02	1.29	88.33	0.01	0.72	27.71
SMP-INF-TM-1/2/08	**1/2/2008**	1.58	0.00	88.22	0.13	0.01	0.01	0.37	4.48	9.20	12.06	0.01	0.01	1.16	88.22	0.05	0.73	27.88
SMP-INF-TM-1/9/08	**1/9/2008**	2.62	0.00	91.37	0.14	0.01	0.02	0.63	4.38	9.63	10.17	0.01	0.01	1.13	92.44	0.01	0.77	30.79
SMP-INF-TM-1/16/08	**1/16/2008**	2.93	0.00	93.77	0.14	0.01	0.02	0.28	4.38	9.89	11.10	0.01	0.01	1.00	93.67	0.01	0.80	29.73
SMP-INF-TM-1/23/08	**1/23/2008**	7.64	0.00	89.08	0.13	0.01	0.02	0.87	15.11	9.58	11.51	0.01	0.01	3.66	91.00	0.05	0.75	28.39
SMP-INF-TM-2/6/08	**2/6/2008**	5.76	0.00	86.08	0.12	0.01	0.02	1.31	21.22	9.23	11.60	0.01	0.01	5.82	90.11	0.05	0.72	28.22
SMP-INF-TM-2/13/08	**2/13/2008**	3.20	0.00	87.53	0.12	0.01	0.02	0.79	12.78	9.24	11.28	0.01	0.01	3.23	91.11	0.01	0.74	27.43
SMP-INF-TM-2/20/08	**2/20/2008**	3.57	0.03	88.49	0.14	0.06	0.03	0.83	12.33	9.40	11.47	0.03	0.04	3.57	90.56	0.08	0.74	28.42
SMP-INF-TM-2/27/08	**2/27/2008**	2.63	0.00	90.03	0.12	0.01	0.02	0.61	9.03	9.48	11.26	0.01	0.01	2.55	91.44	0.02	0.76	28.67
SMP-INF-TM-3/5/08	**3/5/2008**	2.84	0.00	90.89	0.12	0.01	0.02	0.86	8.84	9.60	11.16	0.01	0.01	2.64	92.78	0.05	0.76	28.84
SMP-INF-TM-3/12/08	**3/12/2008**	1.14	0.00	90.94	0.14	0.01	0.01	0.52	3.29	9.64	10.18	0.01	0.01	1.10	92.78	0.01	0.76	31.10
SMP-INF-TM-3/19/08	**3/19/2008**	1.22	0.00	91.01	0.17	0.01	0.01	0.56	2.71	9.54	10.23	0.01	0.01	0.93	94.56	0.05	0.76	31.48
SMP-INF-TM-3/26/08	**3/26/2008**	0.78	0.00	89.90	0.16	0.01	0.02	0.41	1.91	9.41	10.98	0.01	0.02	0.70	93.22	0.05	0.75	30.10
SMP-INF-TM-4/2/08	**4/2/2008**	0.81	0.00	89.23	0.15	0.01	0.01	0.74	1.82	9.30	11.44	0.01	0.01	0.71	92.56	0.05	0.75	28.89
SMP-INF-TM-4/9/08	**4/9/2008**	0.79	0.00	91.09	0.15	0.01	0.01	0.24	1.84	9.46	11.86	0.01	0.01	0.75	95.00	0.06	0.75	29.30
SMP-INF-TM-4/16/08	**4/16/2008**	0.94	0.00	92.18	0.14	0.01	0.01	0.25	2.33	9.57	10.93	0.01	0.01	0.93	93.89	0.01	0.77	29.32
SMP-INF-TM-4/23/08	**4/23/2008**	0.75	0.00	91.60	0.13	0.01	0.02	0.20	1.46	9.64	10.90	0.01	0.01	0.58	92.22	0.01	0.77	28.81
SMP-INF-TM-4/30/08	**4/30/2008**	0.65	0.03	90.49	0.13	0.06	0.02	0.21	1.47	9.50	10.61	0.03	0.04	0.55	90.33	0.08	0.76	27.53
SMP-INF-TM-5/7/08	**5/7/2008**	0.82	0.00	87.83	0.13	0.01	0.02	0.20	1.59	9.24	10.38	0.01	0.01	0.58	90.78	0.01	0.74	28.19
SMP-INF-TM-6/11/08	**6/11/2008**	2.09	0.00	33.64	0.12	0.06	0.04	1.09	4.90	3.42	5.85	0.01	0.01	1.86	47.89	0.01	0.28	20.39
SMP-EFF-TM-1/2/08	**1/2/2008**	0.06	0.00	127.44	0.002	0.00	0.01	0.01	0.39	9.63	10.56	0.00	0.00	0.01	57.56	0.02	0.54	2.08
SMP-EFF-TM-1/9/08	**1/9/2008**	0.09	0.00	138.00	0.001	0.00	0.01	0.05	0.67	9.10	11.36	0.00	0.00	0.01	57.56	0.06	0.60	0.69
SMP-EFF-TM-1/16/08	**1/16/2008**	0.18	0.00	160.56	0.002	0.00	0.01	0.01	1.86	13.22	14.31	0.00	0.03	0.01	9.02	0.06	0.70	0.77
SMP-EFF-TM-1/30/08	**1/30/2008**	0.05	0.00	137.89	0.000	0.00	0.01	0.00	0.47	10.54	11.43	0.00	0.00	0.00	64.78	0.05	0.58	2.12
SMP-EFF-TM-2/6/08	**2/6/2008**	0.00	0.00	123.22	0.002	0.00	0.03	0.01	0.21	9.71	10.98	0.00	0.02	0.00	62.44	0.06	0.61	1.46
SMP-EFF-TM-2/13/08	**2/13/2008**	0.00	0.00	126.00	0.002	0.00	0.02	0.00	0.13	10.02	11.13	0.00	0.00	0.00	61.11	0.05	0.62	1.31
SMP-EFF-TM-2/20/08	**2/20/2008**	0.00	0.00	123.56	0.001	0.00	0.02	0.00	0.10	9.96	10.85	0.00	0.00	0.00	54.78	0.02	0.62	1.26
SMP-EFF-TM-2/27/08	**2/27/2008**	0.01	0.04	126.22	0.009	0.06	0.03	0.03	0.13	10.12	10.88	0.02	0.03	0.04	51.11	0.10	0.64	1.21
SMP-EFF-TM-3/5/08	**3/5/2008**	0.06	0.01	126.00	0.001	0.00	0.01	0.10	0.09	10.39	11.07	0.00	0.00	0.01	28.56	0.05	0.63	1.07
SMP-EFF-TM-3/12/08	**3/12/2008**	0.07	0.00	125.89	0.002	0.00	0.01	0.00	0.50	10.49	11.10	0.00	0.00	0.00	24.00	0.06	0.63	1.05
SMP-EFF-TM-3/19/08	**3/19/2008**	0.06	0.00	126.56	0.001	0.00	0.01	0.00	0.73	10.46	11.11	0.00	0.01	0.00	22.33	0.01	0.62	1.02
SMP-EFF-TM-3/26/08	**3/26/2008**	0.03	0.00	131.00	0.002	0.00	0.01	0.00	0.93	10.91	11.66	0.00	0.02	0.00	16.22	0.06	0.62	0.94
SMP-EFF-TM-4/2/08	**4/2/2008**	0.01	0.00	136.56	0.001	0.00	0.01	0.00	1.06	11.33	12.18	0.00	0.02	0.01	16.33	0.05	0.63	0.90
SMP-EFF-TM-4/9/08	**4/9/2008**	0.07	0.00	144.44	0.002	0.00	0.01	0.00	1.11	12.11	12.72	0.00	0.03	0.00	10.90	0.01	0.63	0.78
SMP-EFF-TM-4/16/08	**4/16/2008**	0.10	0.00	161.11	0.002	0.01	0.01	0.01	1.71	13.22	14.26	0.00	0.03	0.01	9.06	0.06	0.70	0.76
SMP-EFF-TM-4/23/08	**4/23/2008**	0.00	0.00	183.44	0.002	0.00	0.01	0.05	1.49	14.44	16.37	0.00	0.02	0.00	7.12	0.06	0.80	0.71
SMP-EFF-TM-4/30/08	**4/30/2008**	0.00	0.00	205.22	0.001	0.00	0.03	0.00	1.91	16.00	18.32	0.00	0.02	0.01	6.28	0.06	0.93	0.72
SMP-EFF-TM-5/7/08	**5/7/2008**	0.00	0.03	249.00	0.008	0.04	0.03	0.03	1.21	17.44	21.11	0.02	0.02	0.07	54.44	0.09	1.08	0.83
SMP-EFF-TM-5/14/08	**5/14/2008**	0.01	0.00	163.11	0.003	0.00	0.02	0.00	0.70	11.22	13.74	0.00	0.00	0.02	60.11	0.06	0.70	0.68
SMP-EFF-TM-5/21/08	**5/21/2008**	0.09	0.00	137.11	0.000	0.00	0.01	0.01	0.66	9.01	11.31	0.00	0.00	0.01	57.78	0.01	0.60	0.73
SMP-EFF-TM-5/28/08	**5/28/2008**	0.07	0.00	124.33	0.001	0.00	0.01	0.00	0.74	8.24	10.37	0.00	0.00	0.00	51.00	0.06	0.54	0.74
SMP-EFF-TM-6/4/08	**6/4/2008**	0.12	0.00	110.76	0.001	0.00	0.01	0.00	0.53	7.40	9.04	0.00	0.00	0.00	40.67	0.05	0.48	0.79
SMP-EFF-TM-6/11/08	**6/11/2008**	0.06	0.00	97.90	0.002	0.00	0.01	0.00	0.19	6.27	7.76	0.00	0.00	0.00	30.78	0.05	0.44	0.83

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Date	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L
SMP-INF-DM-12/26/07	**12/26/07**	1.16	0.00	86.85	0.14	0.01	0.00	0.40	3.64	8.50	11.79	0.01	0.02	1.19	96.90	0.00	0.67
SMP-INF-DM-1/2/08	**01/02/08**	0.96	0.00	86.73	0.14	0.01	0.00	0.35	3.57	8.34	11.66	0.01	0.01	1.07	97.10	0.00	0.68
SMP-INF-DM-1/9/08	**01/09/08**	1.02	0.01	92.63	0.16	0.04	0.01	0.53	3.00	9.06	10.36	0.02	0.03	1.06	101.00	0.01	0.72
SMP-INF-DM-1/16/08	**01/16/08**	0.64	0.00	93.04	0.15	0.01	0.00	0.24	1.85	9.55	10.92	0.01	0.02	0.85	103.00	0.00	0.72
SMP-INF-DM-1/23/08	**01/23/08**	3.28	0.00	90.22	0.14	0.01	0.00	0.81	12.20	9.40	11.58	0.01	0.01	3.48	99.90	0.01	0.70
SMP-INF-DM-2/6/08	**02/06/08**	5.44	0.00	88.49	0.14	0.01	0.01	1.35	22.00	9.22	11.86	0.01	0.01	5.82	99.90	0.00	0.68
SMP-INF-DM-2/13/08	**02/13/08**	3.02	0.00	89.14	0.13	0.01	0.00	0.79	12.70	8.86	11.33	0.01	0.01	3.20	98.20	0.01	0.70
SMP-INF-DM-2/20/08	**02/20/08**	3.32	0.00	89.14	0.14	0.01	0.00	0.81	11.70	8.52	11.21	0.01	0.01	3.47	99.20	0.00	0.71
SMP-INF-DM-2/27/08	**02/27/08**	2.50	0.00	89.43	0.13	0.01	0.00	0.59	8.31	8.59	10.78	0.01	0.01	2.50	98.20	0.00	0.72
SMP-INF-DM-3/5/08	**03/05/08**	2.63	0.00	90.14	0.13	0.01	0.01	0.82	8.06	8.63	10.62	0.01	0.01	2.53	100.00	0.01	0.73
SMP-INF-DM-3/12/08	**03/12/08**	1.03	0.00	90.56	0.16	0.01	0.00	0.50	2.66	8.96	9.32	0.01	0.01	1.06	103.00	0.01	0.75
SMP-INF-DM-3/19/08	**03/19/08**	0.85	0.00	90.64	0.18	0.01	0.00	0.53	2.03	8.30	9.41	0.01	0.01	0.89	103.00	0.01	0.76
SMP-INF-DM-3/26/08	**03/26/08**	0.57	0.01	89.70	0.18	0.03	0.01	0.38	1.54	8.87	10.01	0.02	0.02	0.68	102.00	0.03	0.73
SMP-INF-DM-4/2/08	**04/02/08**	0.58	0.00	91.27	0.17	0.01	0.01	0.73	1.54	9.00	10.55	0.01	0.02	0.70	103.00	0.02	0.74
SMP-INF-DM-4/9/08	**04/09/08**	0.48	0.00	92.30	0.16	0.01	0.00	0.23	1.54	8.60	10.73	0.01	0.01	0.68	103.00	0.02	0.73
SMP-INF-DM-4/16/08	**04/16/08**	0.66	0.00	92.44	0.16	0.01	0.00	0.24	1.95	8.75	9.76	0.01	0.01	0.84	103.00	0.01	0.77
SMP-INF-DM-4/23/08	**04/23/08**	0.60	0.00	92.78	0.15	0.01	0.00	0.19	1.28	8.79	9.67	0.01	0.01	0.55	101.00	0.01	0.78
SMP-INF-DM-4/30/08	**04/30/08**	0.51	0.00	91.35	0.14	0.01	0.01	0.18	1.28	8.49	9.50	0.01	0.01	0.51	101.00	0.01	0.78
SMP-INF-DM-5/7/08	**05/07/08**	0.62	0.00	88.91	0.15	0.01	0.00	0.19	1.42	8.37	9.48	0.01	0.01	0.55	98.70	0.01	0.76
SMP-INF-DM-6/11/08	**06/11/08**	1.52	0.00	33.82	0.12	0.01	0.00	1.06	4.51	3.02	5.34	0.00	0.01	1.81	52.50	0.01	0.28
SMP-EFF-DM-1/2/08	**1/2/2008**	0.00	0.00	137.80	0.00	0.00	0.00	0.00	0.33	9.78	10.35	0.00	0.04	0.01	69.30	0.01	0.59
SMP-EFF-DM-1/9/08	**1/9/2008**	0.00	0.00	135.20	0.00	0.00	0.00	0.00	0.56	8.09	9.79	0.00	0.00	0.00	92.30	0.02	0.61
SMP-EFF-DM-1/16/08	**1/16/2008**	0.00	0.02	156.80	0.01	0.03	0.01	0.01	1.55	12.00	12.26	0.01	0.04	0.02	17.50	0.01	0.72
SMP-EFF-DM-1/30/08	**1/30/2008**	0.00	0.00	136.60	0.00	0.00	0.00	0.00	0.35	9.69	9.98	0.00	0.00	0.01	69.30	0.00	0.62
SMP-EFF-DM-2/6/08	**2/6/2008**	0.00	0.00	121.90	0.00	0.00	0.01	0.00	0.07	9.01	9.65	0.00	0.01	0.00	55.70	0.01	0.64
SMP-EFF-DM-2/13/08	**2/13/2008**	0.00	0.00	123.80	0.00	0.00	0.00	0.00	0.04	9.21	9.72	0.00	0.00	0.00	53.50	0.01	0.64
SMP-EFF-DM-2/20/08	**2/20/2008**	0.00	0.00	122.00	0.00	0.00	0.00	0.00	0.04	9.20	9.55	0.00	0.00	0.00	44.40	0.01	0.64
SMP-EFF-DM-2/27/08	**2/27/2008**	0.00	0.00	123.30	0.00	0.00	0.00	0.00	0.04	9.22	9.41	0.00	0.00	0.00	36.90	0.00	0.65
SMP-EFF-DM-3/5/08	**3/5/2008**	0.00	0.00	125.60	0.00	0.00	0.01	0.00	0.08	9.63	9.88	0.00	0.00	0.00	30.80	0.00	0.66
SMP-EFF-DM-3/12/08	**3/12/2008**	0.04	0.00	124.80	0.00	0.00	0.00	0.00	0.39	9.61	9.79	0.00	0.00	0.00	29.50	0.01	0.66
SMP-EFF-DM-3/19/08	**3/19/2008**	0.02	0.00	124.80	0.00	0.00	0.00	0.00	0.68	9.59	9.79	0.00	0.01	0.00	26.70	0.01	0.65
SMP-EFF-DM-3/26/08	**3/26/2008**	0.01	0.00	128.40	0.00	0.00	0.00	0.00	0.85	10.00	10.16	0.00	0.02	0.00	37.70	0.02	0.66
SMP-EFF-DM-4/2/08	**4/2/2008**	0.00	0.02	133.80	0.00	0.03	0.01	0.01	0.98	10.40	10.62	0.01	0.04	0.01	35.40	0.02	0.65
SMP-EFF-DM-4/9/08	**4/9/2008**	0.00	0.00	143.10	0.00	0.00	0.00	0.00	1.02	11.00	11.17	0.00	0.02	0.00	28.00	0.02	0.67
SMP-EFF-DM-4/16/08	**4/16/2008**	0.00	0.00	159.50	0.00	0.00	0.00	0.00	1.60	12.10	12.55	0.00	0.02	0.00	22.30	0.02	0.73
SMP-EFF-DM-4/23/08	**4/23/2008**	0.00	0.00	183.60	0.00	0.00	0.00	0.00	0.26	13.50	14.55	0.00	0.02	0.00	5.88	0.01	0.85
SMP-EFF-DM-4/30/08	**4/30/2008**	0.00	0.00	201.50	0.00	0.00	0.00	0.00	0.32	14.50	16.05	0.00	0.01	0.00	5.17	0.02	0.96
SMP-EFF-DM-5/7/08	**5/7/2008**	0.00	0.00	241.80	0.00	0.00	0.00	0.00	0.73	15.80	18.37	0.00	0.00	0.01	56.40	0.02	1.09
SMP-EFF-DM-5/14/08	**5/14/2008**	0.00	0.00	157.40	0.00	0.00	0.00	0.00	0.54	10.00	11.75	0.00	0.00	0.00	91.80	0.01	0.72
SMP-EFF-DM-5/21/08	**5/21/2008**	0.00	0.00	134.60	0.00	0.00	0.00	0.00	0.59	8.03	9.90	0.00	0.00	0.00	86.30	0.01	0.63
SMP-EFF-DM-5/28/08	**5/28/2008**	0.05	0.03	137.20	0.01	0.04	0.03	0.02	0.90	9.25	11.21	0.02	0.02	0.02	57.00	0.07	0.60
SMP-EFF-DM-6/4/08	**6/4/2008**	0.03	0.01	122.90	0.00	0.01	0.01	0.00	0.62	8.23	9.89	0.00	0.00	0.00	41.90	0.05	0.54
SMP-EFF-DM-6/11/08	**6/11/2008**	0.03	0.00	107.10	0.00	0.00	0.01	0.00	0.20	6.88	8.42	0.00	0.00	0.00	30.00	0.04	0.48

Zn mg/L
28.15
28.38
31.86
29.70
29.22
29.59
28.91
29.17
29.36
29.20
31.57
31.85
31.43
31.09
30.63
30.27
29.71
28.83
29.82
21.40
2.61
1.09
1.02
2.62
0.65
0.52
0.54
0.54
1.57
1.58
1.50
1.43
1.26
1.20
1.16
1.00
0.91
0.86
0.96
1.04
1.26
1.31
1.50

