

APPENDIX 4-S
KSM PROJECT HDS PILOT PLANT



**An Investigation into
KSM PROJECT HDS PILOT PLANT**

prepared for

SEABRIDGE GOLD

Project 1298 – Final Report
January 11, 2013

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Executive Summary

SGS was requested by Rescan Environmental to conduct a high density sludge process pilot plant study for lime neutralization of ARD solution. The pilot plant test work was initiated to allow the determination of optimum operating conditions for the high density sludge (HDS) process to produce acceptable quality effluent and minimize reagent consumption. In addition, it was essential to obtain high density sludge and determine the ultimate sludge density that can be achieved with an HDS process. Standard HDS design was adopted with neutralization using lime in two reactor tanks followed by solid/liquid separation in a conventional clarifier. During the pilot program, the sludge density was consistently increasing with a maximum sludge density of 19% solids. Typically, HDS pilot plants are operated for a minimum of three weeks so all the transitional sludge (combination of low density and high density) is converted to high density and the underflow density tends to level off; however, for the KSM pilot plant the density continued to increase as the pilot plant was terminated after the 9th day of operation due to lack of feed water. Based on experience of similar projects, the sludge density in large scale plants is expected to be above 25% solids in the clarifier underflow. In general, due to high compression zone in the industrial plant, the sludge density is higher than what is experienced during pilot plant trials. The pilot plant clarifier was operated with a sludge bed depth of less than 4 inches which did not allow sufficient retention time or compression for the sludge to release water.

Several operating parameters such as pH, sludge recycle rates and retention times were tested to optimize the operating conditions. Two operating pH values of 9.5 and 10.5 were tested. Most metals of concern were within the discharge limit with the exception of aluminum which was high at 11 mg/L when operated at a pH above 9.0. However, the clarifier overflow was acidified to pH 7.5 using 1N H₂SO₄ and the dissolved aluminum concentration after acidification was below 0.145 mg/L.

Three retention times were also tested and ranged from 40 to 90 minutes in both reactor tanks. Longer retention time did not significantly impact the metal concentrations in the effluent; however, a slight improvement in metal concentration was observed with longer retention time. The aluminum concentration after 90 minutes was still high at 2.3 mg/L and required pH adjustment to the clarifier overflow.

Observed lime consumption in the pilot study with a 90 minute retention time and pH 10.5 with an underflow recycle ratio of approximately 35:1 was 0.83 kg/m³. In a typical HDS plant with similar solids loading, polymer addition rate is usually between 1.0-1.5 mg/L and the expected TSS in the clarifier overflow could be below 10 mg/L with rise rate of 1.0 m/hr or lower in the clarifier. Measurements of TSS from the small clarified were in the 8 to 12 mg/l range.

Based on the results of the pilot plant trials a full scale HDS system using lime neutralization to treat ARD should provide effluent with low metal concentrations and produce a sludge density of 25% solids or higher. However, the clarifier overflow should go through a pH adjustment stage prior to discharge. Although an industrial plant retention time of 40 minutes is sufficient, safety should be included within the design and a longer retention time of 60 minutes is recommended which should improve lime utilization.

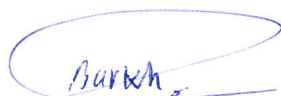
Introduction

Seabridge Gold Inc's KSM project is a proposed gold/copper mine located near the town of Stewart, British Columbia. The project is currently undergoing an environmental assessment and as part of this phase is exploring options for treating acid rock drainage (ARD). SGS Canada Inc. (SGS) was tasked by Rescan Environmental Services Ltd. (Rescan) to conduct a pilot-scale program of the high density sludge (HDS) process for treatment of ARD.

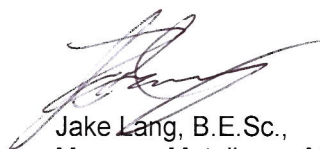
The predicted water quality indicates the proposed ARD for the KSM project will contain elevated levels of iron, arsenic, copper, zinc, and various other metals. Due to the high predicted iron concentration, any neutralization using lime will result in very high volume of sludge. Therefore, based on past experience with similar feed types, an HDS circuit was recommended as the most suitable process to achieve acceptable effluent water quality and maximize sludge density.

The pilot plant testing was carried out to demonstrate the effectiveness of the HDS process for the removal of dissolved metals (specifically Fe, Cu, Zn, As, Se and Hg) and other constituents from the ARD solution and determine design parameters such as operating pH, retention time and sludge density for the treatment plant. Previous bench-scale testing, conducted by SGS for the KSM Project, had indicated that neutralization to pH 10.5 would be sufficient to precipitate iron and other metals of concern to below the target discharge level. As a result the operating pH was maintained at 10.5 for most of the pilot campaign; however, several retention times were tested in order to determine the impact of retention time on effluent quality.

The study was carried out at the SGS Burnaby, BC facility and operated continuously (24 hours per day) beginning October 20, 2012 and completing October 29, 2012. This report provides the fundamentals of the HDS process describing the experimental approach, equipment and provides the experimental results, interpretation and conclusions. The test data, graphs and analytical results from the experiments are provided in the appendices.



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Testwork Summary

1. Project Objective

A pilot plant study was undertaken to optimize conditions for operating a High Density Sludge Plant for the treatment of acid rock drainage and review the expected effect of the HDS process on selenium ions. The pilot plant study determined the impact of iron and acid concentration on the process, operating parameters, agitation, and reagent requirements. The effluent quality and sludge density characteristics are critical in order to determine settling/thickening rate and filtering to size the clarifier. Success of the project was based upon a predetermined set of performance guidelines regarding effluent quality and sludge density as discussed by SGS and Rescan,

- Produce an effluent which would meet discharge target levels in both suspended solids and dissolved metals (water quality)
- Determine the optimum pH and reaction time for oxidation of dissolved iron and metals removal
- Determine the maximum percent solids in the clarifier underflow with lime neutralization
- Determine the recycle ratio, which results in sufficient sludge density; minimize gypsum scale build up on equipment, and minimal reagent consumption
- Generation of data to establish Process Optimization and operating parameters

1.1. Background

The test program was designed for continuous (24 hours/day) pilot plant operation. Commercial grade hydrated lime was used for neutralization and determining the lime requirements. The main indicators that were used during the pilot scale testing to evaluate treatment efficiency were the effluent water quality and density (or specific gravity) of the clarifier underflow sludge. The primary focus was the reduction of iron, copper, aluminum, manganese, selenium, zinc, arsenic, mercury and TSS concentrations in the effluent as the clarifier overflow was further tested for toxicity.

Based on SGS experience with HDS systems and batch test results, conducted during October 2011, the pilot plant commissioning operating pH of 10.5 was selected. The recycle ratio was set very high (about 30:1 dry basis) during the commissioning phase (~96 hrs) while a circulating load of sludge inventory was built up in the system. The recycle ratio was varied during the pilot study from 15:1 to 35:1 in order to determine the impact of low recycle rate on reagent consumption and effluent quality. The retention time was also varied from 40 to 90 minutes during the pilot plant trial to develop an understanding for the influence of residence time on effluent quality.

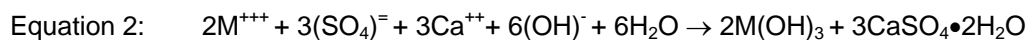
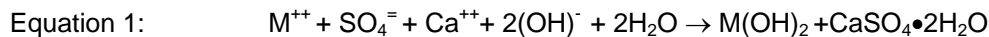
During commissioning, the target operating pH in Reactor #1 was maintained at 10.5 and was adjusted with a pH controller that pumped hydrated lime slurry prepared at 15% solids to maintain the set pH within +/- 0.1 pH units.

1.2. The HDS Process

The effective removal of base metals in a chemically stable form in the HDS process is achieved by co-precipitation with iron on the surfaces of the recycled sludge particles. The chemical stability of the precipitates is favourably influenced by a high iron to total metals ratio in the treatment plant feed. A simple recycle is sometimes not sufficient to change metal ratios and in extreme examples, iron may have to be added. Otherwise, the storage site for the sludge produced must allow for the possibility of long term instability. In all cases, the oxidation of ferrous iron to ferric iron is the principal oxygen-consuming reaction, and oxygen mass transfer into solution is the rate controlling reaction influencing reactor tank sizing. Oxygen transfer should be closely considered during agitator design.

Designed plant throughput is also influenced by the volume of water to be treated. For example, seasonal changes will determine variations in run-off, much of which may have to be treated. Increased flow may be accompanied by a dilution of contaminants, both acid and metal, and the resulting plant influent may require reduced oxidation and/or residence time, thus compensating for the increased flow.

The near-complete precipitation of the metals as hydroxides in the neutralization process proceeds according to the following reactions:



As implied by the equations above, the products of these reactions are metal hydroxide precipitates and calcium sulphate (gypsum). If the sulphate concentration of the wastewater is high enough, there will be sufficient gypsum produced to exceed its solubility and it will precipitate with the sludge.

The main features of the HDS process can be summarized as follows: hydrated lime and recycled sludge are added to the lime-sludge mix tank at the head of the process, providing the main neutralization agent. This mixture is discharged to the rapid mix tank where it is mixed with influent, thereby achieving neutralization. This mixture is fed to the main lime reactor where a combination of aggressive aeration and high shear agitation ensures optimum process chemistry and subsequent clarifier performance. The discharge from the lime reactor is treated with flocculent in the flocculation tank. In the final step, the clarifier separates the treated effluent from the sludge, a portion of which is recycled to the head of the process.

The HDS process is normally run at a pH greater than 9.5, as most metals encountered will precipitate at or below this concentration of hydroxide ions. Oxidation of ferrous to ferric iron takes place rapidly at this pH, with air being the most common oxidizing agent.

For efficiency, the process relies on sludge recycle from a treated effluent. In most plants this is achieved through a unit operation similar to a thickener/clarifier which provides sludge that has the ability to pump underflow as the separated solids product. Recycling sludge from a settling pond or from filters are alternatives but they may present handling problems.

2. Pilot Plant Trial

A pilot plant program was established to determine HDS water treatment effluent quality and to provide plant optimization criteria for the HDS treatment plant. The testwork was designed to confirm the effectiveness of an HDS process utilizing lime at operating pH of 10.5. Acid rock drainage solution was collected on site and shipped to the SGS facility located in Burnaby, BC for the pilot study. The solution was spiked according to the composition provided by Rescan to generate synthetic feed solution that would simulate the predicted ARD water quality. The quality control on the feed solution was provided by Rescan.

2.1. Synthetic Feed Preparation

Two 5,000L batches of the synthetic solution were prepared according to the composition provided by Rescan and indicated in Table 1. After the reagents were added and allowed to mix for a minimum of 6 hours, three profile samples (bottom, middle and top of the tank) of the 5,000L tank were obtained to ensure that the solution was homogenous and the water quality was similar to the predicted water quality outlined by Table 1.

Acid rock drainage water collection and delivery to SGS was the responsibility of Rescan. The ARD water was then split into two 5,000L batches and spiked using laboratory grade reagents as summarized in Table 1. Water for the testwork was collected from the upper Mitchell Creek below the toe of the Mitchell Glacier. An agitator was mounted on top of the 5,000L tank as well as a re-circulating loop was pumped at 8 gallons per minute to properly recycle the solution and provide a consistent feed to the plant. After 24 hours of mixing, three samples from top, middle and bottom of the tank were collected and submitted for analysis to assure homogeneity of each feed solution. The results are provided in Appendix H. After processing 3,500L of Batch #1, the remaining water was transferred into two 1m³ totes, and the second batch was prepared to avoid any interruption during piloting.

Table 1: Synthetic Feed Composition (mg/L)

	Mitchell Creek Water	Predicted Water Quality	Added As	Batch-1	Batch-2
pH	3.09	2.6		2.79	2.73
Aluminum	6.89	35	Al ₂ SO ₄ *18H ₂ O	34.4	34.1
Antimony	<0.00010	0.005	AA Standard	0.0009	0.0018
Arsenic	0.00044	0.162	AA Standard	0.129	0.153
Barium	0.0368	0.015	-	0.091	0.0975
Beryllium	0.00206	0.02	-	0.00277	0.0187
Boron	<0.010	0.05	-	<0.020	<0.05
Cadmium	0.0207	0.0314	3CdSO ₄ *8H ₂ O	0.0446	0.0418
Calcium	30.4	150	-	54.3	165
Chromium	0.00039	0.02	Cr K(SO ₄) ₂ *12H ₂ O	0.0242	0.0224
Cobalt	0.0217	0.45	CoSO ₄ *7H ₂ O	0.487	0.518
Copper	2.45	25	CuSO ₄ *5H ₂ O	20.6	24.9
Iron	13.9	300	Fe ₂ (SO ₄) ₃ *XH ₂ O	234	257
Lead	0.0247	0.04	Pb(NO ₃) ₂	0.038	0.034
Lithium	0.00840	0.038	-	0.012	0.012
Magnesium	4.99	17.2	MgSO ₄	24	24.8
Manganese	2.29	15	MnSO ₄ *H ₂ O	13.8	16.6
Mercury	<0.000010	0.00005	AA Standard	2.5E-05	3.3E-05
Molybdenum	<0.000050	0.23	MoS ₂	0.151	0.0135
Nickel	0.00774	0.147	NiSO ₄ *6H ₂ O	0.188	0.196
Phosphorous	<0.30	20	-	<0.3	<0.3
Potassium	0.526	1.8	K ₂ SO ₄	1.76	1.94
Selenium	0.00054	0.120	Se(VI) Std. plus Se(IV)	0.128	0.13
Silver	0.000031	0.005	AgNO ₃	0.0044	0.00485
Sodium	<2.0	4.1	Na ₂ SO ₄	5.8	4.17
Strontium	0.246	0.8	SrCl ₂ *6H ₂ O	0.737	0.804
Zinc	1.37	3.2	ZnSO ₄ *7H ₂ O	3.64	3.52
Sulphate	222	1850	CaSO ₄	1170	1540

3. Lime Preparation

The lime used for testing was commercial grade with specifications shown in Table 2.

Table 2: Lime Specifications

Product Specs	%Mg	%CaO	Ca(OH) ₂ Equivalent
Hydrated Lime	1	70.6	93.3

The lime slurry was prepared at 10% solids (w/v) using tap water. There are three different sources for tap water in Burnaby; the average water quality of those water sources is illustrated in Appendix A. To

prepare 10% lime solution, 1.5 kg of lime was mixed with water in a 20L pail to produce 15L batches and transferred to the lime stock tank.

4. Flocculent Preparation

Flocculent (Magnafloc-10) was prepared at 0.25 g/L, using tap water. In order to prepare flocculent solution, a vortex was initially generated using a variable speed mixer in a 20L batch of water to which 5 grams of flocculent was slowly introduced into the vortex. After the addition, the solution was stirred gently for 60 to 120 minutes to completely dissolve the flocculent in the water.

5. Pilot Plant Setup

The pilot plant was set up in a standard HDS configuration. The pilot plant consisted of:

- One 0.6L Lime/Recycled sludge mix tank;
- Two 24L reactor tanks equipped with a dual impeller;
- One 1.5L flocculent mix tank with a variable speed agitator;
- One 20L lime slurry feed tank;
- 16 inch diameter clarifier providing a 3-4 hour retention time for solid/liquid separation.

As shown in Figure 2, monitors and controls were mounted on a panel behind the equipment. The feed water was pumped from a 5,000L holding tank into Reactor #1 using a variable speed peristaltic pump; the influent flow rate was maintained at a set flow rate (~750 ml/min with a 60 min retention time) to achieve the desired residence time. Lime slurry and recycled sludge were mixed vigorously in the lime/sludge mix tank, and the mixture overflowed into Reactor #1. Lime addition was controlled to maintain a pH set point in Reactor #1. The reactors were positioned in a cascade which allowed Reactor #1 overflow to gravity feed Reactor #2 and subsequently overflowed to the flocculation tank. Each reactor was equipped with a variable speed agitator and dual A310 hydrofoil impellers.

A two-reactor system was used to minimize solution short-circuiting. Although based on analysis results, which are discussed in greater detail in the following section, overflow from Reactor #1 was almost completely oxidized and metals concentration was reaching the discharge limit. As a result, 30 minutes of retention time (controlled by feeds flow rate) was sufficient to meet the discharge limit.

Air (5 L/min) was sparged into the reactors below the impeller. The flocculent solution was added into the flocculent tank using a variable speed peristaltic pump. The slurry from the flocculation tank overflowed into the clarifier feed well located in the centre of the clarifier. The clarifier overflowed into an effluent collection weir and discharged through a hose for disposal. The precipitated solids settled to the bottom

of the clarifier, forming a sludge bed. The settled sludge was recycled to the lime/sludge mix tank using a variable speed peristaltic pump or discharged from the system using the sludge purge pump. Sludge purge rate was manually controlled to maintain a constant sludge bed level height in the clarifier.

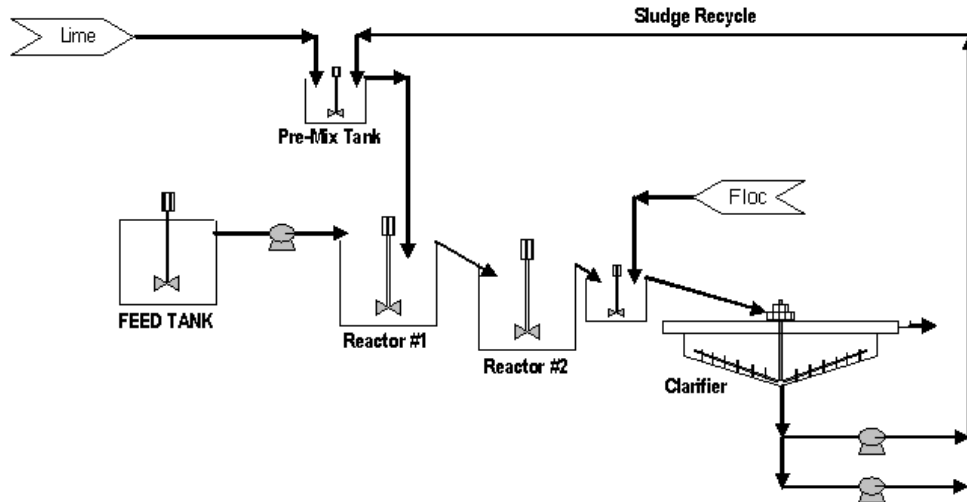


Figure 1: HDS Pilot Plant Flowsheet



Figure 2: HDS Pilot Plant

6. Process Control and Monitoring

To determine the process effectiveness and provide preliminary effluent quality information, operating parameters such as feed, flocculent and recycle flow rates as well as pH of each reactor and clarifier were measured regularly at 2 hour intervals and samples were collected for analysis at established 12 hour intervals. In addition, all pilot plant observations were recorded in a project logbook. The operator starting the shift reviewed the comments from the previous shift and made adjustments accordingly. The pilot plant project manager also reviewed the logbook and the data sheets on regular basis.

Measurements included: influent, sludge recycle, lime slurry, flocculent solution flow rates, and reactors, clarifier, and influent pH. Flowrate measurements were used to determine the residence time and lime and flocculent consumption during the testing program. The following paragraphs describe the measurement and test procedures.

6.1. Flowrate Measurement

The feed flowrate, sludge recycle and flocculent were controlled by changing the pumps speed. The influent feed, sludge recycle and flocculent addition flowrate measurements were made using a stopwatch and a graduated cylinder.

6.2. pH Measurement

The pH of each reactor vessel and the clarifier overflow were measured and recorded every two hours. The probes connected to the pH controllers were acid cleaned and calibrated with standardized pH buffers every 4 hours.

7. Process Samples

7.1. Effluent Water Samples

Reactor slurry samples and effluent water samples were collected once per shift (every 12 hours) for analysis. The solution samples were submitted to ALS Environmental (as requested by the Rescan) for dissolved and total ICP-MS, anions, nutrients, TDS and TSS analysis.

7.2. Sludge and Filter Cake Samples

A sample of underflow sludge were collected and dried once per day to determine the % solids. Towards the end of the pilot campaign, 5L of the High Density Sludge was shipped to Delkor for filtration testwork. The filtered cake was then submitted for TCLP, modified SWEP and total digestion. Two cake thicknesses of 20 mm and 40 mm were tested and as was expected, the results indicated that a filter

cake with 60% to 62% moisture can be produced after filtration. Detailed results of the filtration test are provided in Appendix G.