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 18, 2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous
# 3	**Chit-Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
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Sample Name	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMBCR -INF9/18-1	-0.628	0.005	1113	-0.0044	0.003	0.0369	0	3.69	91.7	12.17	-0.0002	0.0024	0.0001	9.18	0.039	17.5	0.0436
SMBCR -INF9/18-2	-0.688	0.003	1152	-0.0045	0.001	0.0509	0.005	3.57	95.6	12.82	-0.0004	0.004	-0.0027	9.64	0.006	18.07	0.0863
SMBCR -INF9/18-3	-0.692	0.012	1133	-0.0044	0.002	0.0127	0.001	3.72	92.9	12.5	-0.0001	0.0028	0.0001	9.63	0.004	17.75	0.1593
SMBCR EFF 9/18-1	-0.187	0	107	0.0005	-0.001	0.0085	0.01	0.609	0.549	8.88	0.002	-0.0007	0.0062	42.4	0.008	0.4133	1.196
SMBCR EFF 9/18-2	-0.021	-0.004	109.3	0.0006	0.001	0.0248	0.008	0.007	1.01	8.881	0.0014	0.0028	0.0071	38.5	0.006	0.4609	1.634
SMBCR EFF 9/18-3	0.014	0	107.1	-0.0001	0.001	0.0171	0.007	0.132	0.991	8.852	0.0011	0.0053	0.0032	41.1	0.005	0.4693	1.642
SMCHIT EFF 9/18-1	8.94	0.059	71.64	0.1382	0.027	0.0282	1.64	45.9	0.539	13.28	0.0281	0.0274	6.075	77.8	0.018	0.5034	26.95
SMCHIT EFF 9/18-2	7.63	0.023	71.31	0.1301	0.021	-0.0016	1.48	36.1	0.19	12.08	0.0115	0.0142	5.555	76.4	0.011	0.4833	25.38
SMCHIT EFF 9/18-3	6.94	0.024	72.36	0.135	0.019	0.0544	1.48	35.5	0.623	11.65	0.0084	0.0145	5.548	79.7	0.01	0.4667	26.46
SMBCR INF 9/18 DM	-0.062	-0.001	80.48	0.1462	0.017	0.0161	0.108	0.074	0.947	11.7	0.0042	0.0183	0.1247	98.7	0.008	0.5536	28.45
SMBCR EFF 9/18 DM	-0.141	0.003	120.9	-0.0017	-0.001	0.0484	-0.003	-0.028	0.705	10.28	-0.0001	0.0009	-0.0019	162	0.008	0.5118	0.45
SMCHIT EFF 9/18 DM	-0.968	0.013	1282	-0.0053	0	0.0194	-0.003	0.2	106	11.43	0.0023	0.0014	-0.0048	82.8	0.064	20.19	-0.2658

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 18, 2008

Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED METALS CONCENTRATIONS																	
SMBCR INF 9/18 DM	0.000	0.000	80.480	0.146	0.017	0.016	0.108	0.074	0.947	11.700	0.004	0.018	0.125	98.700	0.008	0.554	28.450
SMBCR EFF 9/18 DM	0.000	0.003	120.900	0.000	0.000	0.048	0.000	0.000	0.705	10.280	0.000	0.001	0.000	162.000	0.008	0.512	0.450
SMCHIT EFF 9/18 DM	0.000	0.013	1282.000	0.000	0.000	0.019	0.000	0.200	106.000	11.430	0.002	0.001	0.000	82.800	0.064	20.190	0.000
TOTAL METALS CONCENTRATIONS																	
BCR Inf 9/18	0.000	0.007	1258.519	0.000	0.002	0.037	0.002	4.067	103.778	13.885	0.000	0.003	0.000	10.537	0.018	19.748	0.107
BCR Eff 9/18	0.005	0.000	119.778	0.000	0.001	0.019	0.009	0.277	0.944	9.857	0.002	0.003	0.006	45.185	0.007	0.498	1.656
Chit Eff 9/18	8.705	0.039	79.718	0.149	0.025	0.031	1.703	43.505	0.501	13.703	0.018	0.021	6.360	86.600	0.014	0.538	29.172

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 18, 2008

pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 9/9/08
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	**BCR-Inf**	6.37	0.35	45.5
2	**BCR -Eff**	6.75	1.55	201.5
3	**Chit-Eff**	6.53	4.5	585

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 18, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Meas. 1 SO_4^{2-}	Meas. 2 SO_4^{2-}	Meas. 3 SO_4^{2-}	Measured average	Actual SO_4^{2-} (ppm)
1	**BCR-Inf**	25	16.16	15.53	15.16	15.62	390.4
2	**BCR -Eff**	25	4.27	4.13	4.57	4.33	108.2
3	**Chit-Eff**	25	0.17	0.28	0.31	0.26	6.4

Note: The Chit-Eff sample gave an atypical chromatogram for different dilutions in the IC.

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 2, 2008

Log Sheet

Sample Taken 10/2/2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous
# 3	**Chit-Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 2, 2008

Sample Name	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
SMBCR -INF10/02-1	1.580	0.000	37.420	0.118	0.013	0.476	0.369	1.720	0.000	11.320	0.004	0.015	1.131	84.200	0.007	0.218	26.850
SMBCR -INF10/02-2	1.360	0.000	36.970	0.119	0.012	0.404	0.356	1.740	47.700	10.520	0.004	0.015	1.095	83.600	0.004	0.181	26.480
SMBCR -INF10/02-3	1.340	0.003	37.610	0.121	0.013	0.585	0.366	1.370	4.450	10.110	0.004	0.019	1.113	82.400	0.002	0.288	26.210
SMBCR EFF 10/02-1	0.000	0.000	79.000	0.000	0.000	0.517	0.021	0.238	4.620	8.483	0.002	0.005	0.008	30.000	0.005	0.236	1.511
SMBCR EFF 10/02-2	0.000	0.000	79.780	0.000	0.000	0.651	0.028	0.622	20.700	8.785	0.000	0.002	0.011	30.600	0.004	0.227	1.467
SMBCR EFF 10/02-3	0.000	0.000	80.590	0.000	0.000	0.538	0.019	0.161	26.600	9.469	0.000	0.003	0.009	30.300	0.009	0.223	1.478
SMCHIT EFF 10/02-1	0.000	0.033	1154.000	0.000	0.005	0.449	0.023	8.860	12.400	14.770	0.021	0.006	0.008	10.400	0.022	18.660	0.320
SMCHIT EFF 10/02-2	0.000	0.014	1152.000	0.000	0.004	0.447	0.018	8.350	17.500	14.650	0.005	0.004	0.010	10.700	0.018	18.870	0.337
SMCHIT EFF 10/02-3	0.000	0.019	1164.000	0.000	0.004	0.529	0.019	8.600	19.000	14.080	0.002	0.020	0.006	10.800	0.015	18.560	0.297
SMBCR INF 10/02 DM	0.000	0.002	48.470	0.140	0.015	0.570	0.137	0.381	7.420	12.370	0.003	0.017	0.159	128.000	0.014	0.237	27.130
SMBCR EFF 10/02 DM	0.000	0.000	93.770	0.000	0.001	0.458	0.008	0.759	0.000	9.690	0.000	0.001	0.000	321.000	0.021	0.344	0.362
SMCHIT EFF 10/02 DM	0.000	0.015	1444.000	0.000	0.007	0.503	0.011	7.440	27.300	16.470	-0.001	0.003	0.000	90.600	0.065	20.570	0.000

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 2, 2008

Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
Dissolved Metals Analyses																	
SMBCR INF 10/02 DM	0.00	0.00	48.47	0.14	0.02	0.57	0.14	0.38	7.42	12.37	0.00	0.02	0.16	128.00	0.01	0.24	27.13
SMBCR EFF 10/02 DM	0.00	0.00	93.77	0.00	0.00	0.46	0.00	0.00	0.00	9.69	0.00	0.00	0.00	321.00	0.02	0.34	0.36
SMCHIT EFF 10/02 DM	0.00	0.02	1444.00	0.00	0.01	0.50	0.00	7.44	27.30	16.47	0.00	0.00	0.00	90.60	0.07	20.57	0.00
Total Metals Concentrations																	
BCR Inf 10/02	1.43	0.00	37.33	0.12	0.01	0.49	0.36	1.61	17.38	10.65	0.00	0.02	1.11	83.40	0.00	0.23	26.51
BCR Eff 10/02	0.00	0.00	79.79	0.00	0.00	0.57	0.02	0.34	17.31	8.91	0.00	0.00	0.01	30.30	0.01	0.23	1.49
Chit Eff 10/02	0.00	0.02	1156.67	0.00	0.00	0.47	0.02	8.60	16.30	14.50	0.01	0.01	0.01	10.63	0.02	18.70	0.32

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 2, 2008

pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Date of Analysis: 10/3/08
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	**BCR-Inf**	6.63	0.25	32.50
2	**BCR -Eff**	6.44	2.50	325.00
3	**Chit-Eff**	6.66	37.50	4875.00

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected October 2, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Meas. 1 SO_4^{2-}	Meas. 2 SO_4^{2-}	Meas. 3 SO_4^{2-}	Measured average	Actual SO_4^{2-} (ppm)
1	**BCR-Inf**	25	11.08	10.10	9.83	10.34	258.5
2	**BCR -Eff**	25	1.43	1.29	1.84	1.52	38.0
3	**Chit-Eff**	25	0.00	0.00	0.00	0.00	0.0

Note: Chit-Eff shows an atypical chromatogram.

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected July 30, 2008

Log Sheet
Sample Taken 7/30/2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous
# 3	**Chit-Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected July 30, 2008

Sample Name	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Ni mg/L	Ni mg/L	Pb mg/L	S mg/L
BCR Inf 8/4 -1	0.624	0.003	-0.0077	65.46	0.1432	0.016	0.0057	0.356	1.88	6.22	10.14	0.0055	-0.2023	-0.015	0.0334	0.7831	101
BCR Inf 8/4 -2	0.661	-0.001	-0.008	66.6	0.1394	0.017	0.0003	0.35	1.83	6.35	10.32	0.0056	-0.2324	-0.0435	0.0151	0.7845	80.4
BCR Inf 8/4 -3	0.562	0	-0.0119	66.31	0.1379	0.017	0.0008	0.347	1.79	6.27	10.23	0.0049	-0.2373	-0.0448	0.0159	0.777	77
BCR Eff 8/4-1	-0.206	0	-0.0072	168.4	0.0026	-0.002	0.0027	0.014	0.906	8.55	11.67	-0.0012	-0.7037	-0.1536	0.0006	0.0128	12.5
BCR Eff 8/4-2	-0.227	0.003	-0.0063	165.7	0.0029	-0.001	-0.0003	0.013	0.904	8.49	11.56	-0.0014	-0.6671	-0.1298	0.0029	0.012	12.1
BCR Eff 8/4-3	-0.212	-0.002	-0.0094	163.6	0.0034	-0.002	-0.0004	0.011	0.93	8.17	11.49	-0.0014	-0.648	-0.1196	0.0008	0.0117	11.5
Chit Eff 8/4-1	-0.29	0.069	0.0669	157.3	0.0017	0.029	0.0009	0.069	0.177	41.7	1.148	0.0066	-0.3843	-0.0494	0.0224	0.0193	30.1
Chit Eff 8/4-2	-0.245	0.075	0.0645	156.6	0.0017	0.03	-0.0008	0.058	0.158	41.1	1.129	0.0136	-0.408	-0.0672	0.0144	0.0143	29.9
Chit Eff 8/4-3	-0.238	0.069	0.0633	158.1	0.0016	0.028	0.0004	0.056	0.158	41.9	1.13	0.008	-0.4177	-0.0736	0.0146	0.0142	30.1
BCR Inf 8/4 DM	0.136	0.001	-0.0041	71.91	0.1687	0.025	-0.0023	0.305	0.213	7.44	11.39	0.0049	-0.2249	-0.0272	0.0171	0.4602	86.9
BCR Eff 8/4 DM	-0.309	0	-0.0057	185.1	0.0011	-0.001	0.0026	0.006	1.07	9.52	13.06	-0.0021	-0.7393	-0.1268	0.0015	-0.0021	51.3
Chit Eff 8/4 DM	-0.334	0.077	0.0646	174.7	0.0023	0.03	0.0045	0.036	0.142	46	1.104	0.0057	-0.4543	-0.0619	0.0146	0.0058	32.6

Se mg/L	Sr mg/L	Zn mg/L
0.016	0.5674	27.26
0.011	0.5668	27.59
0.015	0.5655	27.14
0.013	0.6809	0.7504
0.013	0.6736	0.7414
0.011	0.6634	0.7345
0.037	2.022	0.5662
0.043	2.007	0.5663
0.015	2.02	0.591
0.011	0.623	30.87
0.044	0.7551	0.4202
0.034	2.231	0.3915

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected July 30, 2008
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al	As	As	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	Ni	Pb	S	Se	Sr	Zn
DISSOLVED METALS CONCENTRATIONS																		
BCR Inf 8/4 DM	0.136	0.001	0	71.91	0.1687	0.025	0	0.305	0.213	7.44	11.39	0.0049	0.0171	0.4602	86.9	0.011	0.623	30.87
BCR Eff 8/4 DM	0	0	0	185.1	0.0011	0	0.0026	0.006	1.07	9.52	13.06	0	0.0015	0	51.3	0.044	0.7551	0.4202
Chit Eff 8/4 DM	0	0.077	0.0646	174.7	0.0023	0.03	0.0045	0.036	0.142	46	1.104	0.0057	0.0146	0.0058	32.6	0.034	2.231	0.3915
TOTAL METALS CONCENTRATIONS																		
BCR Inf	0.684	0.001	0.000	73.470	0.156	0.019	0.003	0.390	2.037	6.978	11.367	0.006	0.024	0.868	95.704	0.016	0.630	30.367
BCR Eff	0.000	0.001	0.000	184.333	0.003	0.000	0.001	0.014	1.015	9.337	12.859	0.000	0.002	0.014	13.370	0.014	0.747	0.825
Chit Eff	0.000	0.079	0.072	174.815	0.002	0.032	0.000	0.068	0.183	46.185	1.262	0.010	0.019	0.018	33.370	0.035	2.240	0.638

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected July 30, 2008
pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received

Data of Analysis: 8/4/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant	Alkalinity (mg/L as $CaCo_3$)
1	**BCR-Inf**	5.9	0.2	26
2	**BCR -Eff**	6.3	3.6	468
3	**Chit-Eff**	8.05	8.4	1092

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected July 30, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	BCR Inf -1	100	4.0260	402.6	365.50
	BCR Inf -2	100	3.5410	354.1	
	BCR Inf -3	100	3.3980	339.8	
2	BCR Eff -1	100	0.2490	24.9	24.07
	BCR Eff -2	100	0.2390	23.9	
	BCR Eff -3	100	0.2340	23.4	
3	Chit Eff -1	100	0.4300	43	40.53
	Chit Eff -2	100	0.3910	39.1	
	Chit Eff -3	100	0.3950	39.5	

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 7, 2008

Log Sheet
Sample Taken 8/7/2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous
# 3	**Chit-Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 7, 2008

Sample Name	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Ni mg/L	Ni mg/L	Pb mg/L	S mg/L
SMBCR Inf 8/7-1	2.86	0.011	0.0002	67.61	0.1418	0.017	0.0074	0.527	9.35	6.95	10.95	0.0047	-0.3227	-0.0441	0.0151	1.833	74.3
SMBCR Inf 8/7-2	2.07	0.011	-0.0019	67.7	0.1403	0.016	0.005	0.513	8.67	6.84	10.76	0.0044	-0.2711	-0.0393	0.0143	1.777	74.6
SMBCR Inf 8/7-3	2.97	0.015	0.0012	68.78	0.1422	0.017	0.0062	0.525	9.25	7.1	10.92	0.0112	-0.3422	-0.049	0.0144	1.831	76
SMBCR Eff 8/7-1	-0.027	-0.001	-0.0038	116.2	0.0043	-0.002	-0.0015	0.012	0.201	6.23	7.886	0.0001	-0.3487	-0.0588	0	0.0049	51.5
SMBCR Eff 8/7-2	-0.021	0.001	-0.0059	115.4	0.0049	0	-0.0009	0.012	0.212	6.19	7.828	-0.0003	-0.3393	-0.0558	-0.0006	0.0024	50.9
SMBCR Eff 8/7-3	-0.113	-0.004	-0.0018	116.7	0.0044	-0.001	-0.0051	0.033	0.201	6.28	7.905	-0.0009	-0.3389	-0.0555	0.0002	0.0031	50.2
Chit EFF 8/7 -1	-0.227	0.007	0.0009	193.1	0.0068	0.002	0.0003	0.007	0.087	19	1.491	0.0006	-0.3965	-0.0694	0.0009	0.0076	44.7
Chit EFF 8/7 -2	-0.203	0.005	-0.0007	189.5	0.0051	0.002	-0.0006	0.012	0.095	18.6	1.485	-0.0005	-0.4173	-0.0785	0.0012	0.0018	46.2
Chit EFF 8/7 -3	-0.222	0.005	-0.0025	190.2	0.004	0.002	-0.0006	0.013	0.094	18.9	1.485	-0.0001	-0.4159	-0.0798	0.003	0.0005	45.7
SMBCR Inf 8/7 DM	-0.041	0.008	-0.0006	73.88	0.1582	0.019	-0.0017	0.202	0.206	7.27	11.46	0.0086	-0.2292	-0.0308	0.0177	0.3269	89.3
SMBCR Eff 8/7 DM	-0.314	0.003	-0.0002	132.6	0.0049	0	0.0025	0.005	0.205	7.14	8.858	-0.0003	-0.4386	-0.0874	-0.0002	-0.0011	108
Chit Eff 8/7 DM	-0.401	0.01	0.0044	210.5	0.0025	0.006	0.004	0	0.064	21.3	1.641	-0.0004	-0.4807	-0.0913	0.0024	-0.002	57.5

Se mg/L	Sr mg/L	Zn mg/L
0.013	0.5861	27.17
0.039	0.5835	26.93
0.017	0.5868	27.14
0.008	0.5059	1.303
0.006	0.4914	1.304
0.009	0.4986	1.321
0.008	2.145	1.067
0.006	2.098	1.067
0.004	2.106	1.091
0.013	0.6299	29
0.021	0.5562	0.5847
0.009	2.315	0.4452

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 7, 2008

Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al	As	As	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	Ni	Pb	S	Se	Sr	Zn
DISSOLVED METALS CONCENTRATIONS																		
SMBCR Inf 8/7 DM	0	0.008	0	73.88	0.1582	0.019	0	0.202	0.206	7.27	11.46	0.0086	0.0177	0.3269	89.3	0.013	0.6299	29
SMBCR Eff 8/7 DM	0	0.003	0	132.6	0.0049	0	0.0025	0.005	0.205	7.14	8.858	0	0	0	108	0.021	0.5562	0.5847
Chit Eff 8/7 DM	0	0.01	0.0044	210.5	0.0025	0.006	0.004	0	0.064	21.3	1.641	0	0.0024	0	57.5	0.009	2.315	0.4452
TOTAL METALS CONCENTRATIONS																		
BCR Inf	2.926	0.014	0.001	75.589	0.157	0.019	0.007	0.580	10.100	7.737	12.085	0.008	0.016	2.015	83.296	0.026	0.651	30.089
BCR Eff	0.000	0.000	0.000	129.000	0.005	0.000	0.000	0.021	0.227	6.926	8.748	0.000	0.000	0.004	56.519	0.009	0.554	1.455
Chit Eff	0.000	0.006	0.000	212.148	0.006	0.002	0.000	0.012	0.102	20.926	1.652	0.000	0.002	0.004	50.593	0.007	2.351	1.194

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 7, 2008
pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 8/12/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	BCR-Inf	3.03	0.2	26
2	BCR -Eff	6.28	1.7	221
3	Chit-Eff	7.01	3.8	494

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 7, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	BCR Inf -1	100	3.8570	385.7	357.50
	BCR Inf -2	100	3.5060	350.6	
	BCR Inf -3	100	3.3620	336.2	
2	BCR Eff -1	100	1.7160	171.6	168.70
	BCR Eff -2	100	1.6720	167.2	
	BCR Eff -3	100	1.6730	167.3	
3	Chit Eff -1	100	1.4200	142	142.07
	Chit Eff -2	100	1.4210	142.1	
	Chit Eff -3	100	1.4210	142.1	

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 21, 2008

Log Sheet
Sample Taken 8/21/2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous
# 3	**Chit-Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 21, 2008

Sample Name	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Ni mg/L	Ni mg/L	Pb mg/L	S mg/L
SMBCR Inf 8/21-1	0.066	-0.006	-0.0033	66.72	0.1406	0.014	-0.0032	0.178	0.192	6.61	10.63	0.0033	-0.1598	-0.0059	0.0156	0.2748	74.4
SMBCR Inf 8/21-2	0.084	-0.003	-0.0046	67.02	0.1403	0.014	-0.0054	0.179	0.211	6.49	10.83	0.0033	-0.1565	-0.0053	0.0149	0.2796	73.7
SMBCR Inf 8/21-3	0.069	0.001	0.0006	68.18	0.1309	0.014	0.003	0.166	0.198	6.76	10.92	0.0107	-0.1881	-0.021	0.0139	0.2783	74.8
SMBCR Eff 8/21-1	-0.149	-0.004	-0.0062	108.6	0.0015	-0.001	-0.0011	0.013	0.15	6.74	8.808	0.0001	-0.3061	-0.0541	0	0.001	59.2
SMBCR Eff 8/21-2	-0.075	-0.004	-0.0003	107.2	0.0016	0	-0.0004	0.031	0.155	6.68	8.645	-0.001	-0.2933	-0.0473	0.0004	0.0038	58.6
SMBCR Eff 8/21-3	-0.119	-0.003	-0.0048	107.8	0.0011	-0.001	0.0046	0.011	0.505	6.71	8.696	-0.0011	-0.2822	-0.0415	0.0005	0.0017	57.5
Chit EFF 8/21 -1	-0.17	0.002	-0.0073	170.6	0.0023	0	-0.0007	0.01	0.12	10.1	6.57	-0.0008	-0.3569	-0.0611	0	0.0043	50.1
Chit EFF 8/21 -2	-0.224	-0.001	-0.0002	172.2	0.0016	0	-0.0015	0.011	0.239	10.2	6.601	-0.0009	-0.3789	-0.0713	0.0015	0.007	51.2
Chit EFF 8/21 -3	-0.198	0	-0.0018	172.1	0.0019	-0.001	0.0029	0.009	0.117	10.2	6.593	-0.0014	-0.3859	-0.0747	0	0.003	51.8
SMBCR Inf 8/21 DM	1.46	0	-0.0019	75.29	0.1583	0.016	0.002	0.652	7.77	7.39	12.12	0.0035	-0.262	-0.033	0.0165	2.227	90.4
SMBCR Eff 8/21 DM	-0.288	-0.001	-0.0021	120.8	0.0019	0.005	0.0055	0.005	0.155	7.47	9.723	-0.0021	-0.3469	-0.0565	0.001	-0.0002	168
Chit Eff 8/21 DM	-0.36	0.002	-0.004	207.7	0.0017	0.001	-0.0031	0.005	0.039	12.9	6.802	-0.0025	-0.4287	-0.0711	0.0006	-0.0024	90.3