8. Auxiliary Bench Testing

8.1. Settling Tests

Several settling tests were conducted for each test run by collecting a 1.0L sample from Reactor #2 overflow. An appropriate amount of flocculent was added. The slurry was mixed by inverting a 1.0L graduated cylinder end to end five times, then allowed to settle. The interfacial height between the slurry and the overflow was recorded every minute for the first 10 minutes, and after regular intervals up to 180 minutes. Then the slurry was filtered to separate water from solid. The filter paper and solid were kept for 24 hours in a low temperature oven before measuring the weight of dry solid. Another purpose of settling tests was to observe the overflow clarity for sizing the clarifier.

8.2. Solids Generation Tests

Solids generation tests were performed at each new operating condition to determine the amount of solids generated per litre of feed. A 1.0L sample of feed solution was subjected to the optimum test conditions (pH=10.5, 60 minutes retention time and no recycle) to precipitate the dissolved metals. Flocculent was added and the solids were allowed to settle. The clear overflow was decanted and the settled sludge was filtered. The filter cake was dried for a minimum of 24 hours before weighing. The solids generated were used to set the sludge recycle rate as mentioned above.

8.3. Sulphide Precipitation Tests

Since many metal sulphides are insoluble, in some case converting heavy metals to sulphide salts would increase the overall efficiency of the treatment process. To review this option SGS conducted scoping level sulphide addition beaker tests (500mL sample) to treat ARD solution.

The pH of 500mL feed water in three different beakers; #1, #2 and #3 were adjusted using sulphuric acid to pH 4.0, 4.0, and 5.5. Following this 50 mL of 1g/L sulphide was added to each beaker and allowed the solutions to react for 30 minutes. Solution of beaker #1 (at pH 4.0) was sampled for dissolved analysis and pH of the solution in beakers #2 (pH 4.0) and #3 (pH 5.5) was adjusted to 10.5 using hydrated lime. Typically, to assist with the settling of the fine sulphide precipitate, iron should be added before pH adjustment by lime; however, due to the naturally high concentration of iron in the KSM feed no iron was added. After treatment, flocculent at 2 mg/L was added and solution was allowed to settle for 60 minutes before the clear overflow was decanted from the top for analysis. To compare the results of those tests with HDS process, the feed water was treated in another beaker (#4) at pH 10.5 with HDS procedure and treated water sample was sent for dissolve analysis.

Results and Discussion

The following will provide an overview of results from process measurements, tests, and sample analysis produced from the pilot plant study. The complete details are provided in Appendices. All process irregularities and observations were noted in the project data book.

1. Process Measurements and Tests

The results of measurements and tests performed are provided in Appendix A and summarized below in Table 7 and Table 9. Influent and effluent samples from each test were submitted for ICP-MS, anions, nutrients, TDS and TSS. Detailed effluent results are presented in Appendix B. Overall, four different operating conditions; 90 minutes retention time at 10.5 pH (#1A), 60 minutes retention time at 9.5 pH (#2A), 60 minutes retention time at 10.5 pH (#3A), and 40 minutes retention time at 10.5 pH (#4A), were tested in the pilot plant. Discussion of the test results and the implications of the results on process effectiveness and design follow below.

1.1. Optimization of pH

Samples for metals ICP analysis were collected every 12 hours and submitted to ALS Environmental in Vancouver; detailed results are shown in Appendix B. The feed was neutralized to pH 9.5 and 10.5 with 60 minute retention time using hydrated lime and the results for clarifier overflow samples collected are summarized in Table 3 below. Since water (pH 2.54) from the second spiked tank was used for the last three tests, the feed quality was consistent for all discussed tests.

Table 3: Clarifier Overflow Analysis Summary for pH Optimization Tests (mg/L)

Dissolved Metals	Feed	Test #2A	Test #3A
		pH 9.6	pH 10.5
Lab pH		8.36	9.84
Aluminum (Al)-Dissolved	31.3	2.13	2.13
Antimony (Sb)-Dissolved	0.00077	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.130	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0910	0.0236	0.0173
Beryllium (Be)-Dissolved	0.0193	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.0402	0.000065	0.000085
Calcium (Ca)-Dissolved	162	626	482
Chromium (Cr)-Dissolved	0.0209	0.00418	0.00517
Cobalt (Co)-Dissolved	0.496	0.00064	<0.00050
Copper (Cu)-Dissolved	23.6	0.0032	0.0042
Iron (Fe)-Dissolved	235	<0.050	0.051
Lead (Pb)-Dissolved	0.0391	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0133	0.0112	0.0047
Magnesium (Mg)-Dissolved	24.9	18.2	1.11
Manganese (Mn)-Dissolved	15.6	0.116	0.00261
Mercury (Hg)-Dissolved	0.000042	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0146	0.0241	0.0234
Nickel (Ni)-Dissolved	0.189	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.88	1.92	1.87
Selenium (Se)-Dissolved	0.119	0.0628	0.0635
Silicon (Si)-Dissolved	6.73	0.063	0.149
Silver (Ag)-Dissolved	0.00523	<0.000050	<0.000050
Sodium (Na)-Dissolved	3.96	4.26	4.18
Strontium (Sr)-Dissolved	0.894	0.905	0.801
Thallium (Tl)-Dissolved	0.000149	0.000067	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Dissolved	0.96	0.012	<0.010
Uranium (U)-Dissolved	0.00236	<0.000050	<0.000050
Vanadium (V)-Dissolved	0.0072	<0.0050	<0.0050
Zinc (Zn)-Dissolved	3.42	<0.0050	<0.0050
Sulphate	1540	1630	1130

As shown in Table 3, most of metals of concern were removed to below the BC discharge limit, while aluminum concentration remained high at both pH values tested. Also, as expected, manganese concentration was much higher in Test #2A at pH 9.5 compared to Test #3A at pH 10.5. A similar trend was observed for several other elements including lithium, cobalt, and magnesium with better removal efficiencies at higher pH. On the other hand, pH did not seem to have any impact on removal efficiencies of several key parameters including arsenic, cadmium, copper, selenium and zinc which is most likely due to high iron to total metals ratio. Molybdenum concentration increased after HDS treatment for both pH levels tested. The change in molybdenum concentration might be due to elevated pH which facilitates dissolving more MoS_2 to the treated water. Molybdenum is typically removed at low pH (around 4.0) with high iron to molybdenum ratio (similar to Brenda mine); however, the produced sludge from this process is very unstable and small increases in pH could dissociate the sludge and return molybdenum into the solution. That phenomenon could explain why the molybdenum concentration in treated water was higher than the original molybdenum concentration.

The observed removal efficiency for selenium was approximately 47%. Based on SGS previous experiences it was expected that HDS would have no significant effect on removing selenium (VI). Since 50% of the feed solution was selenium (IV), the removal efficiency could be considered primarily for selenium (IV). To confirm the type of removed selenium, samples of treated water were submitted for selenium speciation. The results are as follows:

Table 4: Selenium Speciation Results from Pilot Plant Effluent

		µg/L	µg/L
Location	Sample	Se (IV)	Se (VI)
Pilot plant	Effluent	9.1	63.5
Pilot plant	Effluent	9.7	66.5
Average	Effluent	9.4	65

As illustrated in table 5, the total selenium removal efficiency is more than 38 %

Table 5: Total Selenium Removal

Initial Selenium (mg/L)	Final Selenium (mg/l)	% removal
0.12084	0.0744	38.43

As ICP results indicated, in all conducted tests the mercury concentration dropped down below detection limit. Therefore, it was concluded that HDS process could successfully remove mercury to below discharge limit without any future treatment.

For treatment at either pH 9.5 or 10.5, clarifier overflow solution would need to be acidified to pH 7.5-8.0 in order to precipitate aluminum. As shown in Table 6 above, a pH drop was observed between the field pH and lab pH indicating that pH may drop naturally. In any case, proper clarifier operation becomes extremely critical since any suspended solids in the clarifier overflow would dissolve back into solution during acidification. For a small scale pilot plant, it is difficult to consistently maintain low TSS concentrations as the sludge recycle flow rate is constantly being changed to increase sludge density. Furthermore, the clarifier rake was operating at much higher speed than a typical clarifier in order to move all solids to the centre of the clarifier cone. For the KSM pilot plant, the average TSS in the clarifier overflow at each test is illustrated in Table 6. The TSS was on average 8-14 mg/L.

Table 6: TSS for pH Optimization Tests (mg/L)

ITEM	Test #2A	Test #3A
Retention Time (min.)	60	60
pH	9.5	10.5
TSS (mg/l)	7.7	14.1

In an HDS system sulphate concentration in the effluent is typically between 1400 – 1800 mg/L, which is sulphate saturation in water and excess sulphate is precipitated as gypsum ($\text{CaSO}_4 \times 2\text{H}_2\text{O}$). Sulphate precipitation is dependent on calcium concentration and retention time. Sulphate concentration also showed expected trend where sulphate concentration decreased slightly at higher pH as a result of high lime addition and calcium available for gypsum precipitation. Optimized results are presented in Table 7.

Test #2A to 3A were completed to determine the optimum operating pH that would produce an effluent which meets the discharge targets as well as minimize lime consumption. Two alternative pH values (9.6 and 10.5) were tested with 60 minute retention time and the results are summarized in Table 7. As expected, the lime consumption increased from 0.55 kg/m^3 at pH 9.6 to 1.19 kg/m^3 at pH 10.5.

Table 7: Summary of Results for pH Optimization Tests

Test Parameter	Test #2A	Test #3A
Feed Rate - ml/min	632	683
Underflow Recycle Rate - ml/min	162	95
Lime Retention Time - min.	60	62
pH - Feed	2.73	2.73
pH - Reactor 1	9.67	10.62
pH - Reactor 2	9.66	10.6
pH – Clarifier Overflow	9.61	10.47
Solids Generation - g/L	1	1
Lime $\text{Ca}(\text{OH})_2$ Consumption - kg/m^3	0.55	1.19
Flocculant Consumption – mg/L	6	4
Thickener Underflow slurry density	1.1	1.12
Thickener Underflow % Solids	13.5	15.2
Sludge Recycle Ratio (dry solid ratio)	35:1	19:1

1.2. Retention Time Optimization Tests

For these retention time optimization tests, the ARD solution was neutralized to pH 10.5; however the retention time was varied from 20 minutes to 90 minutes. Results for samples collected are provided in Table 8.

Table 8: Clarifier Overflow Analysis Summary for Retention Time Optimization Tests (mg/L)

Dissolved Metals	Feed	Test #1A	Test #3A	Test #4A	Test #4A
		90 min	60 min	40 min	20 min
pH		8.89	9.84	10.64	
Aluminum (Al)-Dissolved	35.2	2.27	2.13	3.22	3.96
Antimony (Sb)-Dissolved	0.00051	<0.00020	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.135	<0.00020	<0.00050	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0935	0.0118	0.0173	0.0225	0.0277
Beryllium (Be)-Dissolved	0.0186	<0.00020	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0010	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.020	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.0430	0.000121	0.000085	0.000054	0.000058
Calcium (Ca)-Dissolved	167	341	482	526	541
Chromium (Cr)-Dissolved	0.0242	0.00422	0.00517	0.00417	0.0038
Cobalt (Co)-Dissolved	0.525	0.0002	<0.00050	<0.00050	<0.00050
Copper (Cu)-Dissolved	24.2	0.00412	0.0042	0.0082	0.0109
Iron (Fe)-Dissolved	247	0.029	0.051	0.074	0.107
Lead (Pb)-Dissolved	0.0336	<0.00010	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0128	0.0058	0.0047	0.0054	0.0067
Magnesium (Mg)-Dissolved	25.1	1.11	1.11	1.3	4.85
Manganese (Mn)-Dissolved	15.5	0.00167	0.00261	0.00461	0.00689
Mercury (Hg)-Dissolved	0.00030	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0116	0.0579	0.0234	0.0178	0.0139
Nickel (Ni)-Dissolved	0.203	<0.0010	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.97	1.36	1.87	1.9	1.98
Selenium (Se)-Dissolved	0.131	0.0463	0.0635	0.066	0.066
Silicon (Si)-Dissolved	6.68	0.112	0.149	0.152	0.092
Silver (Ag)-Dissolved	0.00457	<0.000020	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.42	4.73	4.18	4.26	4.56
Strontium (Sr)-Dissolved	0.792	0.615	0.801	0.839	0.884
Thallium (Tl)-Dissolved	0.000120	0.000027	<0.000050	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00182	0.00092	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Dissolved	0.95	0.014	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	0.00199	<0.000020	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	0.0070	<0.0020	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	3.62	<0.0020	<0.0050	<0.0050	<0.0050

Similar to previous tests, most metals with the exception of aluminum were removed with high efficiency. With extended retention time, aluminum concentration also decreased slightly as more aluminum was precipitated. However, a pH adjustment to 7.5 for aluminum precipitation would still be needed to remove aluminum to acceptable levels. As expected, several metals such as iron, magnesium and manganese showed improved removal efficiency with longer retention time. Although, the observed concentrations were suggesting that a 60 minute retention time is sufficient for water quality, the lime consumption would increase by 30% for the shorter retention time. The additional lime consumption and decreased retention time would reduce the flocculent consumption by 33%.

It should be noted that the underflow density was increasing throughout the campaign and reached as high as 19% underflow solids near the end of the pilot trial. Typically, HDS pilot plants are operated for a minimum of 3 weeks so all the transitional sludge (combination of Low Density and High Density) is converted to high density and the underflow density reaches steady-state; however, for the KSM pilot plant the density continued to increase after 9 days of running due to lack of water availability resulting in pilot plant termination. However, it should be noted that higher sludge density does not have a significant

impact on the effluent quality but rather improves the overall operation of the plant by producing lower TSS in the clarifier overflow, lower volume of sludge and slightly higher lime utilization.

Table 9: Summary of Results for Retention Time Optimization

Test Parameter	Test #1A	Test #3A	Test #4A
Feed Rate - ml/min	389	683	1018
Underflow Recycle Rate - ml/min	112	95	94
Lime Retention Time - min.	96	62	43
pH - Feed	2.79	2.73	2.73
pH - Reactor 1	10.64	10.62	10.51
pH - Reactor 2	10.61	10.6	10.6
pH – Clarifier Overflow	10.55	10.47	10.64
Solids Generation - g/L	1	1	1
Lime Ca(OH) ₂ Consumption - kg/m ³	0.83	1.19	1.15
Flocculant Consumption – mg/L	6	4	2.7
Thickener Underflow slurry density	1.09	1.12	1.15
Thickener Underflow % Solids	12.8	15.2	18.5
Sludge Recycle Ratio (dry solid ratio)	35:1	19:1	15:1

Test#4A was conducted at 40 minutes of retention time to determine optimum requirements for neutralization. The test was conducted at pH 10.5 in the clarifier overflow and the lime consumption was 1.15 kg/m³ which are significantly higher than Test#1A conducted at similar operating pH but 90 minute of retention time. The underflow density in test #4A was approximately 19% solids with a specific gravity of 1.15. Samples from each reactor tanks were also collected to determine the effluent quality at 20 and 30 minutes. In addition, the flocculent consumption was reviewed for select retention times. As it was expected the trend of flocculent consumption was opposite of the lime consumption trend. This indicates the presence of excesses lime during the test with shorter retention time was modifying the settling process and reducing required flocculent consumption. The impact of retention time on effluent chemistry is further discussed below. During the piloting campaign, the sludge recycle ratio was varied from 15:1 (dry basis) to 35:1. All recycle ratio tests were conducted at pH 10.5 in the clarifier overflow. The lime consumption at pH 10.5 varied from 0.83 kg/m³ at recycle ratio 35:1 and 90 minutes to 1.15 kg/m³ at recycle ratio 15:1 and 40minutes retention time. The lime consumption at optimum operating condition, recycle ratio 35:1 and 90 minutes retention time was 0.8 kg/m³.

2. Observations

The initial commissioning of the pilot plant was completed over a period of 96 hours and was terminated as the clarifier underflow density reached 1.09 (or %12.8 solid); however, it was expected that the clarifier underflow would continue to increase due to high metal content in the feed. Figure 3 below shows the underflow density over the duration of the pilot plant trial. The underflow sludge density continued to increase throughout the pilot campaign approaching 1.15 (~19% solids) as the pilot plant was terminated.

Based on previous pilot studies and HDS plants designed by SGS, the clarifier underflow density typically increases with scale-up to the industrial plants compared to that achieved at the pilot level as the sludge bed is considerably greater in industrial size clarifier due to the influence of a substantial compression zone to which releases water. Therefore, it is critical to account for the higher density in the industrial plant. Although the limited data from pilot plant test confirmed 19% solids (1.15 SG) it is not unusual to expect that an industrial plant would achieve greater underflow density in the 25 to 30% solid rang.

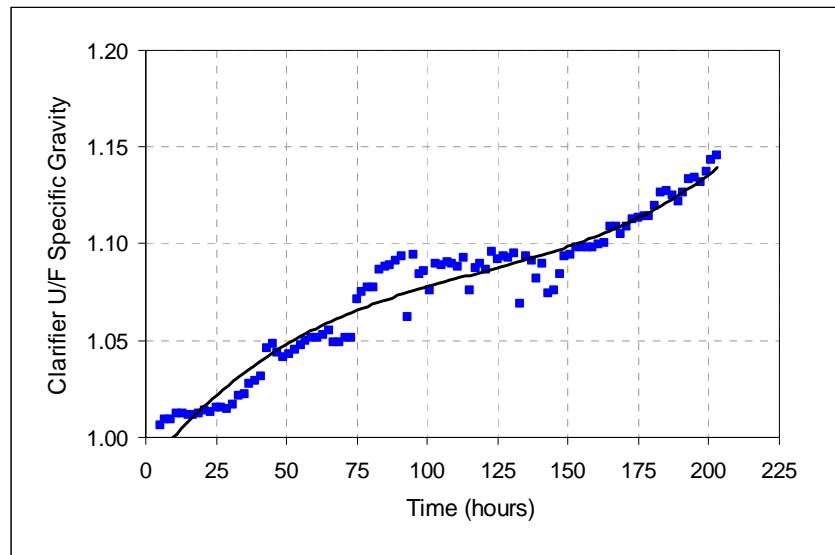


Figure 3: Clarifier Underflow Density as a Function of Operating Time

3. Clarifier Underflow

3.1. Underflow Density and Percent Solids

Clarifier underflow sludge samples were collected daily to determine the percent solids in the underflow. The clarifier underflow slurry density was proportionally related to the percent solids; Figure 4 illustrates this relationship. As the specific gravity increased, the percent solids also increased linearly.

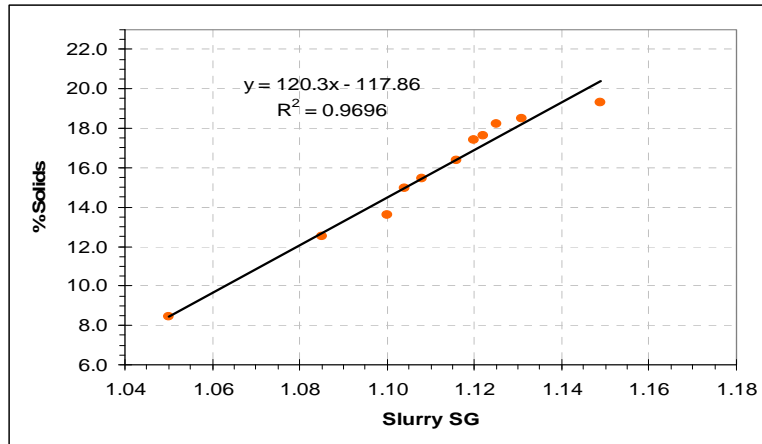


Figure 4: Percent Solids as a Function of SG

The solids percent were calculated by measuring the weight of a sludge pulp sample, and the sludge was then filtered and dried in the oven at 95°C for 24 hours. Maximum percent solids achieved during the pilot trail was 18.7% solids (or 1.15 SG). Due to low sludge production in the ARD feed (0.8 – 1.0 g/L) tested during the pilot campaign, a minimal amount of sludge per day (approximately 300 g) was discharged from the clarifier in order to build up the sludge bed.

3.2. Sludge Recycle Ratio

Sludge recycle is based on the ratio of the recycled solids to the generated solids from the feed solution. An appropriate sludge recycle ratio is critical to control the level of scale formation and maintain appropriate HDS conditions for optimal operation. Typically, scaling is reduced with higher sludge recycle as the high recycle provides increased surface area for the reaction to take place. Conversely, too high sludge recycle increases the solids concentration in the reactors which increases the mixing requirements, as well as higher flocculent requirements.

Initially, during the commissioning phase, the pilot plant was operating with 21:1 sludge recycle ratio to allow adequate solids circulation in the system. During the pilot plant, the sludge recycle ratio was varied from 15:1 to 35:1 in order to determine the impact on flocculent and lime consumptions as well as underflow density. Furthermore, the clarifier overflow clarity was observed to be similar at all recycle ratios.