Se mg/L	Sr mg/L	Zn mg/L
0.008	0.5788	25.67
0.01	0.5815	25.73
0.011	0.5936	24.93
0.007	0.5181	1.275
0.01	0.5114	1.277
0.005	0.5179	1.292
0.007	1.588	1.02
0.003	1.604	0.997
0.008	1.596	1.013
0.011	0.6504	28.97
0.019	0.5726	0.4589
0.007	2.094	0.3906

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 21, 2008
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED METALS CONCENTRATI0NS																		
SMBCR Inf 8/21 DM	1.46	0	0	75.29	0.1583	0.016	0.002	0.652	7.77	7.39	12.12	0.0035	0.0165	2.227	90.4	0.011	0.6504	28.97
SMBCR Eff 8/21 DM	0	0	0	120.8	0.0019	0.005	0.0055	0.005	0.155	7.47	9.723	0	0.001	0	168	0.019	0.5726	0.4589
Chit Eff 8/21 DM	0	0.002	0	207.7	0.0017	0.001	0	0.005	0.039	12.9	6.802	0	0.0006	0	90.3	0.007	2.094	0.3906
TOTAL METALS CONCENTRATIONS																		
BCR Inf	0.081	0.000	0.000	74.785	0.153	0.016	0.001	0.194	0.223	7.356	11.993	0.006	0.016	0.308	82.556	0.011	0.650	28.270
BCR Eff	0.000	0.000	0.000	119.852	0.002	0.000	0.002	0.020	0.300	7.456	9.685	0.000	0.000	0.002	64.926	0.008	0.573	1.424
Chit Eff	0.000	0.001	0.000	190.704	0.002	0.000	0.001	0.011	0.176	11.296	7.320	0.000	0.001	0.005	56.704	0.007	1.773	1.122

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 21, 2008

pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 8/22/07
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	BCR-Inf	6.15	0.2	26
2	BCR -Eff	6.26	1.4	182
3	Chit-Eff	7.22	3.4	442

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 21, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	BCR Inf -1	100	4.0070	400.7	323.33
	BCR Inf -2	100	2.9800	298	
	BCR Inf -3	100	2.7130	271.3	
2	BCR Eff -1	100	1.6030	160.3	152.90
	BCR Eff -2	100	1.4870	148.7	
	BCR Eff -3	100	1.4970	149.7	
3	Chit Eff -1	100	1.1790	117.9	116.53
	Chit Eff -2	100	1.1490	114.9	
	Chit Eff -3	100	1.1680	116.8	

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 27, 2008

Log Sheet
Sample Taken 8/27/2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous
# 3	**Chit-Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 27, 2008

Sample Name	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Ni mg/L	Ni mg/L	Pb mg/L	S mg/L
SMBCR Inf 8/27-1	0.522	-0.001	-0.0018	70.73	0.1325	0.014	0.0011	0.233	1.83	6.93	10.85	0.004	-0.2161	-0.0297	0.0196	0.6261	76.9
SMBCR Inf 8/27-2	0.529	0.004	-0.0037	70.38	0.1324	0.014	0.0002	0.236	1.73	7.01	10.8	0.0109	-0.2013	-0.0212	0.0183	0.623	76.5
SMBCR Inf 8/27-3	0.456	-0.002	-0.004	70.35	0.1358	0.015	-0.0034	0.235	1.61	7	10.74	0.0049	-0.1936	-0.019	0.016	0.6221	76
SMBCR Eff 8/27-1	-0.146	0	-0.0068	109.9	0.0029	-0.001	-0.0021	0.009	0.126	7.03	8.996	-0.0008	-0.2867	-0.046	0.0024	0.0004	60.6
SMBCR Eff 8/27-2	-0.159	-0.002	-0.0076	109.8	0.004	-0.001	0.0024	0.009	0.12	7.1	8.938	-0.0014	-0.2912	-0.0484	0.0008	0.0031	60.5
SMBCR Eff 8/27-3	-0.147	-0.004	-0.0075	109.9	0.0038	-0.001	0.0017	0.008	0.116	7.07	9.008	-0.0009	-0.2783	-0.0443	0.0006	0.003	58.6
Chit EFF 8/27 -1	-0.398	0.001	-0.004	271.3	0.003	0	-0.0003	0.008	0.069	17.1	6.32	-0.0018	-0.3719	-0.0583	0.0012	-0.0009	51.7
Chit EFF 8/27 -2	-0.331	0	-0.003	268.5	0.0022	-0.001	-0.0005	0.007	0.072	16.8	6.255	-0.0019	-0.3732	-0.0577	0.002	0.0005	51.3
Chit EFF 8/27 -3	-0.379	-0.001	-0.0026	272.5	0.0037	-0.001	-0.002	0.009	0.077	17	6.32	-0.0021	-0.3715	-0.0575	0.0012	0.0009	50.9
SMBCR Inf 8/27 DM	-0.282	-0.001	-0.0005	77.91	0.1557	0.017	-0.0038	0.081	0.001	7.71	12.03	0.0046	-0.2017	-0.0178	0.0172	-0.0007	90.4
SMBCR Eff 8/27 DM	-0.255	-0.004	-0.0031	121.8	0.0036	0.001	-0.0018	0.005	0.104	7.73	9.987	-0.0016	-0.3188	-0.0487	0.0029	-0.0001	89
Chit Eff 8/27 DM	-0.572	-0.001	-0.0018	300.5	0.0012	-0.002	0.0001	0.005	0.055	19.2	7.268	-0.0024	-0.4225	-0.0656	0.0014	-0.0011	65.7

Se mg/L	Sr mg/L	Zn mg/L
0.006	0.5997	25.77
0.013	0.5955	25.97
0.003	0.5907	26.13
0.007	0.5345	1.336
0.006	0.5317	1.317
0.03	0.5366	1.306
0.03	3.096	0.9189
0.006	3.067	0.8941
0.007	3.111	0.9048
0.031	0.652	28.9
0.013	0.6087	0.4659
0.031	3.384	0.0192

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 27, 2008
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Dilution	Al	As	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	Ni	Pb	S	Se	Sr	Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
DISSOLVED METALS CONCENTRATIONS																		
SMBCR Inf 8/27 DM		0	0	77.91	0.1557	0.017	0	0.081	0.001	7.71	12.03	0.0046	0.0172	0	90.4	0.031	0.652	28.9
SMBCR Eff 8/27 DM		0	0	121.8	0.0036	0	0	0.005	0.104	7.73	9.987	0	0.0029	0	89	0.013	0.6087	0.4659
Chit Eff 8/27 DM		0	0	300.5	0.0012	0	0.0001	0.005	0.055	19.2	7.268	0	0.0014	0	65.7	0.031	3.384	0.0192
TOTAL METALS CONCENTRATIONS																		
BCR Inf		0.558	0.001	78.319	0.148	0.016	0.000	0.261	1.915	7.756	11.996	0.007	0.020	0.693	84.963	0.008	0.661	28.841
BCR Eff		0.000	0.000	122.074	0.004	0.000	0.002	0.010	0.134	7.852	9.979	0.000	0.001	0.002	66.556	0.016	0.594	1.466
Chit Eff		0.000	0.000	300.852	0.003	0.000	0.000	0.009	0.081	18.852	6.998	0.000	0.002	0.001	57.000	0.016	3.435	1.007

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 27, 2008

pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 9/02/08
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	**BCR-Inf**	6.16	0.2	26
2	**BCR -Eff**	6.49	1.4	182
3	**Chit-Eff**	6.86	5.2	676

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 27, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	BCR Inf -1				
	BCR Inf -2				
	BCR Inf -3				
2	BCR Eff -1				
	BCR Eff -2				
	BCR Eff -3				
3	Chit Eff -1				
	Chit Eff -2				
	Chit Eff -3				

Note: We are still processing the samples for sulfate measurement

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 4, 2008

Log Sheet
Sample Taken 9/4/2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous
# 3	**Chit-Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 4, 2008

Sample Name	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Ni mg/L	Ni mg/L	Pb mg/L	S mg/L
SMBCR -INF9/4-1	0.794	0.016	0.0186	70.08	0.1354	0.016	0.0702	0.342	1.08	2.45	11.38	0.0232	-0.1404	0.0032	0.0161	0.6947	74.7
SMBCR -INF9/4-2	0.593	0.002	0.0028	70.79	0.136	0.016	0.0873	0.327	0.745	2.43	11.46	0.0092	-0.1342	0.0026	0.0155	0.6776	75.2
SMBCR -INF9/4-3	0.65	0.006	0.0046	70.24	0.1327	0.015	0.063	0.369	0.865	2.28	11.45	0.0071	-0.1419	0.0018	0.0165	0.7026	76.1
SMBCR EFF 9/4-1	-0.083	0.004	0.0035	110.7	0.0019	-0.001	0.0559	-0.003	0.011	2.53	9.977	0.0018	-0.2005	-0.0188	0.0007	0.0052	61.5
SMBCR EFF 9/4-2	-0.064	0.002	0.0036	110.9	0.0014	0	0.0617	0.002	0.017	2.67	9.934	0.001	-0.2101	-0.0225	0.0011	0.0079	62.2
SMBCR EFF 9/4-3	-0.027	0.002	0.0058	109.9	0.0002	0.001	0.064	0.003	0.041	2.6	9.85	0.0006	-0.2104	-0.0228	0.0004	0.0026	61.5
SMCHIT EFF 9/4-1	-0.208	0.009	0.001	202.9	0	0.006	0.0739	-0.001	-0.039	6.06	4.261	-0.0001	-0.2878	-0.0328	0.0006	0.0043	48.6
SMCHIT EFF 9/4-2	-0.186	0.005	0.0026	204.7	-0.0006	0.006	0.0637	0.004	0.03	5.54	4.242	0.0002	-0.3153	-0.0437	0.0019	0.0009	48.1
SMCHIT EFF 9/4-3	-0.114	0.005	0.0048	202.5	-0.0006	0.005	0.0664	0	0.049	5.41	4.141	-0.0001	-0.307	-0.0408	0.0006	0.0024	50.8
SMBCR INF 9/4 DM	0.097	0.004	0.008	78.36	0.1505	0.022	0.0603	0.167	0.09	2.68	12.71	0.0053	-0.1625	-0.0033	0.0182	0.2226	92
SMBCR EFF 9/4 DM	-0.075	0.009	0.0025	123.5	-0.0004	0.006	0.0838	0	0.026	2.93	11.13	0.0002	-0.2425	-0.0237	0.001	0.003	319
SMCHIT EFF 9/4 DM	-0.165	0.005	0.0082	229.4	0.0002	0.006	0.0583	-0.003	-0.01	7.67	4.947	-0.0009	-0.2894	-0.0236	0.0016	0.0045	275

Se mg/L	Sr mg/L	Zn mg/L
0.015	0.5358	25.54
0.008	0.5584	25.4
0.01	0.5535	25.7
0.009	0.5308	0.8398
0.01	0.5347	0.8153
0.012	0.5094	1.195
0.013	2.148	-0.0286
0.011	2.163	-0.0293
0.013	2.124	0.3885
0.011	0.6006	28.46
0.008	0.5856	0.4011
0.007	2.484	0.333

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 4, 2008
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Dilution	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED METALS CONCENTRATIONS																			
SMBCR INF 9/4 DM		0.097	0.004	0.008	78.36	0.1505	0.022	0.0603	0.167	0.09	2.68	12.71	0.0053	0.0182	0.2226	92	0.011	0.6006	28.46
SMBCR EFF 9/4 DM		0	0.009	0.0025	123.5	0	0.006	0.0838	0	0.026	2.93	11.13	0.0002	0.001	0.003	319	0.008	0.5856	0.4011
SMCHIT EFF 9/4 DM		0	0.005	0.0082	229.4	0.0002	0.006	0.0583	0	0	7.67	4.947	0	0.0016	0.0045	275	0.007	2.484	0.333
TOTAL METALS CONCENTRATIONS																			
BCR Inf 9/4		0.754	0.009	0.010	78.189	0.150	0.017	0.082	0.384	0.996	2.652	12.700	0.015	0.018	0.768	83.704	0.012	0.610	28.385
BCR Eff 9/4		0.000	0.003	0.005	122.778	0.001	0.000	0.067	0.002	0.026	2.889	11.023	0.001	0.001	0.006	68.593	0.011	0.583	1.056
Chit Eff 9/4		0.000	0.007	0.003	225.963	0.000	0.006	0.076	0.001	0.015	6.300	4.683	0.000	0.001	0.003	54.630	0.014	2.383	0.144

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 4, 2008

pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 9/9/08
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	**BCR-Inf**	6.05	0.2	26
2	**BCR -Eff**	6.27	1.2	156
3	**Chit-Eff**	6.87	3.9	507

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected September 4, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	BCR Inf -1				
	BCR Inf -2				
	BCR Inf -3				
2	BCR Eff -1				
	BCR Eff -2				
	BCR Eff -3				
3	Chit Eff -1				
	Chit Eff -2				
	Chit Eff -3				

Note: We are still processing the samples for sulfate measurement

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 14, 2008
Sulfate Data of Standard Mine samples
Method: 300 IC

#	Sample Name	Dilution	Measured SO_4^{2-}	Actual SO_4^{2-}	Average
1	BCR Inf -1	100	3.5350	353.5	324.07
	BCR Inf -2	100	3.1700	317	
	BCR Inf -3	100	3.0170	301.7	
2	BCR Eff -1	100	1.2770	127.7	123.20
	BCR Eff -2	100	1.2130	121.3	
	BCR Eff -3	100	1.2060	120.6	

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 14, 2008

Log Sheet
Sample Taken 8/14/2008

Bottle #	Sample Name	Matrix
# 1	**BCR-Inf**	Aqueous
# 2	**BCR -Eff**	Aqueous

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 14, 2008

Sample Name	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Ni mg/L	Ni mg/L	Pb mg/L	S mg/L
SMBCR Inf 8/14-1	2.63	0.004	-0.0032	64.62	0.1362	0.015	0.0023	0.476	8.31	6.57	10.26	0.0046	-0.3203	-0.0447	0.014	1.686	73.3
SMBCR Inf 8/14-2	1.75	0.002	-0.0043	66.33	0.1317	0.015	-0.0014	0.443	7.28	6.68	10.33	0.0042	-0.2415	-0.0299	0.0141	1.658	73.3
SMBCR Inf 8/14-3	2.39	0.002	-0.0018	66.08	0.1356	0.015	0.0038	0.456	8.23	6.75	10.41	0.0039	-0.289	-0.0355	0.0154	1.72	73.5
SMBCR Eff 8/14-1	-0.035	0.006	0.0031	111.7	0.0043	0.004	0.0046	0.014	0.143	6.37	8.151	0.0078	-0.3102	-0.0367	0.0058	0.007	48.7
SMBCR Eff 8/14-2	-0.076	-0.002	-0.0073	111.8	0.0043	-0.001	0.0021	0.011	0.127	6.3	8.085	0.0006	-0.3261	-0.0475	0.0008	0.0004	46.7
SMBCR Eff 8/14-3	-0.105	-0.002	-0.0034	111.5	0.0029	-0.001	0.003	0.011	0.13	6.26	8.029	-0.0002	-0.3367	-0.0528	0.0009	0.0063	49
SMBCR Inf 8/14 DM	0.005	-0.003	-0.002	72	0.1567	0.02	-0.0023	0.194	0.187	7.16	11.31	0.0035	-0.2044	-0.0148	0.0177	0.356	83.7
SMBCR Eff 8/14 DM	-0.247	-0.004	-0.0046	122.6	0.0013	0.002	0.0016	0.006	0.102	7.07	9.06	-0.002	-0.3648	-0.0482	0.0017	0.0019	117

Se mg/L	Sr mg/L	Zn mg/L
0.013	0.552	25.41
0.009	0.5607	25.53
0.007	0.5643	25.94
0.015	0.5046	1.235
0.006	0.4964	1.204
0.005	0.5007	1.227
0.006	0.617	27.83
0.017	0.5471	0.5004

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 14, 2008
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	As mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L	Zn mg/L
DISSOLVED METALS CONCENTRATIONS																		
SMBCR Inf 8/14 DM	0.005	0	0	72	0.1567	0.02	0	0.194	0.187	7.16	11.31	0.0035	0.0177	0.356	83.7	0.006	0.617	27.83
SMBCR Eff 8/14 DM	0	0	0	122.6	0.0013	0.002	0.0016	0.006	0.102	7.07	9.06	-0.002	0.0017	0.0019	117	0.017	0.5471	0.5004
TOTAL METALS CONCENTRATIONS																		
BCR Inf	2.507	0.003	0.000	72.974	0.149	0.017	0.002	0.509	8.822	7.407	11.481	0.005	0.016	1.876	81.519	0.011	0.621	28.474
BCR Eff	0.000	0.002	0.001	124.074	0.004	0.001	0.004	0.013	0.148	7.011	8.987	0.003	0.003	0.005	53.481	0.010	0.556	1.358

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Samples Collected August 14, 2008
pH and Alkalinity for Standard mine samples
Method:310.1 (Potentiometric titration to end point 3.9)
Sample Preparation: None, samples used as received
Data of Analysis: 8/19/08
Normality of HCl =0.104

#	Sample Name	pH	Vol. of Titrant (ml)	Alkalinity (mg/L as $CaCo_3$)
1	0	6.07	0.2	26
2	Sample Name	6.3	1.6	208

Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ISCO-INF-1-1	**1.11**	4.411	80.200	0.138	0.014	0.731	8.567	8.089	11.844	###	3.230	94.778	0.665	27.000
ISCO-INF-1-2	**1.11**	4.278	79.489	0.135	0.012	0.697	8.433	7.822	11.789	###	3.224	94.222	0.656	27.200
ISCO-INF-1-3	**1.11**	4.467	80.967	0.138	0.012	0.690	8.578	8.056	12.011	###	3.232	95.667	0.680	27.267
ISCO-INF-2-1	**1.11**	4.944	81.978	0.136	0.013	0.811	####	8.322	11.778	###	3.788	97.111	0.691	27.289
ISCO-INF-2-2	**1.11**	4.911	81.622	0.136	0.013	0.809	####	8.789	11.678	###	3.789	96.889	0.693	27.267
ISCO-INF-2-3	**1.11**	5.033	81.522	0.132	0.013	0.803	####	8.444	11.789	###	3.750	96.222	0.695	27.144
ISCO-INF-3-1	**1.11**	2.089	83.622	0.133	0.012	0.371	3.889	8.644	11.889	###	1.552	97.222	0.696	26.556
ISCO-INF-3-2	**1.11**	1.944	82.933	0.134	0.012	0.372	3.822	8.433	11.867	###	1.546	96.444	0.689	26.400
ISCO-INF-3-3	**1.11**	1.944	82.033	0.131	0.012	0.370	3.800	8.367	11.767	###	1.540	95.889	0.690	26.322
ISCO-EFF-1-1	**1.11**		142.556			0.017	1.039	10.267	8.387	###	0.011	67.444	0.477	0.944
ISCO-EFF-1-2	**1.11**		142.111			0.002	0.969	10.156	8.323	###	0.014	64.556	0.475	0.959
ISCO-EFF-1-3	**1.11**		142.000			0.002	0.950	10.167	8.302	###	0.009	62.667	0.482	0.927
ISCO-EFF-2-1	**1.11**		141.333			0.011	0.902	10.089	8.319	###	0.011	64.111	0.477	0.950
ISCO-EFF-2-2	**1.11**	0.223	141.444			0.004	0.923	10.211	8.312		0.010	63.778	0.481	0.919
ISCO-EFF-2-3	**1.11**		141.222			0.003	0.899	10.144	8.342		0.011	64.333	0.480	0.937
ISCO-EFF-4-1	**1.11**	0.179	135.778			0.001	0.634	9.978	9.014		0.007	66.778	0.499	1.279
ISCO-EFF-4-2	**1.11**	0.053	135.222				0.607	9.867	8.991		0.016	66.778	0.492	1.264
ISCO-EFF-4-3	**1.11**	0.050	137.000			0.003	0.640	10.100	9.124		0.008	68.000	0.494	1.314
ISCO-EFF-6-1	**1.11**		134.778			0.003	0.434	9.989	9.791		0.006	72.667	0.514	1.203
ISCO-EFF-6-2	**1.11**		133.889				0.441	9.833	9.833		0.004	74.000	0.514	1.223
ISCO-EFF-6-3	**1.11**		133.778			0.001	0.432	9.844	9.828		0.003	73.778	0.505	1.176
ISCO-EFF-8-1	**1.11**		130.889	0.001		0.001	0.357	9.633	10.257		0.006	74.222	0.530	1.457
ISCO-EFF-8-2	**1.11**		131.556	0.001	0.002	0.004	0.370	9.478	10.262	###	0.004	74.444	0.532	1.448
ISCO-EFF-8-3	**1.11**		130.889	0.001		0.001	0.350	9.489	10.241		0.004	72.778	0.538	1.431

Average Concentrations

Sample	Al mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Sr mg/L	Zn mg/L
ISCO Inf #1	4.385	80.219	0.137	0.013	0.706	8.526	7.989	11.881	###	3.229	94.889	0.667	27.156
ISCO Inf #2	4.963	81.707	0.135	0.013	0.808	####	8.519	11.748	###	3.776	96.741	0.693	27.233
ISCO Inf #3	1.993	82.863	0.133	0.012	0.371	3.837	8.481	11.841	###	1.546	96.519	0.692	26.426
ISCO Eff #1	0.000	142.222	0.000	0.000	0.007	0.986	10.196	8.337	###	0.012	64.889	0.478	0.943
ISCO Eff #2	0.223	141.333	0.000	0.000	0.006	0.908	10.148	8.324	###	0.011	64.074	0.479	0.935
ISCO Eff #4	0.094	136.000	0.000	0.000	0.002	0.627	9.981	9.043	###	0.010	67.185	0.495	1.286
ISCO Eff #6	0.000	134.148	0.000	0.000	0.002	0.436	9.889	9.817	###	0.004	73.481	0.511	1.201
ISCO Eff #8	0.000	131.111	0.001	0.002	0.002	0.359	9.533	10.253	###	0.005	73.815	0.533	1.445

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample Name	Al mg/L	As mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Se mg/L	Sr mg/L
ISCO-INF-1-1	3.97	0.016	72.18	0.1243	0.013	0.658	7.71	7.28	10.66	0.0216	2.907	85.3	0.009	0.5982
ISCO-INF-1-2	3.85	0.005	71.54	0.1215	0.011	0.627	7.59	7.04	10.61	0.0202	2.902	84.8	0.013	0.5904
ISCO-INF-1-3	4.02	0.002	72.87	0.124	0.011	0.621	7.72	7.25	10.81	0.0204	2.909	86.1	0.004	0.6117
ISCO-INF-2-1	4.45	0.005	73.78	0.1226	0.012	0.73	9.76	7.49	10.6	0.0144	3.409	87.4	0.004	0.6215
ISCO-INF-2-2	4.42	0.006	73.46	0.1222	0.012	0.728	9.87	7.91	10.51	0.027	3.41	87.2	0.008	0.6236
ISCO-INF-2-3	4.53	0.007	73.37	0.1189	0.012	0.723	9.78	7.6	10.61	0.0114	3.375	86.6	0.009	0.6253
ISCO-INF-3-1	1.88	-0.003	75.26	0.1201	0.011	0.334	3.5	7.78	10.7	0.0114	1.397	87.5	0.001	0.6264
ISCO-INF-3-2	1.75	0.002	74.64	0.1204	0.011	0.335	3.44	7.59	10.68	0.0122	1.391	86.8	0.004	0.6203
ISCO-INF-3-3	1.75	-0.001	73.83	0.1182	0.011	0.333	3.42	7.53	10.59	0.0114	1.386	86.3	0.005	0.621
ISCO-EFF-1-1	-0.001	0.004	128.3	-0.0006	-0.002	0.015	0.935	9.24	7.548	-0.0005	0.01	60.7	-0.001	0.4297
ISCO-EFF-1-2	-0.022	0	127.9	-0.001	-0.004	0.002	0.872	9.14	7.491	-0.0018	0.0129	58.1	0.003	0.4276
ISCO-EFF-1-3	-0.045	0.001	127.8	-0.0011	-0.003	0.002	0.855	9.15	7.472	0.001	0.0082	56.4	-0.004	0.4335
ISCO-EFF-2-1	-0.052	-0.002	127.2	-0.0007	-0.004	0.01	0.812	9.08	7.487	0.0138	0.0096	57.7	-0.001	0.4297
ISCO-EFF-2-2	0.201	-0.001	127.3	-0.0014	-0.004	0.004	0.831	9.19	7.481	-0.0008	0.0093	57.4	0.004	0.4327
ISCO-EFF-2-3	-0.06	-0.001	127.1	-0.0004	-0.003	0.003	0.809	9.13	7.508	-0.0026	0.0101	57.9	0.005	0.432
ISCO-EFF-4-1	0.161	0.001	122.2	-0.0013	-0.003	0.001	0.571	8.98	8.113	-0.002	0.0066	60.1	0.005	0.4488
ISCO-EFF-4-2	0.048	-0.001	121.7	0.0003	-0.003	0	0.546	8.88	8.092	-0.0021	0.0146	60.1	0.001	0.4429
ISCO-EFF-4-3	0.045	0.002	123.3	-0.0009	-0.003	0.003	0.576	9.09	8.212	-0.0028	0.0071	61.2	-0.001	0.4446
ISCO-EFF-6-1	-0.178	-0.001	121.3	0	-0.002	0.003	0.391	8.99	8.812	-0.0011	0.0057	65.4	0.004	0.4628
ISCO-EFF-6-2	-0.166	-0.001	120.5	0.0003	-0.003	0	0.397	8.85	8.85	-0.0029	0.0038	66.6	0.009	0.4623
ISCO-EFF-6-3	-0.188	-0.003	120.4	-0.0002	-0.003	0.001	0.389	8.86	8.845	-0.0024	0.0026	66.4	0.004	0.4546
ISCO-EFF-8-1	-0.18	-0.004	117.8	0.0006	-0.003	0.001	0.321	8.67	9.231	-0.0013	0.0054	66.8	0.011	0.4772
ISCO-EFF-8-2	-0.199	0.009	118.4	0.0008	0.002	0.004	0.333	8.53	9.236	0.0007	0.0038	67	0.014	0.4785
ISCO-EFF-8-3	-0.201	-0.001	117.8	0.0006	-0.003	0.001	0.315	8.54	9.217	-0.0023	0.0036	65.5	-0.025	0.4841
ISCO-INF-DM-1	4.26	0.008	80.28	0.1438	0.014	0.686	8.36	8.16	11.84	0.0225	3.227	98.4	0.009	0.6616
ISCO-INF-DM-2	4.98	0.008	84.35	0.1342	0.013	0.77	10.5	8.67	11.98	0.0117	3.741	102	0.012	0.6753
ISCO-INF-DM-3	1.94	0.002	85.24	0.1319	0.014	0.348	3.68	8.52	11.88	0.0113	1.503	102	0.01	0.6751
ISCO-EFF-DM-1	-0.194	0.001	144.4	-0.0007	-0.002	0.003	0.838	10.5	8.553	-0.0023	0.0097	69.9	-0.023	0.4886
ISCO-EFF-DM-2	-0.226	0.005	143.7	-0.0006	-0.003	0.002	0.794	10.5	8.52	-0.0021	0.0026	71	0	0.4751
ISCO-EFF-DM-4	-0.12	0.002	139.4	-0.0003	-0.003	0.002	0.599	10.4	9.342	-0.0032	0.0021	74.6	0.01	0.4974
ISCO-EFF-DM-6	-0.175	0	136	0.0005	-0.002	0	0.431	10	10.08	-0.0031	0.0044	80.4	0.002	0.5228
ISCO-EFF-DM-8	-0.13	-0.005	132.8	0	-0.001	0	0.39	9.8	10.52	-0.0024	0.0014	80.9	0.002	0.5349

Zn mg/L
24.3
24.48
24.54
24.56
24.54
24.43
23.9
23.76
23.69
0.8498
0.8628
0.8347
0.8553
0.8268
0.8432
1.151
1.138
1.183
1.083
1.101
1.058
1.311
1.303
1.288
27.37
27.26
26.3
0.8087
0.8406
1.179
1.548
1.83

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Matrix Aqueous

THE SAMPLES SUBMITTED WERE PRESERVED IN FIELD AS TOTAL SAMPLES. ALL DISSOLVED RESULTS SHOULD BE DISREGARDED.

Bottle #	Sample Name	Sample Taken	Sample pH
# 1	**ISCO Inf #1**	11/14/2007	1.67
# 2	**ISCO Inf #2**	11/21/2007	1.68
# 3	**ISCO Inf #3**	11/28/2007	1.68
# 4	**ISCO Eff #1**	11/14/2007	2.26
# 5	**ISCO Eff #2**	11/21/2007	2.33
# 6	**ISCO Eff #4**	11/28/2007	1.74
# 7	**ISCO Eff #6**	12/5/2007	2.03
# 8	**ISCO Eff #8**	12/12/2007	2.05

EPA ORD Analytical Laboratory Report
Standard Mine Pilot Scale Passive Treatment System
Total Metal Data of Standard Mine samples
Method: ICP analysis (6010B)

Sample	Al mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cu mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Ni mg/L	Pb mg/L	S mg/L	Sr mg/L	Zn mg/L
TOTAL METALS CONCENTRATIONS													
ISCO Inf #1	4.385	80.219	0.137	0.013	0.706	8.526	7.989	11.881	0.023	3.229	94.889	0.667	27.156
ISCO Inf #2	4.963	81.707	0.135	0.013	0.808	10.893	8.519	11.748	0.020	3.776	96.741	0.693	27.233
ISCO Inf #3	1.993	82.863	0.133	0.012	0.371	3.837	8.481	11.841	0.013	1.546	96.519	0.692	26.426
ISCO Eff #1	0.000	142.222	0.000	0.000	0.007	0.986	10.196	8.337	0.000	0.012	64.889	0.478	0.943
ISCO Eff #2	0.223	141.333	0.000	0.000	0.006	0.908	10.148	8.324	0.015	0.011	64.074	0.479	0.935
ISCO Eff #4	0.094	136.000	0.000	0.000	0.002	0.627	9.981	9.043	0.000	0.010	67.185	0.495	1.286
ISCO Eff #6	0.000	134.148	0.000	0.000	0.002	0.436	9.889	9.817	0.000	0.004	73.481	0.511	1.201
ISCO Eff #8	0.000	131.111	0.001	0.002	0.002	0.359	9.533	10.253	0.001	0.005	73.815	0.533	1.445

APPENDIX F

GUNNISON WATER TREATMENT PLANT LABORATORY REPORTS

SUMMARY OF LAB DATA

CUSTOMER:

URS OPERATING SERVICES, INC
1099 18TH STREET, STE 710
DENVER, COLORADO 80202
303-291-8200

CITY OF GUNNISON WATER LAB
BOX 239
GUNNISON, CO 81230
641-8042

YEAR2008

ITEM:

SAMPLE NUMBER	280806	280807	280808	280815		280816
DATE	8-Aug	8-Aug	8-Aug	14-Aug		14-Aug
LOCATION	INFLUENT	CHIT	BCR	INFLUENT	CHIT	BCR
INFLUENT E.COLI					NO TEST	
EFFLUENT E.COLI		187.2	<1			<1
BOD INFLUENT	<0.1			1.16		
BOD EFFLUENT		194.38	72.75			55.54
NITRATE/NITRITE INF	1.7	1.043	0.876	1.52		0.273
AMMONIA		8.95	1.128			5.238
SAMPLE NUMBER	280728	280825	280826	280830	280728	280832
DATE	21-Aug	21-Aug	21-Aug	27-Aug	27-Aug	27-Aug
LOCATION	INFLUENT	CHIT	BCR	INFLUENT	CHIT	BCR
INFLUENT E.COLI						
EFFLUENT E.COLI		20.1	<0.1		>2419.2	<1
BOD INFLUENT	<0.1			<0.1		
BOD EFFLUENT		207.71	54.53		352.71	37.21
NITRATE/NITRITE INF	0.693	1.00	1.122	0.339	1.052	1.053
AMMONIA		14.81	5.565		28.28	6.313
SAMPLE NUMBER	280907	280908	280909	280925	280926	280927
DATE	4-Sep	4-Sep	4-Sep	19-Sep	19-Sep	19-Sep
LOCATION	INFLUENT	CHIT	BCR	INFLUENT	CHIT	BCR
INFLUENT E.COLI						
EFFLUENT E.COLI		8.60	<1		>2949.12	<1
BOD INFLUENT	0.37			0.88		
BOD EFFLUENT		169.95	<0.1		387.71	29.99
NITRATE/NITRITE INF		0.958	0.71	1.177	4.148	3.063
AMMONIA	0.423	5.864	19.67		>36.61	6.08
SAMPLE NUMBER	280925	281007	281008			
DATE	19-Sep	2-Aug	2-Oct			
LOCATION	INFLUENT	CHIT	BCR			
INFLUENT E.COLI						
EFFLUENT E.COLI		8.60	<1			
BOD INFLUENT	0.3					
BOD EFFLUENT		354.38	139.4			
NITRATE/NITRITE INF		1.2	3.5			
AMMONIA	0.35	7.2	6.5			

SUMMARY OF LAB DATA					
CUSTOMER:			CITY OF	GUNNISON	WATER LAB
GOLDER ASSOCIATES			BOX 239		
44 UNION BLVD #300			GUNNISON,	CO 81230	
LAKEWOOD				641-8042	
COLORADO,80228					
2007					
ITEM:					
SAMPLE NUMBER		270817	270831		
DATE		9-Aug	23-Aug		
INFLUENT E.COLI		<1	11,900,000		
EFFLUENT E.COLI		>2416.2	UNMEASURED		
BOD INFLUENT		12.2	314.39		
BOD EFFLUENT		<0.1	3.91		
NITRATE/NITRITE INF		10.67	10.24		
NITRATE/NITRITE EFF		0.202	0.292		

SUMMARY OF LAB DATA

CUSTOMER:			CITY OF	GUNNISON	WATER LAB
GOLDER ASSOCIATES			BOX 239		
44 UNION BLVD #300			GUNNISON,	CO 81230	
LAKEWOOD				641-8042	
COLORADO, 80228					
2007					
ITEM:					
SAMPLE NUMBER		270817	270831		
DATE		9-Aug	23-Aug		
INFLUENT E. COLI		<1	11,900,000		
EFFLUENT E. COLI		>2416.2	UNMEASURED		
BOD INFLUENT		12.2	314.39		
BOD EFFLUENT		<0.1	3.91		
NITRATE/NITRITE INF		10.67	10.24		
NITRATE/NITRITE EFF		0.202	0.292		

SUMMARY OF LAB DATA

CUSTOMER: CITY OF GUNNISON WATER LAB

BOX 239

GUNNISON, CO 81230

641-8042

URS OPERATING SERVICES, INC

1099 18TH STREET, STE 710

DENVER, COLORADO 80202

303-291-8200

YEAR2008

ITEM:

SAMPLE NUMBER	280806	280807	280808	280815		280816
DATE	8-Aug	8-Aug	8-Aug	14-Aug		14-Aug
LOCATION	INFLUENT	CHIT	BCR	INFLUENT	CHIT	BCR
INFLUENT E.COLI					NO TEST	
EFFLUENT E.COLI		187.2	<1			<1
BOD INFLUENT	<0.1			1.16		
BOD EFFLUENT		194.38	72.75			55.54
NITRATE/NITRITE INF	1.7	1.043	0.876	1.52		0.273
AMMONIA		8.95	1.128			5.238
SAMPLE NUMBER	280728	280825	280826	280830	280728	280832
DATE	21-Aug	21-Aug	21-Aug	27-Aug	27-Aug	27-Aug
LOCATION	INFLUENT	CHIT	BCR	INFLUENT	CHIT	BCR
INFLUENT E.COLI						
EFFLUENT E.COLI		20.1	<0.1		>2419.2	<1
BOD INFLUENT	<0.1			<0.1		
BOD EFFLUENT		207.71	54.53		352.71	37.21
NITRATE/NITRITE INF	0.693	1.00	1.122	0.339	1.052	1.053
AMMONIA		14.81	5.565		28.28	6.313
SAMPLE NUMBER	280907	280908	280909	280925	280926	280927
DATE	4-Sep	4-Sep	4-Sep	19-Sep	19-Sep	19-Sep
LOCATION	INFLUENT	CHIT	BCR	INFLUENT	CHIT	BCR
INFLUENT E.COLI						
EFFLUENT E.COLI		8.60	<1		>2949.12	<1
BOD INFLUENT	0.37			0.88		
BOD EFFLUENT		169.95	<0.1		387.71	29.99
NITRATE/NITRITE INF		0.958	0.71	1.177	4.148	3.063
AMMONIA	0.423	5.864	19.67		>36.61	6.08
SAMPLE NUMBER	280925	281007	281008			
DATE	19-Sep	2-Aug	2-Oct			
LOCATION	INFLUENT	CHIT	BCR			
INFLUENT E.COLI						
EFFLUENT E.COLI		8.60	<1			
BOD INFLUENT	0.3					
BOD EFFLUENT		354.38	139.4			
NITRATE/NITRITE INF		1.2	3.5			
AMMONIA	0.35	7.2	6.5			

APPENDIX G

ACZ LABORATORY REPORTS

ACZ Laboratories, Inc.
2773 Downhill Drive   Steamboat Springs, CO 80487   (800) 334-5493

Analytical Report

September 24, 2008

Report to:
Jan Christner
URS Operating Services, Inc.
1099 18th Street   Suite 710
Denver, CO 80202

Bill to:
Jan Christner
URS Operating Services, Inc.
1099 18th Street   Suite 710
Denver, CO 80202

Project ID: 36548232.00003
ACZ Project ID: L71950

Jan Christner:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on September 22, 2008. This project has been assigned to ACZ's project number, L71950. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan, version 12.0. The enclosed results relate only to the samples received under L71950. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after October 24, 2008. If the samples are determined to be hazardous, additional charges apply for disposal (typically less than $10/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical reports for five years.

If you have any questions or other needs, please contact your Project Manager.

Sue Webber has reviewed and approved this report.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

URS Operating Services, Inc.

Project ID: 36548232.00003
Sample ID: SMCHIT-EFF

ACZ Sample ID: ***L71950-01***
Date Sampled: *09/18/08 11:50*
Date Received: *09/22/08*
Sample Matrix: *Waste Water*

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfide as S	376.2 - Methylene Blue	16.8		*	mg/L	0.8	4	09/23/08 16:11	kah

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

URS Operating Services, Inc.

Project ID: 36548232.00003

Sample ID: SMBCR-EFF

ACZ Sample ID: ***L71950-02***

Date Sampled: *09/18/08 11:50*

Date Received: *09/22/08*

Sample Matrix: *Waste Water*

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfide as S	376.2 - Methylene Blue	26.3		*	mg/L	0.8	4	09/23/08 16:15	kah

** Please refer to Qualifier Reports for details.*

Inorganic Analytical Results

URS Operating Services, Inc.

Project ID: 36548232.00003
Sample ID: SMBCR-INF

ACZ Sample ID: ***L71950-03***
Date Sampled: *09/18/08 11:50*
Date Received: *09/22/08*
Sample Matrix: *Waste Water*

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Sulfide as S	376.2 - Methylene Blue		U	*	mg/L	0.02	0.1	09/23/08 16:18	kah

** Please refer to Qualifier Reports for details.*

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit. Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit, typically 5 times the MDL.
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calivation Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
U	Analyte was analyzed for but not detected at the indicated MDL

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(5) EPA SW-846. Test Methods for Evaluating Solid Waste, Third Edition with Update III, December 1996.
(6) Standard Methods for the Examination of Water and Wastewater, 19th edition, 1995.

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.