Due to low sulphate concentration (below gypsum saturation limit), gypsum scaling was not expected to be a concern for this pilot plant. However, gypsum scaling is significantly reduced with an HDS system compared to conventional treatment options. The HDS system can minimize scaling with sludge recycle, as the recycled sludge provides nucleated sites for incoming particles to precipitate onto; therefore, enhancing the precipitation reactions and increasing sludge density.

3.3. Sludge Characterization

The filter cake sample was dried and submitted to ALS Environmental for TCLP, modified SWEP and total digestion. As the sludge analysis illustrated the sludge is mainly composed of gypsum (CaSO_4 , 127,000 mg/kg of calcium) and metal hydroxides, predominantly iron hydroxide (195,000 mg/kg of iron). Detailed results of the TCLP, modified SWEP and total digestion are provided in Appendix G.

4. Lime Consumption

Lime consumption in the pilot study with a 90 minute retention time at pH 10.5 with an underflow recycle ratio of approximately 35:1 is observed to be approximately 0.83 kg/m^3 . Lime is a slow-reacting agent and a 90 minute residence time is optimum for high lime utilization. This is observed in the retention time optimization tests where lime consumption (1.19 kg/m^3) increases by 30% when retention time was reduced to 60 minutes.

Typically, the HDS process produces a reduction in lime use over straight lime neutralization as a portion of un-reacted lime reports back to the lime/sludge agitation tank with the recycled sludge. Hence, lime consumption can be decreased by increasing the clarifier underflow recycle rate (not recommended as this would increase solids content in the reactors).

Results illustrating lime consumption in Table 10 for different operating conditions are as expected, with lime consumption reduced at constant pH by increasing retention time. Figure 5 illustrates the effect of retention time on lime consumption at constant operating pH.

Table 10: Lime Consumption at Different Operating Conditions

Test ID	pH	Retention time (min)	Lime consumption (kg/m^3)
1A	10.5	90	0.83
3A	10.5	60	1.19
4A	10.5	40	1.15

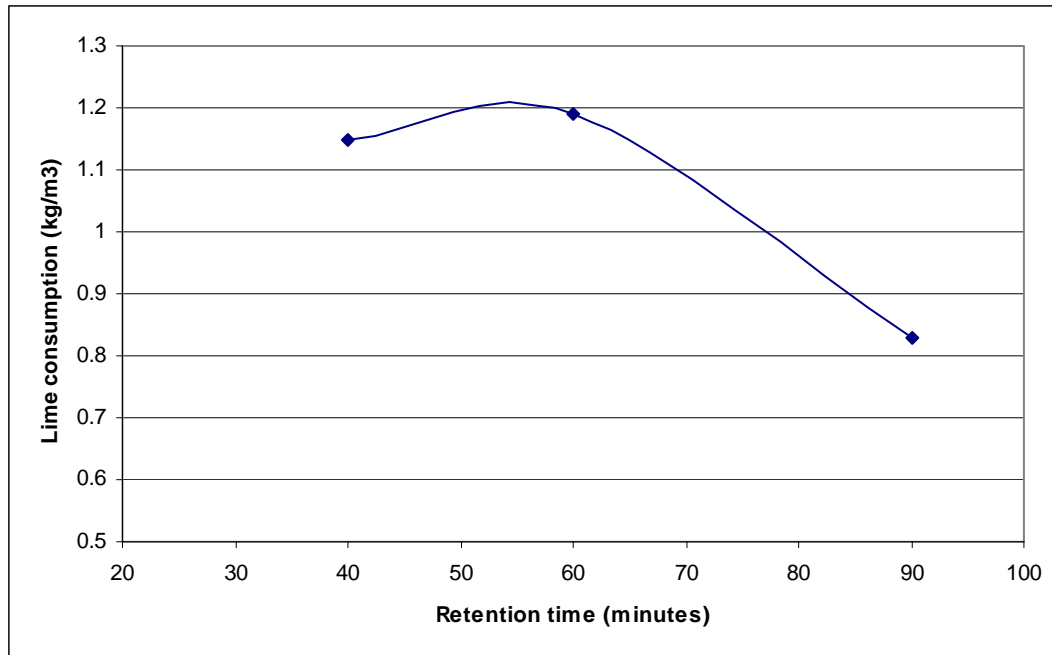


Figure 5: Lime Consumption with Retention Time (pH 10.5)

5. Flocculent Consumption

Flocculent addition affects the overflow TSS (clarity) and clarifier underflow density. High flocculation interferes with the formation of high density clarifier underflow sludge; on the other hand, insufficient flocculent could lead to high TSS in effluent. Flocculent scoping test with Magnafloc 10 were conducted before and during the neutralization pilot study (detailed analysis of flocculent scoping test is provided in Appendix D). The flocculent consumption ranged between 2.7 to 6.0 mg/L. The flocculent consumption decreased in short retention time, due to increase in un-reacted lime. The residual lime in the treated water modified the settling process and reduces the overall flocculent consumption. In a typical HDS plant with similar solids loading, the polymer addition rate is usually between 1.0 to 1.5 mg/L. Usually the total suspended solids in the effluent for a full size HDS plant is much lower than achieved in a pilot plant study with same flocculent addition due to the differences in the dynamics of a full size clarifier compared to the pilot plant clarifier.

6. Settling Test and Clarifier Sizing

One-litre samples of overflow from Reactor #2 were collected and used to conduct settling tests. The detailed results are attached in Appendix D. Tests were conducted in a 1.0L graduated cylinder. The settled pulp density after 3 hours ranged from 15 to 19%. The pulp density achieved with settling tests is lower than the clarifier underflow sludge due to the differences in the mechanics of a clarifier compared to

a 1.0L graduated cylinder. Appendix D illustrates that additional amounts of flocculent had a negative impact on both settling time and pulp density. Using 3 mL of flocculent in the first test caused a 2 minute delay in creating a clear interface at the start of the test. In addition, the observed pulp density was never higher than 14.1. During the other test carried out with 2 mL of flocculent, the clear interface appeared immediately after adding flocculent and the observed pulp density at the end of test was more than 18.5. Therefore, it was concluded that 2 mL of flocculent was the optimum amount required to improve the settling process without reducing pulp density.

7. Solids Generation

The solids generation rate is an important parameter in the design of a water treatment plant as it affects aeration recycle rate and mixing requirements, filtering and pumping and sludge disposal requirements. Test conducted at optimum condition confirmed that the average solids generation rate of the feed water was 1.05 g/L.

8. Sulphide Precipitation Tests

The sulphide test results are illustrated in Appendix F. As the results indicated, sulphide alone was not sufficient in removing heavy metals; therefore, sulphide followed by lime treatment at pH 10.5 is required. Comparing results of sulphide treatment to the HDS process (Test #4); no significant improvements were observed for most metals of concern with the exception of molybdenum which was significantly lower.

9. Toxicity Testing

Samples from Test #3A and 4A were collected and submitted for toxicity testing. The sample's initial pH was adjusted to 7.3 and 8.5 for rainbow trout and *D. magna* respectively. The results for the toxicity testing for 100% v/v solution are summarized in Table 11.

Table 11: Toxicity Test Results

Sample ID	Collection Date and Time	Type of Test	Result
PP Effluent Tox test 1	October 28, 2012 @0200h	96-h LC50 (%v/v)	>100
		48-h LC50 (%v/v) [with 95% confidence limits)	16.5 (14.5- 18.8)

Conclusions and Recommendations

The pilot test program demonstrated the viability of using the HDS process for removal of contaminants from ARD solution and determined the optimum parameters for an industrial plant. Project objectives, as outlined in the test proposal were established for the solution tested, with several conclusions and recommendations:

- Effluent with low metal concentration was regularly produced
- The optimum HDS condition reduced mercury concentration in feed from 0.000049 mg/L to below 0.000010 mg/L (detection limit).
- Aluminum concentration was observed to be high for all tests ranging from 2.1 mg/L at 90 minutes retention time to 3.96 mg/L with 20 minutes. A pH adjustment to 7.5 for clarifier overflow is required to remove aluminum concentration below 0.2 mg/L.
- Approximately 47% of the selenium was removed by HSD which is most likely Se(IV).
- 60 minute retention time would be sufficient to remove most metals however as expected the lime consumption was much higher compared to the 90 minute retention time.
- The clarifier underflow density increased throughout the pilot test program and reached as high as 1.15 (19% solids). It was expected to produce clarifier underflow solids up to 25%. The sludge was further thickened to 38 to 40% solids by filtration.
- Observed lime consumption in the pilot study with a 90 minute retention time at pH 10.5 (optimum operating condition) with an underflow recycle ratio of approximately 35:1 was 0.83 kg/m³. With the same operating condition the flocculent consumption was 6 mg/L.

One issue with the pilot plant study was the limitation of feed water available once steady state operating conditions were achieved. This limitation did not permit the clarifier underflow to reach the maximum targeted density of 25 to 30% solids. Based on the sludge consistency and the clarifier performance, it is very likely that 25% sludge solids will be achievable in a full-scale operating plant. The steady state operating period was more than adequate to demonstrate the efficiency of metals removal.