Inorganic QC Summary

URS Operating Services, Inc.
Project ID: 36548232.00003

ACZ Project ID: ***L71950***

Sulfide as S 376.2 - Methylene Blue

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec	Lower	Upper	RPD	Limit	Qual
WG252343													
WG252343ICV	ICV	09/23/08 10:34	WC080923-6	.46666		.512	mg/L	109.7	90	110			
WG252343ICB	ICB	09/23/08 10:38				U	mg/L		-0.06	0.06			
WG252388													
WG252388ICV	ICV	09/23/08 15:40	WC080923-6	.46666		.505	mg/L	108.2	90	110			
WG252388ICB	ICB	09/23/08 15:43				U	mg/L		-0.06	0.06			
WG252388LFB1	LFB	09/23/08 15:47	WC080923-8	.3297733		.332	mg/L	100.7	80	120			
WG252388CCV1	CCV	09/23/08 16:22	WC080923-5	.24733		.236	mg/L	95.4	90	110			
WG252388CCB1	CCB	09/23/08 16:25				U	mg/L		-0.06	0.06			
L71961-01AS	AS	09/23/08 16:33	WC080923-8	.3297733	U	.303	mg/L	91.9	75	125			
L71961-01DUP	DUP	09/23/08 16:36			U	U	mg/L				0	20	RA
WG252388CCV2	CCV	09/23/08 17:04	WC080923-5	.24733		.232	mg/L	93.8	90	110			
WG252388CCB2	CCB	09/23/08 17:08				U	mg/L		-0.06	0.06			
WG252388LFB2	LFB	09/23/08 17:29	WC080923-8	.3297733		.318	mg/L	96.4	80	120			
WG252388CCV3	CCV	09/23/08 17:47	WC080923-5	.24733		.23	mg/L	93	90	110			
WG252388CCB3	CCB	09/23/08 17:50				U	mg/L		-0.06	0.06			

ACZ Laboratories, Inc.
2773 Downhill Drive   Steamboat Springs, CO 80487   (800) 334-5493

Inorganic Extended Qualifier Report

URS Operating Services, Inc.   ACZ Project ID: ***L71950***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L71950-01	WG252388	Sulfide as S	376.2 - Methylene Blue	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L71950-02	WG252388	Sulfide as S	376.2 - Methylene Blue	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).
L71950-03	WG252388	Sulfide as S	376.2 - Methylene Blue	QD	Reported value is the background-corrected concentration, as described by the method.
			376.2 - Methylene Blue	RA	Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (< 10x MDL).

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Certification Qualifiers

URS Operating Services, Inc.

ACZ Project ID: ***L71950***

Wet Chemistry

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Sulfide as S	376.2 - Methylene Blue

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

URS Operating Services, Inc.
36548232.00003

ACZ Project ID:	L71950
Date Received:	9/22/2008
Received By:	
Date Printed:	9/22/2008

Receipt Verification

	YES	NO	NA
1) Does this project require special handling procedures such as CLP protocol?			X
2) Are the custody seals on the cooler intact?			X
3) Are the custody seals on the sample containers intact?			X
4) Is there a Chain of Custody or other directive shipping papers present?	X		
5) Is the Chain of Custody complete?	X		
6) Is the Chain of Custody in agreement with the samples received?	X		
7) Is there enough sample for all requested analyses?	X		
8) Are all samples within holding times for requested analyses?	X		
9) Were all sample containers received intact?	X		
10) Are the temperature blanks present?			X
11) Is the trip blank for Cyanide present?			X
12) Is the trip blank for VOA present?			X
13) Are samples requiring no headspace, headspace free?			X
14) Do the samples that require a Foreign Soils Permit have one?			X

Exceptions: If you answered no to any of the above questions, please describe

The sample dates and times were entered on the COC per the sample containers.

Contact (For any discrepancies, the client must be contacted)

The client was not contacted.

Shipping Containers

Cooler Id	Temp (°C)	Rad (µR/hr)
NA6954	17.5	17

Client must contact ACZ Project Manager if analysis should not proceed for samples received outside of thermal preservation acceptance criteria.

Notes

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

URS Operating Services, Inc.
36548232.00003

ACZ Project ID: L71950
Date Received: 9/22/2008
Received By:

Sample Container Preservation

SAMPLE	CLIENT ID	R < 2	G < 2	BK < 2	Y< 2	YG< 2	B< 2	O < 2	T >12	N/A	RAD	ID
L71950-01	SMCHIT-EFF								Y			
L71950-02	SMBCR-EFF								Y			
L71950-03	SMBCR-INF								Y			

Sample Container Preservation Legend

Abbreviation	Description	Container Type	Preservative/Limits
R	Raw/Nitric	RED	pH must be < 2
B	Filtered/Sulfuric	BLUE	pH must be < 2
BK	Filtered/Nitric	BLACK	pH must be < 2
G	Filtered/Nitric	GREEN	pH must be < 2
O	Raw/Sulfuric	ORANGE	pH must be < 2
P	Raw/NaOH	PURPLE	pH must be > 12 *
T	Raw/NaOH Zinc Acetate	TAN	pH must be > 12
Y	Raw/Sulfuric	YELLOW	pH must be < 2
YG	Raw/Sulfuric	YELLOW GLASS	pH must be < 2
N/A	No preservative needed	Not applicable	
RAD	Gamma/Beta dose rate	Not applicable	must be < 250 µR/hr

* pH check performed by analyst prior to sample preparation

Sample IDs Reviewed By: ______________________

L71950

UOS URS Operating Services, Inc.
1099 18th Street, STE 710
Denver, CO 80202
303-291-8200

SHIP TO:
ACZ Labs
2773 Downhill Drive
Steamboat Springs, CO 80487

CHAIN OF CUSTODY RECORD

PROJECT NUMBER / PURCHASE ORDER NUMBER: 36548232.00003

SITE MANAGER / PHONE NUMBER: Jan Christner (720) 810-0759

SAMPLER'S SIGNATURE:

TURNAROUND REQUESTED:

	SAMPLE ID	DATE	TIME	COMP/ GRAB	REMARKS	Number of Containers	Sulfide					TAG NUMBERS
1)	SMCHIT-EFF	9·18·08	11:56	Grab	CHit Effluent	1	1					
2)	SMBCR-EFF			Grab	BCR Effluent	1	1					
3)	SMBCR-INF			Grab	BCR Influent	1	1					
4)		LEG 9·22·08										
5)		per sample containers										
6)												
7)												
8)												
9)												
10)												
11)												
12)												
13)												
14)												
15)												

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)			OTHER INFORMATION:
	9/19/08	12:14				
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)			
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)	DATE	TIME	AIRBILL NUMBER: LAB REMARKS:
				9-22-08	10:10	

White - Original to Accompany Samples Yellow - UOS Chemist Pink - UOS Project Manager

DN 7464

APPENDIX H

PHREEQC GEOCHEMICAL MODEL RESULTS

```
   Input file: C:\Documents and Settings\jwaples\Desktop\chitin\Chitin.pqi
  Output file: C:\Documents and Settings\jwaples\Desktop\chitin\Chitin.pqo
Database file: C:\Program Files\USGS\Phreeqc Interactive 2.15.0\minteq.v4.dat

------------------
Reading data base.
------------------

      SOLUTION_MASTER_SPECIES
      SOLUTION_SPECIES
      SOLUTION_SPECIES
      PHASES
      PHASES
      SURFACE_MASTER_SPECIES
      SURFACE_SPECIES
      END
------------------------------------
Reading input data for simulation 1.
------------------------------------

      DATABASE C:\Program Files\USGS\Phreeqc Interactive 2.15.0\minteq.v4.dat
      TITLE 043-2269
      TITLE Speciation of Standard Mine Passive Treatment System Waters
      SOLUTION_SPREAD
          redox    S(-2)/S(6)
          units    mg/l
                  Description   pH      Al          Fe             Cd
Cu        Ca           Pb         Mn          Mg    Zn  S(6)  S(-2)
Alkalinity   N(-3)       N(5)  Temperature         pe      Cl
                                       mg/l        mg/l           mg/l
mg/l    mg/l         mg/l       mg/l       mg/l  mg/l  mg/l   mg/l
mg/l                                             charge
          BCR_Effluent_9/4/08  6.2   0.041       0.026         0.0012
0.0018         124         0.004         11         2.9   0.4   207     18
156       20       0.71          5.0       -3.3      10
       Chitin_Effluent_9/4/08  7.0   0.097       0.011        0.00020
0.0018         229        0.0045        4.9         7.7  0.33   164     15
507      5.9       0.96          4.6       -3.7      10
      SELECTED_OUTPUT
          file                 Chitin.sel
          state                false
          distance             false
          time                 false
          step                 false
          ph                   true
          pe                   true
          alkalinity           true
          charge_balance       true
          percent_error        true
          saturation_indices   Rhodochrosite  MnS(grn)  MnS(pnk)  MnSO4
      END
-----
TITLE
-----

 Speciation of Standard Mine Passive Treatment System Waters
```

Beginning of initial solution calculations.

Initial solution 1.   BCR_Effluent_9/4/08

-----------------------------Solution composition------------------------------

Elements	Molality	Moles	
Al	1.520e-006	1.520e-006	
Alkalinity	2.558e-003	2.558e-003	
Ca	3.096e-003	3.096e-003	
Cd	1.068e-008	1.068e-008	
Cl	1.357e-003	1.357e-003	Charge balance
Cu	2.834e-008	2.834e-008	
Fe	4.658e-007	4.658e-007	
Mg	1.194e-004	1.194e-004	
Mn	2.003e-004	2.003e-004	
N(-3)	1.429e-003	1.429e-003	
N(5)	5.072e-005	5.072e-005	
Pb	1.932e-008	1.932e-008	
S(-2)	5.617e-004	5.617e-004	
S(6)	2.156e-003	2.156e-003	
Zn	6.121e-006	6.121e-006	

----------------------------Description of solution----------------------------

pH = 6.200
pe = -3.300
Activity of water = 1.000
Ionic strength = 1.211e-002
Mass of water (kg) = 1.000e+000
Total carbon (mol/kg) = 6.549e-003
Total CO2 (mol/kg) = 6.549e-003
Temperature (deg C) = 5.000
Electrical balance (eq) = 1.392e-015
Percent error, 100*(Cat-|An|)/(Cat+|An|) = 0.00
Iterations = 12
Total H = 1.110310e+002
Total O = 5.553526e+001

---------------------------------Redox couples---------------------------------

Redox couple	pe	Eh (volts)
N(-3)/N(5)	8.1866	0.4518
S(-2)/S(6)	-2.4917	-0.1375

----------------------------Distribution of species----------------------------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma

H+		7.034e-007	6.310e-007	-6.153	-6.200	-0.047
OH-		3.533e-009	3.161e-009	-8.452	-8.500	-0.048
H2O		5.551e+001	9.997e-001	1.744	-0.000	0.000
Al	1.520e-006					
Al(OH)2+		1.127e-006	1.014e-006	-5.948	-5.994	-0.046
Al(OH)3		3.230e-007	3.230e-007	-6.491	-6.491	0.000
AlOH+2		3.044e-008	2.000e-008	-7.517	-7.699	-0.182
AlSO4+		2.175e-008	1.952e-008	-7.663	-7.709	-0.047
Al+3		1.334e-008	5.017e-009	-7.875	-8.300	-0.425
Al(OH)4-		4.749e-009	4.264e-009	-8.323	-8.370	-0.047
Al(SO4)2-		4.197e-010	3.768e-010	-9.377	-9.424	-0.047
C(4)	6.549e-003					
H2CO3		4.061e-003	4.061e-003	-2.391	-2.391	0.000
HCO3-		2.437e-003	2.194e-003	-2.613	-2.659	-0.046
CaHCO3+		4.408e-005	3.976e-005	-4.356	-4.401	-0.045
MnHCO3+		4.691e-006	4.218e-006	-5.329	-5.375	-0.046
MgHCO3+		1.530e-006	1.371e-006	-5.815	-5.863	-0.048
CaCO3		1.849e-007	1.849e-007	-6.733	-6.733	0.000
CO3-2		1.649e-007	1.067e-007	-6.783	-6.972	-0.189
MgCO3		4.300e-009	4.300e-009	-8.367	-8.367	0.000
FeHCO3+		2.797e-009	2.523e-009	-8.553	-8.598	-0.045
ZnHCO3+		1.037e-011	9.151e-012	-10.984	-11.039	-0.054
ZnCO3		1.237e-012	1.237e-012	-11.908	-11.908	0.000
PbHCO3+		7.749e-015	6.837e-015	-14.111	-14.165	-0.054
PbCO3		2.055e-015	2.055e-015	-14.687	-14.687	0.000
CdHCO3+		1.494e-017	1.318e-017	-16.826	-16.880	-0.054
CdCO3		9.805e-018	9.805e-018	-17.009	-17.009	0.000
Pb(CO3)2-2		1.044e-018	6.327e-019	-17.981	-18.199	-0.218
CuCO3		2.079e-021	2.079e-021	-20.682	-20.682	0.000
Cd(CO3)2-2		1.280e-021	7.759e-022	-20.893	-21.110	-0.218
CuHCO3+		3.399e-022	2.999e-022	-21.469	-21.523	-0.054
Cu(CO3)2-2		9.859e-025	5.974e-025	-24.006	-24.224	-0.218
Ca	3.096e-003					
Ca+2		2.685e-003	1.738e-003	-2.571	-2.760	-0.189
CaSO4		3.660e-004	3.660e-004	-3.437	-3.437	0.000
CaHCO3+		4.408e-005	3.976e-005	-4.356	-4.401	-0.045
CaNO3+		3.293e-007	2.906e-007	-6.482	-6.537	-0.054
CaCO3		1.849e-007	1.849e-007	-6.733	-6.733	0.000
CaNH3+2		4.092e-009	2.480e-009	-8.388	-8.606	-0.218
CaOH+		9.555e-011	8.619e-011	-10.020	-10.065	-0.045
Ca(NH3)2+2		1.846e-015	1.119e-015	-14.734	-14.951	-0.218
Cd	1.068e-008					
Cd(HS)2		1.062e-008	1.062e-008	-7.974	-7.974	0.000
Cd(HS)3-		3.847e-011	3.394e-011	-10.415	-10.469	-0.054
CdHS+		1.871e-011	1.651e-011	-10.728	-10.782	-0.054
Cd(HS)4-2		3.538e-013	2.144e-013	-12.451	-12.669	-0.218
Cd+2		6.224e-015	4.030e-015	-14.206	-14.395	-0.189
CdSO4		8.289e-016	8.289e-016	-15.082	-15.082	0.000
CdCl+		5.156e-016	4.549e-016	-15.288	-15.342	-0.054
Cd(SO4)2-2		2.682e-017	1.625e-017	-16.572	-16.789	-0.218
CdHCO3+		1.494e-017	1.318e-017	-16.826	-16.880	-0.054
CdCO3		9.805e-018	9.805e-018	-17.009	-17.009	0.000
CdCl2		2.177e-018	2.177e-018	-17.662	-17.662	0.000
CdNO3+		1.200e-018	1.059e-018	-17.921	-17.975	-0.054
CdOHCl		1.807e-019	1.807e-019	-18.743	-18.743	0.000
CdOH+		1.181e-019	1.042e-019	-18.928	-18.982	-0.054

	CdCl3-		1.547e-021	1.364e-021	-20.811	-20.865	-0.054
	Cd(CO3)2-2		1.280e-021	7.759e-022	-20.893	-21.110	-0.218
	Cd(OH)2		5.141e-023	5.141e-023	-22.289	-22.289	0.000
	Cd(NO3)2		1.304e-023	1.304e-023	-22.885	-22.885	0.000
	Cd(OH)3-		5.680e-029	5.011e-029	-28.246	-28.300	-0.054
	Cd2OH+3		8.432e-033	2.732e-033	-32.074	-32.564	-0.490
	Cd(OH)4-2		2.160e-037	1.309e-037	-36.666	-36.883	-0.218
Cl		1.357e-003					
	Cl-		1.356e-003	1.217e-003	-2.868	-2.915	-0.047
	MnCl+		1.843e-007	1.658e-007	-6.734	-6.781	-0.046
	MnCl2		2.849e-010	2.849e-010	-9.545	-9.545	0.000
	ZnCl+		5.873e-013	5.264e-013	-12.231	-12.279	-0.048
	MnCl3-		1.062e-013	9.548e-014	-12.974	-13.020	-0.046
	ZnOHCl		1.286e-014	1.286e-014	-13.891	-13.891	0.000
	CuCl		6.303e-016	6.303e-016	-15.200	-15.200	0.000
	CdCl+		5.156e-016	4.549e-016	-15.288	-15.342	-0.054
	ZnCl2		4.059e-016	4.059e-016	-15.392	-15.392	0.000
	PbCl+		2.435e-016	2.149e-016	-15.613	-15.668	-0.054
	CuCl2-		1.882e-016	1.686e-016	-15.725	-15.773	-0.048
	CdCl2		2.177e-018	2.177e-018	-17.662	-17.662	0.000
	PbCl2		1.061e-018	1.061e-018	-17.974	-17.974	0.000
	ZnCl3-		4.013e-019	3.597e-019	-18.397	-18.444	-0.048
	CdOHCl		1.807e-019	1.807e-019	-18.743	-18.743	0.000
	CuCl3-2		6.178e-020	4.039e-020	-19.209	-19.394	-0.185
	CdCl3-		1.547e-021	1.364e-021	-20.811	-20.865	-0.054
	PbCl3-		7.348e-022	6.483e-022	-21.134	-21.188	-0.054
	ZnCl4-2		2.824e-022	1.846e-022	-21.549	-21.734	-0.185
	CuCl+		5.595e-024	5.015e-024	-23.252	-23.300	-0.048
	PbCl4-2		4.354e-025	2.638e-025	-24.361	-24.579	-0.218
	FeCl+2		3.491e-025	2.283e-025	-24.457	-24.642	-0.185
	FeCl2+		2.688e-027	2.418e-027	-26.570	-26.617	-0.046
	CuCl2		7.472e-028	7.472e-028	-27.127	-27.127	0.000
	FeCl3		2.942e-031	2.942e-031	-30.531	-30.531	0.000
	CuCl3-		6.475e-033	5.804e-033	-32.189	-32.236	-0.048
	CuCl4-2		1.109e-037	7.251e-038	-36.955	-37.140	-0.185
Cu(1)		9.003e-009					
	Cu(S4)2-3		7.617e-009	4.105e-009	-8.118	-8.387	-0.268
	CuS4S5-3		1.386e-009	7.644e-010	-8.858	-9.117	-0.258
	CuCl		6.303e-016	6.303e-016	-15.200	-15.200	0.000
	Cu+		4.664e-016	4.115e-016	-15.331	-15.386	-0.054
	CuCl2-		1.882e-016	1.686e-016	-15.725	-15.773	-0.048
	CuCl3-2		6.178e-020	4.039e-020	-19.209	-19.394	-0.185
Cu(2)		1.934e-008					
	Cu(HS)3-		1.934e-008	1.706e-008	-7.714	-7.768	-0.054
	Cu+2		5.109e-021	3.308e-021	-20.292	-20.480	-0.189
	CuCO3		2.079e-021	2.079e-021	-20.682	-20.682	0.000
	CuSO4		6.649e-022	6.649e-022	-21.177	-21.177	0.000
	CuNH3+2		5.109e-022	3.096e-022	-21.292	-21.509	-0.218
	CuHCO3+		3.399e-022	2.999e-022	-21.469	-21.523	-0.054
	CuOH+		6.591e-023	5.907e-023	-22.181	-22.229	-0.048
	CuCl+		5.595e-024	5.015e-024	-23.252	-23.300	-0.048
	Cu(CO3)2-2		9.859e-025	5.974e-025	-24.006	-24.224	-0.218
	CuNO3+		6.035e-025	5.324e-025	-24.219	-24.274	-0.054
	Cu(OH)2		5.313e-025	5.313e-025	-24.275	-24.275	0.000
	CuCl2		7.472e-028	7.472e-028	-27.127	-27.127	0.000
	Cu(OH)3-		1.971e-029	1.739e-029	-28.705	-28.760	-0.054
	Cu(NO3)2		2.690e-030	2.690e-030	-29.570	-29.570	0.000

	CuCl3-	6.475e-033	5.804e-033	-32.189	-32.236	-0.048
	Cu(OH)4-2	3.603e-036	2.183e-036	-35.443	-35.661	-0.218
	CuCl4-2	1.109e-037	7.251e-038	-36.955	-37.140	-0.185
	Cu2(OH)2+2	1.251e-040	0.000e+000	-39.903	-40.120	-0.218
Fe(2)	4.658e-007					
	Fe+2	2.302e-007	1.395e-007	-6.638	-6.855	-0.218
	Fe(HS)2	2.011e-007	2.011e-007	-6.696	-6.696	0.000
	FeSO4	3.066e-008	3.066e-008	-7.513	-7.513	0.000
	FeHCO3+	2.797e-009	2.523e-009	-8.553	-8.598	-0.045
	Fe(HS)3-	9.986e-010	8.811e-010	-9.001	-9.055	-0.054
	FeOH+	1.952e-011	1.756e-011	-10.709	-10.756	-0.046
	Fe(OH)2	3.495e-017	3.495e-017	-16.456	-16.456	0.000
	Fe(OH)3-	1.610e-019	1.447e-019	-18.793	-18.839	-0.046
Fe(3)	8.603e-016					
	Fe(OH)2+	8.596e-016	7.740e-016	-15.066	-15.111	-0.046
	Fe(OH)3	6.533e-019	6.533e-019	-18.185	-18.185	0.000
	FeOH+2	5.671e-020	3.708e-020	-19.246	-19.431	-0.185
	Fe(OH)4-	2.188e-020	1.970e-020	-19.660	-19.705	-0.046
	FeSO4+	8.259e-023	7.427e-023	-22.083	-22.129	-0.046
	Fe+3	3.219e-023	1.210e-023	-22.492	-22.917	-0.425
	Fe(SO4)2-	2.405e-024	2.122e-024	-23.619	-23.673	-0.054
	FeCl+2	3.491e-025	2.283e-025	-24.457	-24.642	-0.185
	FeNO3+2	2.640e-026	1.600e-026	-25.578	-25.796	-0.218
	FeCl2+	2.688e-027	2.418e-027	-26.570	-26.617	-0.046
	FeCl3	2.942e-031	2.942e-031	-30.531	-30.531	0.000
	Fe2(OH)2+4	7.179e-037	9.679e-038	-36.144	-37.014	-0.870
	Fe3(OH)4+5	0.000e+000	0.000e+000	-49.702	-51.061	-1.360
H(0)	6.698e-011					
	H2	3.349e-011	3.358e-011	-10.475	-10.474	0.001
Mg	1.194e-004					
	Mg+2	1.059e-004	6.859e-005	-3.975	-4.164	-0.189
	MgSO4	1.191e-005	1.191e-005	-4.924	-4.924	0.000
	MgHCO3+	1.530e-006	1.371e-006	-5.815	-5.863	-0.048
	MgCO3	4.300e-009	4.300e-009	-8.367	-8.367	0.000
	MgOH+	6.746e-011	6.095e-011	-10.171	-10.215	-0.044
Mn(2)	2.003e-004					
	Mn+2	1.786e-004	1.082e-004	-3.748	-3.966	-0.218
	MnSO4	1.688e-005	1.688e-005	-4.773	-4.773	0.000
	MnHCO3+	4.691e-006	4.218e-006	-5.329	-5.375	-0.046
	MnCl+	1.843e-007	1.658e-007	-6.734	-6.781	-0.046
	MnNO3+	8.784e-009	7.750e-009	-8.056	-8.111	-0.054
	MnOH+	9.555e-010	8.592e-010	-9.020	-9.066	-0.046
	MnCl2	2.849e-010	2.849e-010	-9.545	-9.545	0.000
	Mn(NO3)2	9.231e-013	9.231e-013	-12.035	-12.035	0.000
	MnCl3-	1.062e-013	9.548e-014	-12.974	-13.020	-0.046
	Mn(OH)3-	7.587e-021	6.822e-021	-20.120	-20.166	-0.046
	Mn(OH)4-2	5.374e-028	3.514e-028	-27.270	-27.454	-0.185
Mn(3)	1.817e-033					
	Mn+3	1.817e-033	6.833e-034	-32.741	-33.165	-0.425
Mn(6)	0.000e+000					
	MnO4-2	0.000e+000	0.000e+000	-91.528	-91.712	-0.185
Mn(7)	0.000e+000					
	MnO4-	0.000e+000	0.000e+000	-104.933	-104.982	-0.049
N(-3)	1.429e-003					
	NH4+	1.407e-003	1.254e-003	-2.852	-2.902	-0.050
	NH4SO4-	1.687e-005	1.517e-005	-4.773	-4.819	-0.046
	NH3	5.120e-006	5.120e-006	-5.291	-5.291	0.000

	CaNH3+2	4.092e-009	2.480e-009	-8.388	-8.606	-0.218
	Ca(NH3)2+2	1.846e-015	1.119e-015	-14.734	-14.951	-0.218
	CuNH3+2	5.109e-022	3.096e-022	-21.292	-21.509	-0.218
N(5)	5.072e-005					
	NO3-	5.038e-005	4.519e-005	-4.298	-4.345	-0.047
	CaNO3+	3.293e-007	2.906e-007	-6.482	-6.537	-0.054
	MnNO3+	8.784e-009	7.750e-009	-8.056	-8.111	-0.054
	Mn(NO3)2	9.231e-013	9.231e-013	-12.035	-12.035	0.000
	ZnNO3+	2.961e-014	2.613e-014	-13.529	-13.583	-0.054
	PbNO3+	4.579e-018	4.040e-018	-17.339	-17.394	-0.054
	CdNO3+	1.200e-018	1.059e-018	-17.921	-17.975	-0.054
	Zn(NO3)2	2.062e-019	2.062e-019	-18.686	-18.686	0.000
	Pb(NO3)2	3.979e-022	3.979e-022	-21.400	-21.400	0.000
	Cd(NO3)2	1.304e-023	1.304e-023	-22.885	-22.885	0.000
	CuNO3+	6.035e-025	5.324e-025	-24.219	-24.274	-0.054
	FeNO3+2	2.640e-026	1.600e-026	-25.578	-25.796	-0.218
	Cu(NO3)2	2.690e-030	2.690e-030	-29.570	-29.570	0.000
O(0)	0.000e+000					
	O2	0.000e+000	0.000e+000	-77.220	-77.219	0.001
Pb	1.932e-008					
	Pb(HS)2	1.930e-008	1.930e-008	-7.714	-7.714	0.000
	Pb(HS)3-	1.755e-011	1.549e-011	-10.756	-10.810	-0.054
	Pb+2	9.893e-015	6.405e-015	-14.005	-14.193	-0.189
	PbHCO3+	7.749e-015	6.837e-015	-14.111	-14.165	-0.054
	PbSO4	3.543e-015	3.543e-015	-14.451	-14.451	0.000
	PbCO3	2.055e-015	2.055e-015	-14.687	-14.687	0.000
	PbOH+	2.909e-016	2.567e-016	-15.536	-15.591	-0.054
	PbCl+	2.435e-016	2.149e-016	-15.613	-15.668	-0.054
	Pb(SO4)2-2	3.978e-017	2.410e-017	-16.400	-16.618	-0.218
	PbNO3+	4.579e-018	4.040e-018	-17.339	-17.394	-0.054
	PbCl2	1.061e-018	1.061e-018	-17.974	-17.974	0.000
	Pb(CO3)2-2	1.044e-018	6.327e-019	-17.981	-18.199	-0.218
	Pb(OH)2	1.295e-019	1.295e-019	-18.888	-18.888	0.000
	PbCl3-	7.348e-022	6.483e-022	-21.134	-21.188	-0.054
	Pb(NO3)2	3.979e-022	3.979e-022	-21.400	-21.400	0.000
	Pb(OH)3-	2.342e-024	2.066e-024	-23.630	-23.685	-0.054
	PbCl4-2	4.354e-025	2.638e-025	-24.361	-24.579	-0.218
	Pb2OH+3	8.044e-029	2.606e-029	-28.095	-28.584	-0.490
	Pb(OH)4-2	1.332e-029	8.074e-030	-28.875	-29.093	-0.218
	Pb3(OH)4+2	0.000e+000	0.000e+000	-42.903	-43.120	-0.218
	Pb4(OH)4+4	0.000e+000	0.000e+000	-52.204	-53.074	-0.870
S(-2)	5.617e-004					
	H2S	5.031e-004	5.031e-004	-3.298	-3.298	0.000
	HS-	4.559e-005	4.022e-005	-4.341	-4.396	-0.054
	ZnS(HS)-	3.780e-006	3.335e-006	-5.423	-5.477	-0.054
	Zn(HS)2	2.153e-006	2.153e-006	-5.667	-5.667	0.000
	Fe(HS)2	2.011e-007	2.011e-007	-6.696	-6.696	0.000
	Zn(HS)3-	1.871e-007	1.650e-007	-6.728	-6.782	-0.054
	Cu(HS)3-	1.934e-008	1.706e-008	-7.714	-7.768	-0.054
	Pb(HS)2	1.930e-008	1.930e-008	-7.714	-7.714	0.000
	S5-2	1.525e-008	9.242e-009	-7.817	-8.034	-0.218
	S6-2	1.384e-008	8.385e-009	-7.859	-8.077	-0.218
	Cd(HS)2	1.062e-008	1.062e-008	-7.974	-7.974	0.000
	Cu(S4)2-3	7.617e-009	4.105e-009	-8.118	-8.387	-0.268
	S4-2	3.683e-009	2.232e-009	-8.434	-8.651	-0.218
	CuS4S5-3	1.386e-009	7.644e-010	-8.858	-9.117	-0.258
	Fe(HS)3-	9.986e-010	8.811e-010	-9.001	-9.055	-0.054

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   S3-2                 5.294e-010  3.208e-010    -9.276    -9.494    -0.218
   ZnS(HS)2-2           4.520e-011  2.739e-011   -10.345   -10.562    -0.218
   S2-2                 4.516e-011  2.737e-011   -10.345   -10.563    -0.218
   Cd(HS)3-             3.847e-011  3.394e-011   -10.415   -10.469    -0.054
   CdHS+                1.871e-011  1.651e-011   -10.728   -10.782    -0.054
   Pb(HS)3-             1.755e-011  1.549e-011   -10.756   -10.810    -0.054
   Zn(HS)4-2            3.799e-013  2.302e-013   -12.420   -12.638    -0.218
   Cd(HS)4-2            3.538e-013  2.144e-013   -12.451   -12.669    -0.218
   S-2                  1.166e-016  7.625e-017   -15.933   -16.118    -0.185
S(6)             2.156e-003
   SO4-2                1.744e-003  1.129e-003    -2.758    -2.947    -0.189
   CaSO4                3.660e-004  3.660e-004    -3.437    -3.437     0.000
   MnSO4                1.688e-005  1.688e-005    -4.773    -4.773     0.000
   NH4SO4-              1.687e-005  1.517e-005    -4.773    -4.819    -0.046
   MgSO4                1.191e-005  1.191e-005    -4.924    -4.924     0.000
   HSO4-                4.097e-008  3.678e-008    -7.387    -7.434    -0.047
   FeSO4                3.066e-008  3.066e-008    -7.513    -7.513     0.000
   AlSO4+               2.175e-008  1.952e-008    -7.663    -7.709    -0.047
   Al(SO4)2-            4.197e-010  3.768e-010    -9.377    -9.424    -0.047
   ZnSO4                4.157e-011  4.157e-011   -10.381   -10.381     0.000
   Zn(SO4)2-2           8.077e-013  4.894e-013   -12.093   -12.310    -0.218
   PbSO4                3.543e-015  3.543e-015   -14.451   -14.451     0.000
   CdSO4                8.289e-016  8.289e-016   -15.082   -15.082     0.000
   Pb(SO4)2-2           3.978e-017  2.410e-017   -16.400   -16.618    -0.218
   Cd(SO4)2-2           2.682e-017  1.625e-017   -16.572   -16.789    -0.218
   CuSO4                6.649e-022  6.649e-022   -21.177   -21.177     0.000
   FeSO4+               8.259e-023  7.427e-023   -22.083   -22.129    -0.046
   Fe(SO4)2-            2.405e-024  2.122e-024   -23.619   -23.673    -0.054
Zn               6.121e-006
   ZnS(HS)-             3.780e-006  3.335e-006    -5.423    -5.477    -0.054
   Zn(HS)2              2.153e-006  2.153e-006    -5.667    -5.667     0.000
   Zn(HS)3-             1.871e-007  1.650e-007    -6.728    -6.782    -0.054
   Zn+2                 3.111e-010  2.014e-010    -9.507    -9.696    -0.189
   ZnS(HS)2-2           4.520e-011  2.739e-011   -10.345   -10.562    -0.218
   ZnSO4                4.157e-011  4.157e-011   -10.381   -10.381     0.000
   ZnHCO3+              1.037e-011  9.151e-012   -10.984   -11.039    -0.054
   ZnCO3                1.237e-012  1.237e-012   -11.908   -11.908     0.000
   Zn(SO4)2-2           8.077e-013  4.894e-013   -12.093   -12.310    -0.218
   ZnCl+                5.873e-013  5.264e-013   -12.231   -12.279    -0.048
   Zn(HS)4-2            3.799e-013  2.302e-013   -12.420   -12.638    -0.218
   ZnOH+                7.217e-014  6.368e-014   -13.142   -13.196    -0.054
   ZnNO3+               2.961e-014  2.613e-014   -13.529   -13.583    -0.054
   ZnOHCl               1.286e-014  1.286e-014   -13.891   -13.891     0.000
   Zn(OH)2              8.126e-016  8.126e-016   -15.090   -15.090     0.000
   ZnCl2                4.059e-016  4.059e-016   -15.392   -15.392     0.000
   ZnCl3-               4.013e-019  3.597e-019   -18.397   -18.444    -0.048
   Zn(NO3)2             2.062e-019  2.062e-019   -18.686   -18.686     0.000
   Zn(OH)3-             7.365e-020  6.498e-020   -19.133   -19.187    -0.054
   ZnCl4-2              2.824e-022  1.846e-022   -21.549   -21.734    -0.185
   Zn(OH)4-2            6.811e-026  4.127e-026   -25.167   -25.384    -0.218

------------------------------Saturation indices-----------------------------
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      Phase               SI log IAP  log KT