Appendix A – Pilot Plant Operation Data

PILOT SCALE TESTING OF THE HIGH DENSITY SLUDGE PROCESS
 Shahidul KSM - October 2012

TEST ID: Commissioning

Date	Time	Cumulm Hours	Feed (mL/min)	Floc. (0.5 g/L)	Line (L)	Lime Consump. (L/hr)	Clar. U/F Recycle (mL/min)	Clarifier U/F		Actual Clar. U/F % Solids	Recycle Ratio	pH		
								Vol (mL)	WL (g)			R1	R2	
20-Oct	15:00	0	760	12.0	12.50	6.56	303					10.67	10.56	
	16:05	1	670	12.0	12.00	6.50	300	250	10.68		0	10.69	10.56	
	18:00	3	740	12.0	11.00	6.50	300	250	10.53		0	10.53	10.50	
	20:00	5	680	10.0	8.50	6.75	300	250	10.83		19	10.83	11.34	
	22:00	7	690	10.0	9.00	6.75	300	250	10.85		20	10.78	10.83	
	24:00	9	685	10.0	8.50	6.50	300	250	10.85		20	10.42	10.85	
	21-Oct	6:00	11	690	10.0	8.00	6.50	310	250	10.83		22	10.42	10.85
		8:00	13	690	10.5	7.00	6.50	306	250	10.83		21	10.86	10.88
		10:00	15	700	10.5	6.00	6.50	302	250	10.83		21	10.86	10.88
		12:00	17	700	10.5	5.00	6.50	300	250	10.83		21	10.88	10.77
		14:00	19	700	10.5	4.50	6.50	160	250	10.83		11	10.49	10.68
		16:00	21	760	10.5	17.50	6.50	160	250	10.83		11	10.85	10.54
		18:00	23	700	10.5	16.00	6.50	158	250	10.83		12	10.74	10.42
		20:00	25	680	10.5	15.00	6.50	155	250	10.83		12	10.78	10.43
22:00		27	670	10.5	14.00	6.50	156	250	10.83		12	10.68	10.41	
22-Oct		0:00	28	670	10.5	13.00	6.50	156	250	10.83		12	10.60	10.48
		2:00	31	680	10.5	12.00	6.50	156	250	10.83		14	10.65	10.49
		4:00	33	660	10.5	11.50	6.50	156	250	10.83		14	10.65	10.42
		6:00	35	660	10.0	11.00	6.50	156	250	10.83		15	10.41	10.39
		8:00	37	660	10.0	10.50	6.50	156	250	10.83		15	10.65	10.42
	10:00	39	660	10.0	10.00	6.50	156	250	10.83		15	10.41	10.39	
	12:00	41	660	10.0	9.50	6.50	156	250	10.83		15	10.65	10.49	
	14:00	43	640	10.0	8.00	6.50	156	250	10.83		15	10.65	10.42	
	16:00	45	640	10.0	7.50	6.50	156	250	10.83		15	10.65	10.42	
	18:00	47	630	8.0	6.50	6.50	153	250	10.83		15	10.65	10.42	
	20:00	49	600	8.0	5.00	6.50	154	250	10.83		15	10.65	10.42	
	22:00	51	580	8.0	5.00	6.50	154	250	10.83		15	10.65	10.42	
	23-Oct	0:00	53	550	10.0	4.50	6.50	154	250	10.83		15	10.65	10.42
		2:00	55	840	8.5	18.50	6.50	156	250	10.83		20	10.75	10.85
4:00		57	840	8.5	17.50	6.50	156	250	10.83		20	10.52	10.67	
6:00		59	840	8.5	16.50	6.50	156	250	10.83		21	10.78	10.60	
8:00		61	840	8.5	15.50	6.50	156	250	10.83		21	10.56	10.52	
10:00		63	850	8.5	14.50	6.50	156	250	10.83		21	10.55	10.63	
12:00		65	840	8.5	14.00	6.50	154	250	10.83		21	10.55	10.63	
14:00		67	830	8.5	13.00	6.50	154	250	10.83		21	10.52	10.65	
16:00		69	810	8.5	12.00	6.50	153	250	10.83		21	10.61	10.52	
18:00		71	650	8.5	11.50	6.50	183	250	10.83		25	10.61	10.52	
20:00		73	640	8.5	10.50	6.50	183	250	10.83		25	10.65	10.49	
22:00		75	660	8.5	10.00	6.50	182	250	10.83		24	10.65	10.53	
24:00		77	765	8.5	9.00	6.50	183	250	10.83		30	10.60	10.43	
24-Oct		0:00	79	740	8.5	8.00	6.50	183	250	10.83		30	10.61	10.57
	2:00	81	740	8.0	7.50	6.50	183	250	10.83		27	10.51	10.56	
	4:00	83	740	10.5	6.50	6.50	183	250	10.83		27	10.65	10.53	
	6:00	85	740	10.0	5.00	6.50	182	250	10.83		30	10.53	10.48	
	8:00	87	755	14.5	3.50	6.50	176	250	10.83		30	10.77	10.56	
	10:00	89	740	14.0	2.50	6.50	176	250	10.83		30	10.39	10.45	
	12:00	91	640	14.0	1.50	6.50	175	250	10.83		29	10.51	10.59	
	14:00	93	670	14.0	1.00	6.50	178	250	10.83		27	10.65	10.56	
	16:00	95	1080	14.0	16.00	6.50	174	250	10.83		33	10.54	10.52	
	18:00	97	1080	14.0	16.00	6.50	174	250	10.83		33	10.54	10.52	
	20:00	99	1080	14.0	16.00	6.50	174	250	10.83		33	10.54	10.52	
	22:00	101	1080	14.0	16.00	6.50	174	250	10.83		33	10.54	10.52	
	24:00	103	1080	14.0	16.00	6.50	174	250	10.83		33	10.54	10.52	

Feed Rate	687 mL/min
Clarifier U/F Recycle Rate	190 mL/min
Recycle Ratio	21 : 1
Lime Retention Time	55 minutes
Solids Generation Rate	0.8 kg/m ³
Lime Consumption Rate	1.06 kg/m ³
Flocculant Consumption Rate	4.1 mg/L

Feed	5700 mL
Reactor 1	10.53
Reactor 2	10.53
Clar. O/F	10.53

Feed	3913.22449
Reactor 1	0.44
Reactor 2	0.44

TEST ID: Test 1A

Date	Time	Cummul. Hours	Feed (mL/min)	Floc. (0.5 g/L)	Lime (L)	Lime Consump. (L/hr)	Clar. U/F Recycle (mL/min)	Clarifier U/F		Calc. Clar. U/F % Solids	Actual Clar. U/F % Solids	Recycle Ratio		pH	
								Vol (mL)	Wt (g)			Feed	R1	R2	Clar O/F
24-Oct	14:00	0	389	14.0	18.00	0.250	104	250	271.13	1.085	11.8		10.54	10.52	10.51
	16:00	2	370	8.0	15.50	0.250	112	250	271.13	1.085	11.8	34	10.55	10.56	10.46
	18:00	4	370	9.5	14.00	0.250	112	250	271.13	1.085	12.0	36	10.51	10.62	10.62
	20:00	6	370	9.0	14.50	0.250	114	250	268.84	1.076	11.0	34	10.77	10.68	10.56
	22:00	8	400	8.5	14.00	0.250	114	250	272.52	1.093	12.3	38	10.40	10.60	10.64
	0:00	10	400	9.0	13.50	0.250	112	250	272.52	1.093	12.3	34	10.85	10.62	10.59
	2:00	12	400	9.0	13.00	0.250	112	250	272.52	1.093	12.4	35	10.50	10.63	10.61
	4:00	14	400	9.0	12.50	0.250	112	250	272.52	1.093	12.3	34	10.55	10.61	10.59
	6:00	16	400	9.0	12.00	0.100	114	250	272.00	1.088	12.2	35	10.78	10.72	10.70
	8:00	18	390	9.0	12.0	0.150	112	250	273.160	1.093	12.6	35	10.34	10.7	10.70
25-Oct	10:00	20	390	9.5	11.8	0.100	112	250	268.960	1.076	11.0	32	10.77	10.54	10.50
	12:00	22	390	9.5	11.5	0.150	112	250	271.860	1.087	12.1	35	10.57	10.5	10.30
	14:00	24	380	9.5	11.0	0.250	112	250	272.450	1.092	12.3	35	10.62	10.5	10.60
	16:00	26	385	9.5	10.5	0.250	112	250	271.560	1.086	12.0	34	10.84	10.56	10.44
	18:00	28	385	9.5	10.0	0.250	112	250	273.320	1.096	12.9	38	10.65	10.61	10.55
	20:00	30	390	9.5	9.8	0.100	112	250	273.910	1.092	12.5	38	10.91	10.6	10.58
	22:00	32	390	9.5	9.5	0.150	112	250	273.400	1.094	12.7	37	10.65	10.68	10.67
	0:00	34	390	9	9.3	0.100	114	250	273.120	1.092	12.6	37	10.57	10.69	10.68
	2:00	36	390	9	9	0.150	114	250	273.69	1.095	12.8	37	10.59	10.62	10.65

Feed Rate 389 mL/min
 Clarifier U/F Recycle Rate 112 mL/min
 Recycle Ratio 35:1
 Lime Recirculation Time 96 minutes
 Solids Generation Rate 1.0 kg/m³
 Lime Consumption Rate 0.83 kg/m³
 Flocculant Consumption Rate 6.0 mg/L

Feed 2160 mlh
 Reactor 1 840.126316
 Clar. O/F 0.194

TEST ID: Test 2A

Date	Time	Cummul. Hours	Feed (mL/min)	Floc. (0.5 g/L)	Lime (L)	Lime Consump. (L/hr)	Clar. U/F Recycle (mL/min)	Clarifier U/F		Calc. Clar. U/F % Solids	Actual Clar. U/F % Solids	Recycle Ratio		pH	
								Vol (mL)	Wt (g)			Feed	R1	R2	Clar O/F
26-Oct	2:00	0	635	8.0	3.00	0	184	250	267.27	1.059	10.3		10.59	10.63	10.65
	4:00	2	605	9.0	3.00	0	184	250	273.38	1.094	12.7	31	9.68	9.63	9.55
	6:00	4	605	9.5	2.50	0.25	174	250	272.79	1.091	12.5	39	9.80	9.83	9.81
	8:00	6	650	12.0	8.00	0.25	174	250	270.59	1.082	11.6	36	9.63	9.80	9.07
	10:00	8	650	12.0	7.50	0.25	174	250	272.39	1.090	12.3	32	9.65	9.84	9.83
	12:00	10	630	13.5	7.35	0.1	174	250	268.49	1.074	10.8	34	9.61	9.62	9.62
	14:00	12	690	10.0	7.00	0.15	185	250	268.93	1.076	11.0	38	9.68	9.61	9.60
	16:00	14	690	10.0	6.50	0.25	185	250	271.12	1.084	11.6	36	9.67	9.53	9.51
	18:00	16	690	12.0	6.00	0.25	200	250	273.340	1.094	12.7	30	9.66	9.58	9.58
	20:00	18	645	11.0	5.5	0.25	152	250	273.470	1.094	12.7	18	9.63	9.61	9.55
27-Oct	22:00	20	630	11	5.0	0.25	96	250	274.540	1.098	13.2	18	9.55	9.6	9.47
	0:00	22	630	11	4.5	0.25	96	250	274.540	1.098	13.2	18	9.55	9.6	9.47
	2:00	24	685	11	4	0.25	96	250	274.6	1.098	13.2	18	9.54	9.51	9.45

Feed Rate 632 mL/min
 Clarifier U/F Recycle Rate 162 mL/min
 Recycle Ratio 33:1
 Lime Recirculation Time 60 minutes
 Solids Generation Rate 1.0 kg/m³
 Lime Consumption Rate 0.55 kg/m³
 Flocculant Consumption Rate 4.4 mg/L