      Al(OH)3(am)      -1.90   10.30   12.20  Al(OH)3
```

Al2O3	-2.31	20.60	22.91	Al2O3
Al4(OH)10SO4	3.15	25.85	22.70	Al4(OH)10SO4
AlOHSO4	-1.82	-5.05	-3.23	AlOHSO4
Anglesite	-9.20	-17.14	-7.94	PbSO4
Anhydrite	-1.44	-5.71	-4.27	CaSO4
Anilite	7.78	-26.39	-34.17	Cu0.25Cu1.5S
Antlerite	-48.38	-39.59	8.79	Cu3(OH)4SO4
Aragonite	-1.58	-9.73	-8.15	CaCO3
Artinite	-14.01	-2.90	11.11	MgCO3:Mg(OH)2:3H2O
Atacamite	-33.84	-25.28	8.57	Cu2(OH)3Cl
Azurite	-47.28	-62.98	-15.71	Cu3(OH)2(CO3)2
Bianchite	-10.89	-12.64	-1.76	ZnSO4:6H2O
Birnessite	-28.95	-10.86	18.09	MnO2
Bixbyite	-30.05	-29.13	0.92	Mn2O3
BlaubleiI	4.46	-19.71	-24.16	Cu0.9Cu0.2S
BlaubleiII	4.49	-22.79	-27.28	Cu0.6Cu0.8S
Boehmite	0.24	10.30	10.06	AlOOH
Brochantite	-65.45	-47.67	17.78	Cu4(OH)6SO4
Brucite	-10.04	8.24	18.28	Mg(OH)2
Calcite	-1.35	-9.73	-8.38	CaCO3
Cd(OH)2	-16.83	-1.99	14.84	Cd(OH)2
Cd(OH)2(am)	-16.82	-1.99	14.82	Cd(OH)2
Cd3(OH)2(SO4)2	-43.39	-36.68	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-43.89	-21.33	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-51.73	-23.33	28.40	Cd4(OH)6SO4
CdCl2	-19.80	-20.22	-0.42	CdCl2
CdCl2:1H2O	-18.63	-20.22	-1.60	CdCl2:1H2O
CdCl2:2.5H2O	-18.22	-20.22	-2.00	CdCl2:2.5H2O
Cdmetal(alpha)	-23.87	-9.41	14.46	Cd
Cdmetal(gamma)	-23.99	-9.41	14.57	Cd
CdOHCl	-15.04	-11.11	3.93	CdOHCl
CdSO4	-17.82	-17.34	0.48	CdSO4
CdSO4:1H2O	-16.01	-17.34	-1.33	CdSO4:1H2O
CdSO4:2.67H2O	-15.70	-17.34	-1.65	CdSO4:2.67H2O
Cerrusite	-7.72	-21.17	-13.44	PbCO3
CH4(g)	-4.75	-49.04	-44.28	CH4
Chalcanthite	-20.71	-23.43	-2.72	CuSO4:5H2O
Chalcocite	8.07	-28.97	-37.04	Cu2S
Chalcopyrite	13.41	-23.73	-37.14	CuFeS2
CO2(g)	-1.17	-19.37	-18.20	CO2
Cotunnite	-14.91	-20.02	-5.11	PbCl2
Covellite	4.85	-18.68	-23.52	CuS
Cu(OH)2	-17.47	-8.08	9.38	Cu(OH)2
Cu2(OH)3NO3	-36.87	-26.71	10.17	Cu2(OH)3NO3
Cu2SO4	-32.01	-33.72	-1.71	Cu2SO4
CuCO3	-15.95	-27.45	-11.50	CuCO3
Cumetal	-3.24	-12.89	-9.66	Cu
CuOCuSO4	-43.55	-31.51	12.04	CuOCuSO4
Cupricferrite	-25.35	-16.71	8.64	CuFe2O4
Cuprite	-18.53	-18.37	0.16	Cu2O
Cuprousferrite	-4.79	-13.50	-8.72	CuFeO2
CuSO4	-27.29	-23.43	3.86	CuSO4
Diaspore	2.13	10.30	8.17	AlOOH
Djurleite	8.16	-28.29	-36.44	Cu0.066Cu1.868S
Dolomite(disordered)	-4.91	-20.87	-15.96	CaMg(CO3)2
Dolomite(ordered)	-4.27	-20.87	-16.59	CaMg(CO3)2
Epsomite	-4.84	-7.11	-2.27	MgSO4:7H2O

Fe(OH)2	-8.02	5.54	13.56	Fe(OH)2
Fe(OH)2.7Cl.3	-4.01	-7.05	-3.04	Fe(OH)2.7Cl.3
Fe2(SO4)3	-53.99	-54.68	-0.69	Fe2(SO4)3
Fe3(OH)8	-23.31	-3.09	20.22	Fe3(OH)8
Ferrihydrite	-8.43	-4.32	4.12	Fe(OH)3
FeS(ppt)	-2.24	-5.05	-2.81	FeS
Galena	2.59	-12.39	-14.98	PbS
Gibbsite	0.81	10.30	9.49	Al(OH)3
Goethite	-5.57	-4.32	1.25	FeOOH
Goslarite	-10.45	-12.64	-2.19	ZnSO4:7H2O
Greenockite	2.46	-12.59	-15.05	CdS
Greigite	-0.44	-45.47	-45.03	Fe3S4
Gypsum	-1.08	-5.71	-4.62	CaSO4:2H2O
H-Jarosite	-34.45	-43.65	-9.19	(H3O)Fe3(SO4)2(OH)6
H2S(g)	-2.59	-10.60	-8.01	H2S
Hausmannite	-33.61	32.72	66.33	Mn3O4
Hematite	-8.84	-8.63	0.21	Fe2O3
Hercynite	-0.70	26.15	26.85	FeAl2O4
Huntite	-14.53	-43.14	-28.61	CaMg3(CO3)4
Hydrocerrusite	-25.35	-44.12	-18.77	Pb3(OH)2(CO3)2
Hydromagnesite	-30.29	-36.31	-6.01	Mg5(CO3)4(OH)2:4H2O
Langite	-67.24	-47.67	19.57	Cu4(OH)6SO4:H2O
Larnakite	-18.77	-18.93	-0.16	PbO:PbSO4
Laurionite	-11.53	-10.91	0.62	PbOHCl
Lepidocrocite	-5.69	-4.32	1.37	FeOOH
Lime	-25.50	9.64	35.14	CaO
Litharge	-15.31	-1.79	13.52	PbO
Mackinawite	-1.45	-5.05	-3.60	FeS
Maghemite	-15.02	-8.63	6.39	Fe2O3
Magnesioferrite	-20.77	-0.40	20.37	Fe2MgO4
Magnesite	-3.42	-11.14	-7.71	MgCO3
Magnetite	-9.12	-3.09	6.03	Fe3O4
Malachite	-29.26	-35.53	-6.27	Cu2(OH)2CO3
Manganite	-13.20	12.14	25.34	MnOOH
Massicot	-15.53	-1.79	13.74	PbO
Melanothallite	-33.37	-26.31	7.06	CuCl2
Melanterite	-7.34	-9.80	-2.47	FeSO4:7H2O
Mg(OH)2(active)	-10.56	8.24	18.79	Mg(OH)2
Minium	-76.80	2.04	78.84	Pb3O4
Mn2(SO4)3	-71.52	-75.17	-3.65	Mn2(SO4)3
MnCl2:4H2O	-12.65	-9.80	2.85	MnCl2:4H2O
MnS(grn)	-2.73	-2.16	0.57	MnS
MnS(pnk)	-5.50	-2.16	3.34	MnS
MnSO4	-10.31	-6.91	3.40	MnSO4
Monteponite	-18.40	-1.99	16.41	CdO
Nantokite	-11.03	-18.30	-7.27	CuCl
Nesquehonite	-6.77	-11.14	-4.36	MgCO3:3H2O
Nsutite	-28.36	-10.86	17.50	MnO2
O2(g)	-75.46	14.83	90.29	O2
Otavite	-9.37	-21.37	-11.99	CdCO3
Pb(OH)2	-10.68	-1.79	8.89	Pb(OH)2
Pb10(OH)6O(CO3)6	-125.41	-134.17	-8.76	Pb10(OH)6O(CO3)6
Pb2(OH)3Cl	-21.50	-12.70	8.79	Pb2(OH)3Cl
Pb2O(OH)2	-29.78	-3.59	26.19	Pb2O(OH)2
Pb2O3	-57.21	3.83	61.04	Pb2O3
Pb2OCO3	-22.92	-22.96	-0.04	Pb2OCO3
Pb3O2CO3	-37.17	-24.75	12.41	Pb3O2CO3

Pb3O2SO4	-32.41	-20.73	11.68	Pb3O2SO4
Pb4(OH)6SO4	-43.62	-22.52	21.10	Pb4(OH)6SO4
Pb4O3SO4	-46.12	-22.52	23.60	Pb4O3SO4
Pbmetal	-13.44	-9.21	4.23	Pb
PbO:0.3H2O	-14.77	-1.79	12.98	PbO:0.33H2O
Periclase	-15.25	8.24	23.49	MgO
Phosgenite	-21.38	-41.19	-19.81	PbCl2:PbCO3
Plattnerite	-47.71	5.62	53.33	PbO2
Portlandite	-14.78	9.64	24.42	Ca(OH)2
Pyrite	10.91	-8.23	-19.14	FeS2
Pyrochroite	-7.98	8.43	16.42	Mn(OH)2
Pyrolusite	-28.96	15.85	44.81	MnO2
Rhodochrosite	-0.38	-10.94	-10.56	MnCO3
Siderite	-3.79	-13.83	-10.04	FeCO3
Smithsonite	-6.87	-16.67	-9.80	ZnCO3
Sphalerite	3.94	-7.89	-11.83	ZnS
Spinel	-12.90	28.84	41.74	MgAl2O4
Sulfur	-1.24	-3.18	-1.94	S
Tenorite	-16.54	-8.08	8.46	CuO
Wurtzite	1.33	-7.89	-9.22	ZnS
Zincite	-9.76	2.70	12.46	ZnO
Zincosite	-17.61	-12.64	4.97	ZnSO4
Zn(NO3)2:6H2O	-21.39	-18.39	3.01	Zn(NO3)2:6H2O
Zn(OH)2	-9.50	2.70	12.20	Zn(OH)2
Zn(OH)2(am)	-10.79	2.70	13.49	Zn(OH)2
Zn(OH)2(beta)	-10.10	2.70	12.80	Zn(OH)2
Zn(OH)2(epsilon)	-9.86	2.70	12.56	Zn(OH)2
Zn(OH)2(gamma)	-9.03	2.70	11.73	Zn(OH)2
Zn2(OH)2SO4	-17.44	-9.94	7.50	Zn2(OH)2SO4
Zn2(OH)3Cl	-18.90	-3.71	15.19	Zn2(OH)3Cl
Zn3O(SO4)2	-44.75	-22.58	22.16	Zn3O(SO4)2
Zn4(OH)6SO4	-32.93	-4.53	28.40	Zn4(OH)6SO4
Zn5(OH)8Cl2	-43.21	-4.71	38.50	Zn5(OH)8Cl2
ZnCl2	-23.49	-15.53	7.96	ZnCl2
ZnCO3:1H2O	-6.41	-16.67	-10.26	ZnCO3:1H2O
Znmetal	-32.43	-4.71	27.72	Zn
ZnO(active)	-9.60	2.70	12.31	ZnO
ZnS(am)	1.35	-7.89	-9.25	ZnS
ZnSO4:1H2O	-12.56	-12.64	-0.08	ZnSO4:1H2O

Initial solution 2.   Chitin_Effluent_9/4/08

-----------------------------Solution composition-----------------------------
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Elements	Molality	Moles	
Al	3.598e-006	3.598e-006	
Alkalinity	8.317e-003	8.317e-003	
Ca	5.719e-003	5.719e-003	
Cd	1.781e-009	1.781e-009	
Cl	8.914e-004	8.914e-004	Charge balance
Cu	2.835e-008	2.835e-008	
Fe	1.972e-007	1.972e-007	
Mg	3.171e-004	3.171e-004	
Mn	8.928e-005	8.928e-005	
N(-3)	4.216e-004	4.216e-004	

N(5)	6.860e-005	6.860e-005
Pb	2.174e-008	2.174e-008
S(-2)	4.682e-004	4.682e-004
S(6)	1.709e-003	1.709e-003
Zn	5.051e-006	5.051e-006

----------------------------Description of solution--------------------------
--

pH	=	7.000
pe	=	-3.700
Activity of water	=	1.000
Ionic strength	=	1.817e-002
Mass of water (kg)	=	1.000e+000
Total carbon (mol/kg)	=	1.014e-002
Total CO2 (mol/kg)	=	1.014e-002
Temperature (deg C)	=	4.600
Electrical balance (eq)	=	-1.422e-017
Percent error, 100*(Cat-|An|)/(Cat+|An|)	=	-0.00
Iterations	=	11
Total H	=	1.110283e+002
Total O	=	5.554432e+001

---------------------------------Redox couples-------------------------------
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Redox couple	pe	Eh (volts)
N(-3)/N(5)	7.2964	0.4021
S(-2)/S(6)	-3.4809	-0.1918

----------------------------Distribution of species--------------------------
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Species		Molality	Activity	Log Molality	Log Activity	Log Gamma
H+		1.138e-007	1.000e-007	-6.944	-7.000	-0.056
OH-		2.200e-008	1.926e-008	-7.658	-7.715	-0.058
H2O		5.551e+001	9.997e-001	1.744	-0.000	0.000
Al	3.598e-006					
Al(OH)3		2.179e-006	2.179e-006	-5.662	-5.662	0.000
Al(OH)2+		1.228e-006	1.085e-006	-5.911	-5.965	-0.054
Al(OH)4-		1.852e-007	1.629e-007	-6.732	-6.788	-0.056
AlOH+2		5.404e-009	3.291e-009	-8.267	-8.483	-0.215
Al+3		4.301e-010	1.348e-010	-9.366	-9.870	-0.504
AlSO4+		3.904e-010	3.435e-010	-9.408	-9.464	-0.056
Al(SO4)2-		5.073e-012	4.463e-012	-11.295	-11.350	-0.056
C(4)	1.014e-002					
HCO3-		7.832e-003	6.919e-003	-2.106	-2.160	-0.054
H2CO3		2.041e-003	2.041e-003	-2.690	-2.690	0.000
CaHCO3+		2.425e-004	2.148e-004	-3.615	-3.668	-0.053
MgHCO3+		1.220e-005	1.071e-005	-4.914	-4.970	-0.057
CaCO3		6.260e-006	6.260e-006	-5.203	-5.203	0.000
MnHCO3+		5.939e-006	5.238e-006	-5.226	-5.281	-0.055
CO3-2		3.525e-006	2.105e-006	-5.453	-5.677	-0.224
MgCO3		2.088e-007	2.088e-007	-6.680	-6.680	0.000

	FeHCO3+		6.039e-010	5.349e-010	-9.219	-9.272	-0.053
	ZnHCO3+		4.811e-013	4.127e-013	-12.318	-12.384	-0.067
	ZnCO3		3.521e-013	3.521e-013	-12.453	-12.453	0.000
	PbCO3		3.558e-015	3.558e-015	-14.449	-14.449	0.000
	PbHCO3+		2.187e-015	1.876e-015	-14.660	-14.727	-0.067
	Pb(CO3)2-2		3.988e-017	2.160e-017	-16.399	-16.666	-0.266
	CdCO3		2.499e-018	2.499e-018	-17.602	-17.602	0.000
	CdHCO3+		6.206e-019	5.324e-019	-18.207	-18.274	-0.067
	Cd(CO3)2-2		7.199e-021	3.899e-021	-20.143	-20.409	-0.266
	CuCO3		2.394e-023	2.394e-023	-22.621	-22.621	0.000
	CuHCO3+		6.379e-025	5.472e-025	-24.195	-24.262	-0.067
	Cu(CO3)2-2		2.504e-025	1.356e-025	-24.601	-24.868	-0.266
Ca		5.719e-003					
	Ca+2		5.049e-003	3.015e-003	-2.297	-2.521	-0.224
	CaSO4		4.211e-004	4.211e-004	-3.376	-3.376	0.000
	CaHCO3+		2.425e-004	2.148e-004	-3.615	-3.668	-0.053
	CaCO3		6.260e-006	6.260e-006	-5.203	-5.203	0.000
	CaNO3+		7.775e-007	6.670e-007	-6.109	-6.176	-0.067
	CaNH3+2		1.423e-008	7.706e-009	-7.847	-8.113	-0.266
	CaOH+		1.023e-009	9.061e-010	-8.990	-9.043	-0.053
	Ca(NH3)2+2		1.150e-014	6.229e-015	-13.939	-14.206	-0.266
Cd		1.781e-009					
	Cd(HS)2		1.756e-009	1.756e-009	-8.756	-8.756	0.000
	Cd(HS)3-		2.338e-011	2.006e-011	-10.631	-10.698	-0.067
	CdHS+		8.896e-013	7.631e-013	-12.051	-12.117	-0.067
	Cd(HS)4-2		8.367e-013	4.531e-013	-12.077	-12.344	-0.266
	Cd+2		8.723e-017	5.209e-017	-16.059	-16.283	-0.224
	CdSO4		7.101e-018	7.101e-018	-17.149	-17.149	0.000
	CdCl+		4.411e-018	3.784e-018	-17.355	-17.422	-0.067
	CdCO3		2.499e-018	2.499e-018	-17.602	-17.602	0.000
	CdHCO3+		6.206e-019	5.324e-019	-18.207	-18.274	-0.067
	Cd(SO4)2-2		1.723e-019	9.329e-020	-18.764	-19.030	-0.266
	CdNO3+		2.133e-020	1.829e-020	-19.671	-19.738	-0.067
	CdCl2		1.165e-020	1.165e-020	-19.934	-19.934	0.000
	CdOH+		9.570e-021	8.210e-021	-20.019	-20.086	-0.067
	CdOHCl		9.380e-021	9.380e-021	-20.028	-20.028	0.000
	Cd(CO3)2-2		7.199e-021	3.899e-021	-20.143	-20.409	-0.266
	Cd(OH)2		2.645e-023	2.645e-023	-22.578	-22.578	0.000
	CdCl3-		5.455e-024	4.680e-024	-23.263	-23.330	-0.067
	Cd(NO3)2		2.934e-025	2.934e-025	-24.533	-24.533	0.000
	Cd(OH)3-		1.896e-028	1.627e-028	-27.722	-27.789	-0.067
	Cd2OH+3		1.112e-035	2.798e-036	-34.954	-35.553	-0.599
	Cd(OH)4-2		4.949e-036	2.680e-036	-35.305	-35.572	-0.266
Cl		8.914e-004					
	Cl-		8.913e-004	7.835e-004	-3.050	-3.106	-0.056
	MnCl+		4.778e-008	4.213e-008	-7.321	-7.375	-0.055
	MnCl2		4.663e-011	4.663e-011	-10.331	-10.331	0.000
	MnCl3-		1.141e-014	1.006e-014	-13.943	-13.997	-0.055
	ZnCl+		5.555e-015	4.876e-015	-14.255	-14.312	-0.057
	ZnOHCl		7.540e-016	7.540e-016	-15.123	-15.123	0.000
	PbCl+		1.408e-017	1.208e-017	-16.851	-16.918	-0.067
	CdCl+		4.411e-018	3.784e-018	-17.355	-17.422	-0.067
	ZnCl2		2.374e-018	2.374e-018	-17.624	-17.624	0.000
	CuCl		2.302e-018	2.302e-018	-17.638	-17.638	0.000
	CuCl2-		4.523e-019	3.970e-019	-18.345	-18.401	-0.057
	PbCl2		3.835e-020	3.835e-020	-19.416	-19.416	0.000
	CdCl2		1.165e-020	1.165e-020	-19.934	-19.934	0.000

CdOHCl		9.380e-021	9.380e-021	-20.028	-20.028	0.000
ZnCl3-		1.540e-021	1.352e-021	-20.812	-20.869	-0.057
CuCl3-2		1.011e-022	6.113e-023	-21.995	-22.214	-0.218
PbCl3-		1.767e-023	1.516e-023	-22.753	-22.819	-0.067
CdCl3-		5.455e-024	4.680e-024	-23.263	-23.330	-0.067
ZnCl4-2		7.364e-025	4.453e-025	-24.133	-24.351	-0.218
PbCl4-2		7.288e-027	3.947e-027	-26.137	-26.404	-0.266
CuCl+		2.137e-027	1.876e-027	-26.670	-26.727	-0.057
FeCl+2		1.623e-027	9.815e-028	-26.790	-27.008	-0.218
FeCl2+		7.700e-030	6.790e-030	-29.114	-29.168	-0.055
CuCl2		1.760e-031	1.760e-031	-30.754	-30.754	0.000
FeCl3		5.320e-034	5.320e-034	-33.274	-33.274	0.000
CuCl3-		9.949e-037	8.732e-037	-36.002	-36.059	-0.057
CuCl4-2		0.000e+000	0.000e+000	-40.928	-41.147	-0.218
Cu(1)	2.782e-008					
Cu(S4)2-3		2.356e-008	1.185e-008	-7.628	-7.926	-0.298
CuS4S5-3		4.263e-009	2.207e-009	-8.370	-8.656	-0.286
Cu+		2.720e-018	2.334e-018	-17.565	-17.632	-0.067
CuCl		2.302e-018	2.302e-018	-17.638	-17.638	0.000
CuCl2-		4.523e-019	3.970e-019	-18.345	-18.401	-0.057
CuCl3-2		1.011e-022	6.113e-023	-21.995	-22.214	-0.218
Cu(2)	5.311e-010					
Cu(HS)3-		5.311e-010	4.556e-010	-9.275	-9.341	-0.067
CuCO3		2.394e-023	2.394e-023	-22.621	-22.621	0.000
Cu+2		3.235e-024	1.932e-024	-23.490	-23.714	-0.224
CuHCO3+		6.379e-025	5.472e-025	-24.195	-24.262	-0.067
CuNH3+2		6.256e-025	3.388e-025	-24.204	-24.470	-0.266
CuSO4		2.574e-025	2.574e-025	-24.589	-24.589	0.000
Cu(CO3)2-2		2.504e-025	1.356e-025	-24.601	-24.868	-0.266
CuOH+		2.425e-025	2.128e-025	-24.615	-24.672	-0.057
Cu(OH)2		1.235e-026	1.235e-026	-25.908	-25.908	0.000
CuCl+		2.137e-027	1.876e-027	-26.670	-26.727	-0.057
CuNO3+		4.794e-028	4.113e-028	-27.319	-27.386	-0.067
Cu(OH)3-		2.973e-030	2.550e-030	-29.527	-29.593	-0.067
CuCl2		1.760e-031	1.760e-031	-30.754	-30.754	0.000
Cu(NO3)2		2.734e-033	2.734e-033	-32.563	-32.563	0.000
Cu(OH)4-2		3.730e-036	2.020e-036	-35.428	-35.695	-0.266
CuCl3-		9.949e-037	8.732e-037	-36.002	-36.059	-0.057
CuCl4-2		0.000e+000	0.000e+000	-40.928	-41.147	-0.218
Cu2(OH)2+2		0.000e+000	0.000e+000	-44.742	-45.008	-0.266
Fe(2)	1.972e-007					
Fe(HS)2		1.745e-007	1.745e-007	-6.758	-6.758	0.000
Fe+2		1.747e-008	9.464e-009	-7.758	-8.024	-0.266
Fe(HS)3-		3.186e-009	2.733e-009	-8.497	-8.563	-0.067
FeSO4		1.379e-009	1.379e-009	-8.860	-8.860	0.000
FeHCO3+		6.039e-010	5.349e-010	-9.219	-9.272	-0.053
FeOH+		8.230e-012	7.258e-012	-11.085	-11.139	-0.055
Fe(OH)2		8.762e-017	8.762e-017	-16.057	-16.057	0.000
Fe(OH)3-		2.585e-018	2.280e-018	-17.588	-17.642	-0.055
Fe(3)	2.375e-016					
Fe(OH)2+		2.362e-016	2.087e-016	-15.627	-15.681	-0.054
Fe(OH)3		1.042e-018	1.042e-018	-17.982	-17.982	0.000
Fe(OH)4-		2.394e-019	2.114e-019	-18.621	-18.675	-0.054
FeOH+2		2.553e-021	1.544e-021	-20.593	-20.811	-0.218
FeSO4+		3.743e-025	3.301e-025	-24.427	-24.481	-0.055
Fe+3		2.616e-025	8.199e-026	-24.582	-25.086	-0.504
Fe(SO4)2-		7.352e-027	6.307e-027	-26.134	-26.200	-0.067

FeCl+2		1.623e-027	9.815e-028	-26.790	-27.008	-0.218
FeNO3+2		2.701e-028	1.463e-028	-27.568	-27.835	-0.266
FeCl2+		7.700e-030	6.790e-030	-29.114	-29.168	-0.055
FeCl3		5.320e-034	5.320e-034	-33.274	-33.274	0.000
Fe2(OH)2+4		1.983e-039	1.705e-040	-38.703	-39.768	-1.065
Fe3(OH)4+5		0.000e+000	0.000e+000	-52.722	-54.387	-1.665
H(0)	1.606e-010					
H2		8.028e-011	8.062e-011	-10.095	-10.094	0.002
Mg	3.171e-004					
Mg+2		2.851e-004	1.702e-004	-3.545	-3.769	-0.224
MgSO4		1.963e-005	1.963e-005	-4.707	-4.707	0.000
MgHCO3+		1.220e-005	1.071e-005	-4.914	-4.970	-0.057
MgCO3		2.088e-007	2.088e-007	-6.680	-6.680	0.000
MgOH+		1.031e-009	9.149e-010	-8.987	-9.039	-0.052
Mn(2)	8.928e-005					
Mn+2		7.886e-005	4.271e-005	-4.103	-4.369	-0.266
MnHCO3+		5.939e-006	5.238e-006	-5.226	-5.281	-0.055
MnSO4		4.417e-006	4.417e-006	-5.355	-5.355	0.000
MnCl+		4.778e-008	4.213e-008	-7.321	-7.375	-0.055
MnNO3+		4.704e-009	4.036e-009	-8.327	-8.394	-0.067
MnOH+		2.344e-009	2.067e-009	-8.630	-8.685	-0.055
MnCl2		4.663e-011	4.663e-011	-10.331	-10.331	0.000
Mn(NO3)2		6.348e-013	6.348e-013	-12.197	-12.197	0.000
MnCl3-		1.141e-014	1.006e-014	-13.943	-13.997	-0.055
Mn(OH)3-		7.669e-019	6.763e-019	-18.115	-18.170	-0.055
Mn(OH)4-2		3.634e-025	2.198e-025	-24.440	-24.658	-0.218
Mn(3)	8.250e-035					
Mn+3		8.250e-035	2.586e-035	-34.084	-34.587	-0.504
Mn(6)	0.000e+000					
MnO4-2		0.000e+000	0.000e+000	-89.646	-89.865	-0.218
Mn(7)	0.000e+000					
MnO4-		0.000e+000	0.000e+000	-104.095	-104.154	-0.059
N(-3)	4.216e-004					
NH4+		4.089e-004	3.561e-004	-3.388	-3.448	-0.060
NH3		9.477e-006	9.477e-006	-5.023	-5.023	0.000
NH4SO4-		3.256e-006	2.872e-006	-5.487	-5.542	-0.055
CaNH3+2		1.423e-008	7.706e-009	-7.847	-8.113	-0.266
Ca(NH3)2+2		1.150e-014	6.229e-015	-13.939	-14.206	-0.266
CuNH3+2		6.256e-025	3.388e-025	-24.204	-24.470	-0.266
N(5)	6.860e-005					
NO3-		6.782e-005	5.962e-005	-4.169	-4.225	-0.056
CaNO3+		7.775e-007	6.670e-007	-6.109	-6.176	-0.067
MnNO3+		4.704e-009	4.036e-009	-8.327	-8.394	-0.067
Mn(NO3)2		6.348e-013	6.348e-013	-12.197	-12.197	0.000
ZnNO3+		5.816e-016	4.989e-016	-15.235	-15.302	-0.067
PbNO3+		5.448e-019	4.674e-019	-18.264	-18.330	-0.067
CdNO3+		2.133e-020	1.829e-020	-19.671	-19.738	-0.067
Zn(NO3)2		5.179e-021	5.179e-021	-20.286	-20.286	0.000
Pb(NO3)2		6.106e-023	6.106e-023	-22.214	-22.214	0.000
Cd(NO3)2		2.934e-025	2.934e-025	-24.533	-24.533	0.000
CuNO3+		4.794e-028	4.113e-028	-27.319	-27.386	-0.067
FeNO3+2		2.701e-028	1.463e-028	-27.568	-27.835	-0.266
Cu(NO3)2		2.734e-033	2.734e-033	-32.563	-32.563	0.000
O(0)	0.000e+000					
O2		0.000e+000	0.000e+000	-78.107	-78.106	0.002
Pb	2.174e-008					
Pb(HS)2		2.167e-008	2.167e-008	-7.664	-7.664	0.000

	Pb(HS)3-	7.248e-011	6.218e-011	-10.140	-10.206	-0.067
	PbCO3	3.558e-015	3.558e-015	-14.449	-14.449	0.000
	PbHCO3+	2.187e-015	1.876e-015	-14.660	-14.727	-0.067
	Pb+2	9.418e-016	5.624e-016	-15.026	-15.250	-0.224
	PbSO4	2.073e-016	2.073e-016	-15.683	-15.683	0.000
	PbOH+	1.658e-016	1.422e-016	-15.781	-15.847	-0.067
	Pb(CO3)2-2	3.988e-017	2.160e-017	-16.399	-16.666	-0.266
	PbCl+	1.408e-017	1.208e-017	-16.851	-16.918	-0.067
	Pb(SO4)2-2	1.736e-018	9.400e-019	-17.761	-18.027	-0.266
	PbNO3+	5.448e-019	4.674e-019	-18.264	-18.330	-0.067
	Pb(OH)2	4.526e-019	4.526e-019	-18.344	-18.344	0.000
	PbCl2	3.835e-020	3.835e-020	-19.416	-19.416	0.000
	Pb(NO3)2	6.106e-023	6.106e-023	-22.214	-22.214	0.000
	Pb(OH)3-	5.311e-023	4.556e-023	-22.275	-22.341	-0.067
	PbCl3-	1.767e-023	1.516e-023	-22.753	-22.819	-0.067
	PbCl4-2	7.288e-027	3.947e-027	-26.137	-26.404	-0.266
	Pb(OH)4-2	2.074e-027	1.123e-027	-26.683	-26.950	-0.266
	Pb2OH+3	5.037e-030	1.267e-030	-29.298	-29.897	-0.599
	Pb3(OH)4+2	0.000e+000	0.000e+000	-42.855	-43.121	-0.266
	Pb4(OH)4+4	0.000e+000	0.000e+000	-53.058	-54.124	-1.065
S(-2)	4.682e-004					
	H2S	2.890e-004	2.890e-004	-3.539	-3.539	0.000
	HS-	1.677e-004	1.438e-004	-3.776	-3.842	-0.067
	ZnS(HS)-	4.527e-006	3.883e-006	-5.344	-5.411	-0.067
	Zn(HS)2	3.974e-007	3.974e-007	-6.401	-6.401	0.000
	S5-2	3.761e-007	2.037e-007	-6.425	-6.691	-0.266
	S6-2	3.493e-007	1.892e-007	-6.457	-6.723	-0.266
	Fe(HS)2	1.745e-007	1.745e-007	-6.758	-6.758	0.000
	Zn(HS)3-	1.270e-007	1.089e-007	-6.896	-6.963	-0.067
	S4-2	9.073e-008	4.914e-008	-7.042	-7.309	-0.266
	Cu(S4)2-3	2.356e-008	1.185e-008	-7.628	-7.926	-0.298
	Pb(HS)2	2.167e-008	2.167e-008	-7.664	-7.664	0.000
	S3-2	1.302e-008	7.050e-009	-7.885	-8.152	-0.266
	CuS4S5-3	4.263e-009	2.207e-009	-8.370	-8.656	-0.286
	Fe(HS)3-	3.186e-009	2.733e-009	-8.497	-8.563	-0.067
	Cd(HS)2	1.756e-009	1.756e-009	-8.756	-8.756	0.000
	S2-2	1.108e-009	5.998e-010	-8.956	-9.222	-0.266
	Cu(HS)3-	5.311e-010	4.556e-010	-9.275	-9.341	-0.067
	ZnS(HS)2-2	2.106e-010	1.140e-010	-9.677	-9.943	-0.266
	Pb(HS)3-	7.248e-011	6.218e-011	-10.140	-10.206	-0.067
	Cd(HS)3-	2.338e-011	2.006e-011	-10.631	-10.698	-0.067
	Zn(HS)4-2	1.003e-012	5.432e-013	-11.999	-12.265	-0.266
	CdHS+	8.896e-013	7.631e-013	-12.051	-12.117	-0.067
	Cd(HS)4-2	8.367e-013	4.531e-013	-12.077	-12.344	-0.266
	S-2	2.759e-015	1.668e-015	-14.559	-14.778	-0.218
S(6)	1.709e-003					
	SO4-2	1.260e-003	7.526e-004	-2.900	-3.123	-0.224
	CaSO4	4.211e-004	4.211e-004	-3.376	-3.376	0.000
	MgSO4	1.963e-005	1.963e-005	-4.707	-4.707	0.000
	MnSO4	4.417e-006	4.417e-006	-5.355	-5.355	0.000
	NH4SO4-	3.256e-006	2.872e-006	-5.487	-5.542	-0.055
	HSO4-	4.356e-009	3.832e-009	-8.361	-8.417	-0.056
	FeSO4	1.379e-009	1.379e-009	-8.860	-8.860	0.000
	AlSO4+	3.904e-010	3.435e-010	-9.408	-9.464	-0.056
	Al(SO4)2-	5.073e-012	4.463e-012	-11.295	-11.350	-0.056
	ZnSO4	3.983e-013	3.983e-013	-12.400	-12.400	0.000
	Zn(SO4)2-2	5.793e-015	3.137e-015	-14.237	-14.503	-0.266

PbSO4		2.073e-016	2.073e-016	-15.683	-15.683	0.000
CdSO4		7.101e-018	7.101e-018	-17.149	-17.149	0.000
Pb(SO4)2-2		1.736e-018	9.400e-019	-17.761	-18.027	-0.266
Cd(SO4)2-2		1.723e-019	9.329e-020	-18.764	-19.030	-0.266
FeSO4+		3.743e-025	3.301e-025	-24.427	-24.481	-0.055
CuSO4		2.574e-025	2.574e-025	-24.589	-24.589	0.000
Fe(SO4)2-		7.352e-027	6.307e-027	-26.134	-26.200	-0.067
Zn	5.051e-006					
ZnS(HS)-		4.527e-006	3.883e-006	-5.344	-5.411	-0.067
Zn(HS)2		3.974e-007	3.974e-007	-6.401	-6.401	0.000
Zn(HS)3-		1.270e-007	1.089e-007	-6.896	-6.963	-0.067
ZnS(HS)2-2		2.106e-010	1.140e-010	-9.677	-9.943	-0.266
Zn+2		4.869e-012	2.907e-012	-11.313	-11.537	-0.224
Zn(HS)4-2		1.003e-012	5.432e-013	-11.999	-12.265	-0.266
ZnHCO3+		4.811e-013	4.127e-013	-12.318	-12.384	-0.067
ZnSO4		3.983e-013	3.983e-013	-12.400	-12.400	0.000
ZnCO3		3.521e-013	3.521e-013	-12.453	-12.453	0.000
ZnOH+		6.528e-015	5.600e-015	-14.185	-14.252	-0.067
Zn(SO4)2-2		5.793e-015	3.137e-015	-14.237	-14.503	-0.266
ZnCl+		5.555e-015	4.876e-015	-14.255	-14.312	-0.057
ZnOHCl		7.540e-016	7.540e-016	-15.123	-15.123	0.000
ZnNO3+		5.816e-016	4.989e-016	-15.235	-15.302	-0.067
Zn(OH)2		4.669e-016	4.669e-016	-15.331	-15.331	0.000
ZnCl2		2.374e-018	2.374e-018	-17.624	-17.624	0.000
Zn(OH)3-		2.746e-019	2.355e-019	-18.561	-18.628	-0.067
Zn(NO3)2		5.179e-021	5.179e-021	-20.286	-20.286	0.000
ZnCl3-		1.540e-021	1.352e-021	-20.812	-20.869	-0.057
Zn(OH)4-2		1.743e-024	9.438e-025	-23.759	-24.025	-0.266
ZnCl4-2		7.364e-025	4.453e-025	-24.133	-24.351	-0.218

------------------------------Saturation indices------------------------------
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Phase	SI	log IAP	log KT	
Al(OH)3(am)	-1.10	11.13	12.23	Al(OH)3
Al2O3	-0.72	22.26	22.98	Al2O3
Al4(OH)10SO4	4.69	27.39	22.70	Al4(OH)10SO4
AlOHSO4	-2.76	-5.99	-3.23	AlOHSO4
Anglesite	-10.43	-18.37	-7.94	PbSO4
Anhydrite	-1.38	-5.64	-4.27	CaSO4
Anilite	5.00	-29.22	-34.22	Cu0.25Cu1.5S
Antlerite	-55.05	-46.27	8.79	Cu3(OH)4SO4
Aragonite	-0.05	-8.20	-8.15	CaCO3
Artinite	-10.36	0.78	11.15	MgCO3:Mg(OH)2:3H2O
Atacamite	-38.13	-29.53	8.59	Cu2(OH)3Cl
Azurite	-52.82	-68.50	-15.68	Cu3(OH)2(CO3)2
Bianchite	-12.90	-14.66	-1.76	ZnSO4:6H2O
Birnessite	-28.16	-10.07	18.09	MnO2
Bixbyite	-28.13	-27.18	0.96	Mn2O3
BlaubleiI	2.45	-21.71	-24.16	Cu0.9Cu0.2S
BlaubleiII	2.10	-25.18	-27.28	Cu0.6Cu0.8S
Boehmite	1.04	11.13	10.09	AlOOH
Brochantite	-73.81	-55.98	17.83	Cu4(OH)6SO4
Brucite	-8.08	10.23	18.31	Mg(OH)2
Calcite	0.18	-8.20	-8.38	CaCO3
Cd(OH)2	-17.15	-2.28	14.86	Cd(OH)2

Cd(OH)2(am)	-17.13	-2.28	14.85	Cd(OH)2
Cd3(OH)2(SO4)2	-47.81	-41.10	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-46.53	-23.97	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-54.66	-26.26	28.40	Cd4(OH)6SO4
CdCl2	-22.08	-22.50	-0.42	CdCl2
CdCl2:1H2O	-20.90	-22.50	-1.60	CdCl2:1H2O
CdCl2:2.5H2O	-20.49	-22.50	-2.01	CdCl2:2.5H2O
Cdmetal(alpha)	-23.81	-9.32	14.48	Cd
Cdmetal(gamma)	-23.92	-9.32	14.59	Cd
CdOHCl	-16.32	-12.39	3.94	CdOHCl
CdSO4	-19.90	-19.41	0.50	CdSO4
CdSO4:1H2O	-18.09	-19.41	-1.32	CdSO4:1H2O
CdSO4:2.67H2O	-17.77	-19.41	-1.64	CdSO4:2.67H2O
Cerrusite	-7.48	-20.93	-13.45	PbCO3
CH4(g)	-3.48	-47.83	-44.35	CH4
Chalcanthite	-24.12	-26.84	-2.72	CuSO4:5H2O
Chalcocite	4.98	-32.11	-37.08	Cu2S
Chalcopyrite	11.76	-25.42	-37.18	CuFeS2
CO2(g)	-1.48	-19.68	-18.20	CO2
Cotunnite	-16.35	-21.46	-5.12	PbCl2
Covellite	2.99	-20.56	-23.55	CuS
Cu(OH)2	-19.11	-9.71	9.40	Cu(OH)2
Cu2(OH)3NO3	-40.84	-30.65	10.19	Cu2(OH)3NO3
Cu2SO4	-36.68	-38.39	-1.70	Cu2SO4
CuCO3	-17.89	-29.39	-11.50	CuCO3
Cumetal	-4.47	-14.15	-9.68	Cu
CuOCuSO4	-48.63	-36.55	12.08	CuOCuSO4
Cupricferrite	-26.58	-17.89	8.69	CuFe2O4
Cuprite	-21.45	-21.26	0.19	Cu2O
Cuprousferrite	-6.01	-14.72	-8.71	CuFeO2
CuSO4	-30.72	-26.84	3.88	CuSO4
Diaspore	2.93	11.13	8.20	AlOOH
Djurleite	5.15	-31.34	-36.50	Cu0.066Cu1.868S
Dolomite(disordered)	-1.70	-17.64	-15.94	CaMg(CO3)2
Dolomite(ordered)	-1.06	-17.64	-16.58	CaMg(CO3)2
Epsomite	-4.62	-6.89	-2.28	MgSO4:7H2O
Fe(OH)2	-7.59	5.98	13.56	Fe(OH)2
Fe(OH)2.7Cl.3	-4.08	-7.12	-3.04	Fe(OH)2.7Cl.3
Fe2(SO4)3	-58.92	-59.54	-0.62	Fe2(SO4)3
Fe3(OH)8	-22.42	-2.20	20.22	Fe3(OH)8
Ferrihydrite	-8.22	-4.09	4.14	Fe(OH)3
FeS(ppt)	-2.06	-4.87	-2.81	FeS
Galena	2.91	-12.09	-15.00	PbS
Gibbsite	1.61	11.13	9.52	Al(OH)3
Goethite	-5.36	-4.09	1.27	FeOOH
Goslarite	-12.47	-14.66	-2.19	ZnSO4:7H2O
Greenockite	1.94	-13.13	-15.07	CdS
Greigite	-0.53	-45.56	-45.03	Fe3S4
Gypsum	-1.02	-5.64	-4.62	CaSO4:2H2O
H-Jarosite	-37.38	-46.51	-9.13	(H3O)Fe3(SO4)2(OH)6
H2S(g)	-2.83	-10.84	-8.01	H2S
Hausmannite	-30.52	35.93	66.45	Mn3O4
Hematite	-8.41	-8.17	0.24	Fe2O3
Hercynite	1.30	28.23	26.93	FeAl2O4
Huntite	-7.95	-36.53	-28.58	CaMg3(CO3)4
Hydrocerrusite	-24.33	-43.10	-18.77	Pb3(OH)2(CO3)2
Hydromagnesite	-21.60	-27.55	-5.96	Mg5(CO3)4(OH)2:4H2O

Langite	-75.60	-55.98	19.62	Cu4(OH)6SO4:H2O
Larnakite	-19.47	-19.62	-0.15	PbO:PbSO4
Laurionite	-11.98	-11.36	0.62	PbOHCl
Lepidocrocite	-5.46	-4.09	1.37	FeOOH
Lime	-23.72	11.48	35.19	CaO
Litharge	-14.79	-1.25	13.54	PbO
Mackinawite	-1.27	-4.87	-3.60	FeS
Maghemite	-14.56	-8.17	6.39	Fe2O3
Magnesioferrite	-18.39	2.06	20.45	Fe2MgO4
Magnesite	-1.73	-9.45	-7.72	MgCO3
Magnetite	-8.28	-2.20	6.09	Fe3O4
Malachite	-32.82	-39.11	-6.29	Cu2(OH)2CO3
Manganite	-12.19	13.15	25.34	MnOOH
Massicot	-15.00	-1.25	13.75	PbO
Melanothallite	-37.00	-29.93	7.07	CuCl2
Melanterite	-8.68	-11.15	-2.47	FeSO4:7H2O
Mg(OH)2(active)	-8.56	10.23	18.79	Mg(OH)2
Minium	-75.66	3.29	78.95	Pb3O4
Mn2(SO4)3	-74.94	-78.55	-3.61	Mn2(SO4)3
MnCl2:4H2O	-13.44	-10.58	2.85	MnCl2:4H2O
MnS(grn)	-1.79	-1.21	0.58	MnS
MnS(pnk)	-4.55	-1.21	3.34	MnS
MnSO4	-10.91	-7.49	3.42	MnSO4
Monteponite	-18.72	-2.28	16.43	CdO
Nantokite	-13.46	-20.74	-7.28	CuCl
Nesquehonite	-5.09	-9.45	-4.36	MgCO3:3H2O
Nsutite	-27.57	-10.07	17.50	MnO2
O2(g)	-76.37	14.08	90.44	O2
Otavite	-9.97	-21.96	-11.99	CdCO3
Pb(OH)2	-10.15	-1.25	8.90	Pb(OH)2
Pb10(OH)6O(CO3)6	-121.80	-130.56	-8.76	Pb10(OH)6O(CO3)6
Pb2(OH)3Cl	-21.40	-12.61	8.79	Pb2(OH)3Cl
Pb2O(OH)2	-28.69	-2.50	26.19	Pb2O(OH)2
Pb2O3	-56.50	4.54	61.04	Pb2O3
Pb2OCO3	-22.14	-22.18	-0.03	Pb2OCO3
Pb3O2CO3	-35.87	-23.43	12.44	Pb3O2CO3
Pb3O2SO4	-32.58	-20.87	11.70	Pb3O2SO4
Pb4(OH)6SO4	-43.22	-22.12	21.10	Pb4(OH)6SO4
Pb4O3SO4	-45.76	-22.12	23.63	Pb4O3SO4
Pbmetal	-12.52	-8.29	4.23	Pb
PbO:0.3H2O	-14.23	-1.25	12.98	PbO:0.33H2O
Periclase	-13.30	10.23	23.53	MgO
Phosgenite	-22.58	-42.39	-19.81	PbCl2:PbCO3
Plattnerite	-47.62	5.79	53.41	PbO2
Portlandite	-12.98	11.48	24.46	Ca(OH)2
Pyrite	10.48	-8.67	-19.15	FeS2
Pyrochroite	-6.81	9.63	16.44	Mn(OH)2
Pyrolusite	-28.21	16.67	44.88	MnO2
Rhodochrosite	0.51	-10.05	-10.56	MnCO3
Siderite	-3.67	-13.70	-10.03	FeCO3
Smithsonite	-7.42	-17.21	-9.80	ZnCO3
Sphalerite	3.46	-8.38	-11.84	ZnS
Spinel	-9.35	32.49	41.84	MgAl2O4
Sulfur	-1.87	-3.80	-1.94	S
Tenorite	-18.19	-9.71	8.48	CuO
Wurtzite	0.84	-8.38	-9.22	ZnS
Zincite	-10.02	2.46	12.49	ZnO

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      Zincosite        -19.65  -14.66    4.99  ZnSO4
      Zn(NO3)2:6H2O    -22.99  -19.99    3.00  Zn(NO3)2:6H2O
      Zn(OH)2           -9.74    2.46   12.20  Zn(OH)2
      Zn(OH)2(am)      -11.05    2.46   13.51  Zn(OH)2
      Zn(OH)2(beta)    -10.36    2.46   12.82  Zn(OH)2
      Zn(OH)2(epsilon)  -10.12    2.46   12.59  Zn(OH)2
      Zn(OH)2(gamma)    -9.27    2.46   11.73  Zn(OH)2
      Zn2(OH)2SO4      -19.70  -12.20    7.50  Zn2(OH)2SO4
      Zn2(OH)3Cl       -20.37   -5.18   15.19  Zn2(OH)3Cl
      Zn3O(SO4)2       -49.09  -26.86   22.23  Zn3O(SO4)2
      Zn4(OH)6SO4      -35.67   -7.27   28.40  Zn4(OH)6SO4
      Zn5(OH)8Cl2      -46.40   -7.90   38.50  Zn5(OH)8Cl2
      ZnCl2            -25.73  -17.75    7.98  ZnCl2
      ZnCO3:1H2O        -6.95  -17.21  -10.26  ZnCO3:1H2O
      Znmetal          -32.34   -4.57   27.76  Zn
      ZnO(active)       -9.87    2.46   12.33  ZnO
      ZnS(am)            0.87   -8.38   -9.25  ZnS
      ZnSO4:1H2O       -14.59  -14.66   -0.07  ZnSO4:1H2O

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End of simulation.
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Reading input data for simulation 2.
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End of run.
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