Feed 1440 mlh
 Reactor 1 809.963231
 Clar. O/F 0.206

TEST ID: Test.3A

Date	Time	Cummul. Hours	Feed (mL/min)	Floc. (0.5 g/L) (mL/min)	Lime (L)	Lime Consump. (L/hr)	Clar. U/F Recycle (mL/min)	Clarifier U/F		Calc. Clar. U/F % Solids	Actual Clar. U/F % Solids	Recycle Ratio		pH		
								Vol (mL)	WT. (g)			Feed	R1	R2	Clar. O/F	
27-Oct	0	0	685	11.0	4.00	0.5	95	250	274.6	1.098	13.2	16	9.54	9.51	9.47	
	2	2	685	11.0	3.50	0.5	97	250	274.60	1.098	13.2	18	10.60	10.55	10.49	
	4	4	685	11.0	3.00	1	96	250	274.58	1.098	13.2	18	10.53	10.46	10.43	
	6	6	680	11.0	15.00	0.5	94	250	274.91	1.100	13.3	18	10.54	10.48	10.43	
	8	8	685	11.0	13.50	0.75	94	250	275.16	1.101	13.4	18	10.58	10.51	10.47	
	10	10	690	11.0	12.00	0.75	94	250	277.13	1.109	14.2	19	10.58	10.51	10.47	
	12	12	690	11.0	11.00	0.5	94	250	277.72	1.108	14.2	19	10.62	10.54	10.48	
	14	14	680	11.0	10.50	0.25	94	250	276.29	1.105	13.9	19	10.65	10.57	10.44	
	16	16	680	11.0	9.5	0.25	94	250	276.150	1.113	14.5	20	10.45	10.61	10.70	
	18	18	680	11.0	9.0	0.25	94	250	276.350	1.113	14.5	20	10.3	10.92	10.83	
	20	20	680	11	8.3	0.35	98	250	276.500	1.114	14.7	21	10.96	10.89	10.81	
	22	22	680	11	7.3	0.5	94	250	278.54	1.114	14.7	20	10.81	10.88	10.82	
	24	24	680	11	7.3	0.5	94	250	278.54	1.114	14.7	20	10.81	10.88	10.82	
	Feed Rate 683 mL/min Clarifier U/F Recycle Rate 95 mL/min Recycle Ratio 19 :1 Lime Resention Time 62 minutes Solids Generation Rate 1.0 kg/m ³ Lime Consumption Rate 1.19 kg/m ³ Flocculant Consumption Rate 4.0 mg/L															
	Feed Rate 1440 min Clarifier U/F Recycle Rate 983.075923 Recycle Ratio 0.4875															

TEST ID: Test.4A

Date	Time	Cummul. Hours	Feed (mL/min)	Floc. (0.5 g/L) (mL/min)	Lime (L)	Lime Consump. (L/hr)	Clar. U/F Recycle (mL/min)	Clarifier U/F		Calc. Clar. U/F % Solids	Actual Clar. U/F % Solids	Recycle Ratio		pH		
								Vol (mL)	WT. (g)			Feed	R1	R2	Clar. O/F	
28-Oct	0	0	1010	11.0	7.30	0.65	94	250	278.54	1.114	14.7	14	10.81	10.88	10.82	
	2	2	1010	11.0	6.00	0.65	96	250	278.86	1.119	15.2	15	10.60	11.05	11.19	
	4	4	1000	11.0	5.00	0.5	94	250	281.53	1.126	15.9	15	10.38	10.78	11.02	
	6	6	1000	11.0	3.50	0.75	94	250	281.81	1.127	16.0	15	10.58	10.49	10.31	
	8	8	1000	11.0	2.00	0.75	94	250	281.39	1.125	15.8	15	10.49	10.33	9.87	
	10	10	1000	11.0	15.00	1	94	250	282.45	1.122	15.4	14	10.41	10.53	10.49	
	12	12	1000	11.0	12.50	1.25	94	250	281.61	1.126	15.9	14	10.45	10.41	10.42	
	14	14	1000	11.0	11.50	0.5	94	250	283.25	1.133	16.5	15	10.85	10.47	10.57	
	16	16	1000	11.0	10.00	0.75	94	250	283.47	1.134	16.6	15	10.25	10.61	10.59	
	18	18	1000	11.0	8.0	0.5	93	250	282.900	1.132	16.4	15	10.48	10.59	11.04	
	20	20	1020	11	5.0	0.2	94	250	284.370	1.137	16.9	16	10.53	10.64	11.01	
	22	22	1020	11	7.5	0.5	94	250	285.410	1.142	17.4	16	10.6	10.71	10.89	
	24	24	1020	11	5.5	0.75	94	250	285.58	1.142	17.4	16	10.47	10.63	10.45	
	Feed Rate 1018 mL/min Clarifier U/F Recycle Rate 94 mL/min Recycle Ratio 15 :1 Lime Resention Time 43 minutes Solids Generation Rate 1.0 kg/m ³ Lime Consumption Rate 1.15 kg/m ³ Flocculant Consumption Rate 2.7 mg/L															
	Feed Rate 1440 min Clarifier U/F Recycle Rate 1465.47692 Recycle Ratio 0.700															

Appendix B – Water Quality Data

RESULTS OF ANALYSIS

	1298-013 OCT21A	1298-016 OCT21B	1298-020 OCT22A	1298-024 OCT22B	1298-028 OCT23A	1298-032 OCT23B	1298-035 OCT24A	1298-039 OCT24B
Sample ID	- REACTOR1	- REACTOR1	- REACTOR1	- REACTOR1	- REACTOR1	- REACTOR1	- REACTOR1	REACTOR1
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12	23-OCT-12	23-OCT-12	24-OCT-12	24-OCT-12
Time Sampled	14:00	14:00	02:00	14:00	02:00	14:00	02:00	14:00
ALS Sample ID	L1227084-4	L1227088-3	L1227087-3	L1227710-3	L1227707-3	L1228195-3	L1228158-3	L1228980-3
Matrix	Water	Water	Water	Water	Water	Water	Water	Water
Physical Tests								
Hardness (as CaCO3)	1280	1310	1250	1180	1160	1210	1190	1270
pH								
Total Suspended Solids								
Total Dissolved Solids								
Turbidity								
Anions and Nutrients								
Acidity (as CaCO3)								
Alkalinity, Bicarbonate (as CaCO3)								
Alkalinity, Carbonate (as CaCO3)								
Alkalinity, Hydroxide (as CaCO3)								
Alkalinity, Total (as CaCO3)								
Ammonia, Total (as N)								
Bromide (Br)								
Chloride (Cl)								
Fluoride (F)								
Nitrate (as N)								
Nitrite (as N)								
Orthophosphate-Dissolved (as P)								
Phosphorus (P)-Total								
Sulfate (SO4)								
Total Metals								
Aluminum (Al)-Total								
Antimony (Sb)-Total								
Arsenic (As)-Total								
Barium (Ba)-Total								
Beryllium (Be)-Total								
Bismuth (Bi)-Total								
Boron (B)-Total								
Cadmium (Cd)-Total								
Calcium (Ca)-Total								
Chromium (Cr)-Total								
Cobalt (Co)-Total								
Copper (Cu)-Total								
Iron (Fe)-Total								
Lead (Pb)-Total								
Lithium (Li)-Total								
Magnesium (Mg)-Total								
Manganese (Mn)-Total								
Mercury (Hg)-Total								
Molybdenum (Mo)-Total								
Nickel (Ni)-Total								
Phosphorus (P)-Total								
Potassium (K)-Total								
Selenium (Se)-Total								
Silicon (Si)-Total								
Silver (Ag)-Total								
Sodium (Na)-Total								
Strontium (Sr)-Total								
Thallium (Tl)-Total								
Tin (Sn)-Total								
Titanium (Ti)-Total								
Uranium (U)-Total								
Vanadium (V)-Total								
Zinc (Zn)-Total								
Dissolved Metals								
Dissolved Metals Filtration Location								
Aluminum (Al)-Dissolved	5.00	5.85	3.74	3.04	2.98	3.41	3.21	3.43
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	0.00062	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0303	0.0301	0.0226	0.0205	0.0193	0.0199	0.0202	0.0195
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000056	<0.000050	0.000070	0.000134	0.000059	0.000077	0.000062	0.000084
Calcium (Ca)-Dissolved	512	521	467	467	461	482	471	502
Chromium (Cr)-Dissolved	0.00163	0.00215	0.00331	0.00402	0.00405	0.00380	0.00372	0.00436
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00050	0.00074	<0.00050	<0.00050	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0012	0.0016	0.0015	0.0038	<0.0010	<0.0010	0.0032	0.0019
Iron (Fe)-Dissolved	<0.050	<0.050	<0.050	0.334	<0.050	<0.050	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0079	0.0058	0.0069	0.0061	0.0060	0.0079	0.0059	0.0057
Magnesium (Mg)-Dissolved	0.85	2.49	1.63	2.26	1.42	1.80	2.76	4.90
Manganese (Mn)-Dissolved	0.00095	0.00114	0.00071	0.0198	0.00034	0.00072	0.00211	0.00137
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0901	0.0717	0.0785	0.0746	0.0797	0.0853	0.0767	0.0719
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.83	1.74	1.71	1.55	1.71	1.69	1.69	1.64
Selenium (Se)-Dissolved	0.0641	0.0675	0.0638	0.0566	0.0606	0.0630	0.0625	0.0615
Silicon (Si)-Dissolved	0.127	0.107	0.105	0.119	0.123	0.112	0.093	0.091
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	6.09	5.90	5.97	5.36	5.83	6.49	6.24	5.83
Strontium (Sr)-Dissolved	0.822	0.823	0.821	0.788	0.854	0.871	0.814	0.831
Thallium (Tl)-Dissolved	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00097	0.00098	0.00093	0.00099	0.00111	0.00102	0.00097	0.00092
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	0.012	<0.010	0.015	0.014	0.015
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	0.0072	<0.0050	<0.0050	<0.0050	<0.0050

RESULTS OF ANALYSIS

Sample ID	1298-011 OCT21A - FEED	1298-017 OCT21B - FEED	1298-021 OCT22A - FEED	1298-025 OCT22B - FEED	1298-029 OCT23A - FEED	1298-036 OCT24A - FEED	1298-040 OCT24B FEED	
Date Sampled	21-OCT-12 14:00	21-OCT-12 14:00	22-OCT-12 02:00	22-OCT-12 02:00	23-OCT-12 14:00	24-OCT-12 02:00	24-OCT-12 14:00	
Time Sampled								
ALS Sample ID	L1227084-2	L1227088-4	L1227087-4	L1227710-4	L1227707-4	L1228158-4	L1228980-4	
Matrix	Water	Water	Water	Water	Water	Water	Water	
Physical Tests								
Hardness (as CaCO3)	370	374	374	365	371	387	395	
pH	2.63							
Total Suspended Solids	37.3							
Total Dissolved Solids	1950							
Turbidity	68.6							
Anions and Nutrients								
Acidity (as CaCO3)	984							
Alkalinity, Bicarbonate (as CaCO3)	<1.0							
Alkalinity, Carbonate (as CaCO3)	<1.0							
Alkalinity, Hydroxide (as CaCO3)	<1.0							
Alkalinity, Total (as CaCO3)	<1.0							
Ammonia, Total (as N)	0.0085							
Bromide (Br)	<1.0							
Chloride (Cl)	<10							
Fluoride (F)	1.38							
Nitrate (as N)	0.81							
Nitrite (as N)	0.030							
Orthophosphate-Dissolved (as P)	0.0340							
Phosphorus (P)-Total	<0.20							
Sulfate (SO4)	1350							
Total Metals								
Aluminum (Al)-Total	33.6							
Antimony (Sb)-Total	0.00207							
Arsenic (As)-Total	0.138							
Barium (Ba)-Total	0.0870							
Beryllium (Be)-Total	0.00271							
Bismuth (Bi)-Total	<0.0025							
Boron (B)-Total	<0.050							
Cadmium (Cd)-Total	0.0423							
Calcium (Ca)-Total	101							
Chromium (Cr)-Total	0.0232							
Cobalt (Co)-Total	0.470							
Copper (Cu)-Total	20.3							
Iron (Fe)-Total	233							
Lead (Pb)-Total	0.0376							
Lithium (Li)-Total	0.0117							
Magnesium (Mg)-Total	22.2							
Manganese (Mn)-Total	13.5							
Mercury (Hg)-Total	0.000039							
Molybdenum (Mo)-Total	0.124							
Nickel (Ni)-Total	0.185							
Phosphorus (P)-Total	<0.30							
Potassium (K)-Total	1.65							
Selenium (Se)-Total	0.112							
Silicon (Si)-Total	6.37							
Silver (Ag)-Total	0.00382							
Sodium (Na)-Total	5.66							
Strontium (Sr)-Total	0.754							
Thallium (Tl)-Total	0.000122							
Tin (Sn)-Total	0.00112							
Titanium (Ti)-Total	0.832							
Uranium (U)-Total	0.00194							
Vanadium (V)-Total	0.0084							
Zinc (Zn)-Total	3.64							
Dissolved Metals								
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	
Aluminum (Al)-Dissolved	34.4	34.5	35.1	31.7	34.7	35.3	34.2	
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	34.3
Arsenic (As)-Dissolved	0.129	0.138	0.132	0.118	0.127	0.122	0.120	
Barium (Ba)-Dissolved	0.0835	0.0837	0.0870	0.0783	0.0900	0.0827	0.0840	
Beryllium (Be)-Dissolved	0.00257	0.00263	0.00255	0.00269	0.00275	0.00295	0.00269	
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Cadmium (Cd)-Dissolved	0.0422	0.0453	0.0455	0.0413	0.0453	0.0422	0.0442	
Calcium (Ca)-Dissolved	109	110	110	106	109	114	116	
Chromium (Cr)-Dissolved	0.0242	0.0251	0.0245	0.0226	0.0242	0.0227	0.0245	
Cobalt (Co)-Dissolved	0.481	0.496	0.499	0.450	0.495	0.507	0.492	
Copper (Cu)-Dissolved	20.7	21.9	21.7	20.5	22.4	21.7	22.3	
Iron (Fe)-Dissolved	232	235	241	219	221	231	231	
Lead (Pb)-Dissolved	0.0345	0.0429	0.0362	0.0368	0.0369	0.0370	0.0389	
Lithium (Li)-Dissolved	0.0104	0.0107	0.0107	0.0119	0.0123	0.0134	0.0116	
Magnesium (Mg)-Dissolved	23.7	24.1	24.0	24.3	24.0	24.9	25.9	
Manganese (Mn)-Dissolved	13.8	14.1	14.2	13.4	14.7	14.8	14.4	
Mercury (Hg)-Dissolved	<0.000010	0.000015	0.000014	0.000017	0.000020	0.000021	0.000015	
Molybdenum (Mo)-Dissolved	0.0758	0.0871	0.0822	0.0809	0.0805	0.0829	0.0850	0.082
Nickel (Ni)-Dissolved	0.186	0.194	0.193	0.185	0.199	0.191	0.194	
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	
Potassium (K)-Dissolved	1.75	1.74	1.74	1.60	1.81	1.77	1.68	
Selenium (Se)-Dissolved	0.107	0.110	0.113	0.0994	0.100	0.107	0.108	
Silicon (Si)-Dissolved	6.43	6.42	6.43	6.53	6.39	6.48	6.64	
Silver (Ag)-Dissolved	0.00338	0.00377	0.00373	0.00360	0.00372	0.00408	0.00363	
Sodium (Na)-Dissolved	5.78	5.84	6.00	5.46	6.01	6.38	5.82	
Strontium (Sr)-Dissolved	0.685	0.762	0.741	0.742	0.742	0.785	0.788	
Thallium (Tl)-Dissolved	0.000161	0.000271	0.000109	0.000108	0.000124	0.000120	0.000124	
Tin (Sn)-Dissolved	0.00101	0.00101	0.00109	0.00097	0.00128	0.00118	0.00122	
Titanium (Ti)-Dissolved	0.797	0.804	0.800	0.792	0.777	0.798	0.840	
Uranium (U)-Dissolved	0.00179	0.00201	0.00195	0.00189	0.00206	0.00208	0.00194	
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	
Zinc (Zn)-Dissolved	3.75	3.88	3.90	3.59	3.98	3.84	3.79	

RESULTS OF ANALYSIS

Sample ID	1298-033 OCT24A	1298-037 OCT24B	1298-041 OCT25A	1298-047 OCT25B	1298-050 OCT26A
Date Sampled	- EFFLUENT 24-OCT-12	EFFLUENT 24-OCT-12	- EFFLUENT 25-OCT-12	EFFLUENT 25-OCT-12	EFFLUENT 28-OCT-12
Time Sampled	02:00	14:00	02:00	14:00	02:00
ALS Sample ID	L1228158-1	L1228980-1	L1228971-1	L1229605-1	L1229604-1
Matrix	Water	Water	Water	Water	Water
Physical Tests					
Hardness (as CaCO3)	1230	1310	973	848	857
pH	8.75	9.14	8.79	9.37	8.89
Total Suspended Solids	24.0	9.3	22.0	15.4	24.5
Total Dissolved Solids	1630	1700	1250	1260	1250
Turbidity	35.4	9.77	25.7	17.7	29.3
Anions and Nutrients					
Acidity (as CaCO3)	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO3)	15.3	13.9	10.1	11.8	15.3
Alkalinity, Carbonate (as CaCO3)	5.5	8.1	3.4	10.4	5.2
Alkalinity, Hydroxide (as CaCO3)	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	20.8	22.0	13.4	22.2	20.5
Ammonia, Total (as N)	0.0582	0.0579	0.0815	0.0833	0.0906
Bromide (Br)	<1.0	<1.0	<0.50	<1.0	<1.0
Chloride (Cl)	<10	<10	<5.0	<10	<10
Fluoride (F)	<0.40	<0.40	<0.20	<0.40	<0.40
Nitrate (as N)	0.90	0.74	0.576	0.58	0.61
Nitrite (as N)	0.037	0.036	0.020	<0.020	0.036
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total	<0.0020	<0.0020	<0.0020	0.0025	0.0020
Sulfate (SO4)	1150	1190	869	848	848
Total Metals					
Aluminum (Al)-Total	4.06	3.47	2.58	3.03	2.96
Antimony (Sb)-Total	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Arsenic (As)-Total	0.00398	0.00204	0.00262	0.00364	0.00311
Barium (Ba)-Total	0.0236	0.0183	0.0131	0.0131	0.0162
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Total	<0.0025	<0.0025	<0.0010	<0.0010	<0.0010
Boron (B)-Total	<0.050	<0.050	<0.020	<0.020	<0.020
Cadmium (Cd)-Total	0.00137	0.000756	0.000885	0.00128	0.00119
Calcium (Ca)-Total	493	496	362	331	338
Chromium (Cr)-Total	0.00553	0.00537	0.00500	0.00512	0.00505
Cobalt (Co)-Total	0.0145	0.00785	0.0100	0.0146	0.0130
Copper (Cu)-Total	0.607	0.334	0.403	0.609	0.506
Iron (Fe)-Total	7.02	3.76	4.39	6.11	5.35
Lead (Pb)-Total	0.00128	0.00084	0.00073	0.00104	0.00095
Lithium (Li)-Total	0.0072	0.0054	0.0057	0.0057	0.0062
Magnesium (Mg)-Total	2.50	3.52	1.69	2.15	1.90
Manganese (Mn)-Total	0.401	0.206	0.253	0.395	0.341
Mercury (Hg)-Total	0.000012	0.000013	<0.000010	<0.000010	0.000010
Molybdenum (Mo)-Total	0.0825	0.0779	0.0658	0.0604	0.0576
Nickel (Ni)-Total	0.0058	0.0031	0.0041	0.0061	0.0052
Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	1.79	1.69	1.36	1.32	1.33
Selenium (Se)-Total	0.0646	0.0635	0.0467	0.0465	0.0476
Silicon (Si)-Total	0.383	0.243	0.274	0.355	0.325
Silver (Ag)-Total	0.000162	0.000101	0.000110	0.000153	0.000135
Sodium (Na)-Total	6.52	5.85	4.81	4.65	4.78
Strontium (Sr)-Total	0.835	0.853	0.655	0.822	0.645
Thallium (Tl)-Total	<0.000050	<0.000050	0.000028	0.000029	0.000029
Tin (Sn)-Total	0.00101	0.00093	0.00092	0.00093	0.00093
Titanium (Ti)-Total	0.040	0.029	0.030	0.036	0.033
Uranium (U)-Total	0.000112	0.000055	0.000063	0.000089	0.000073
Vanadium (V)-Total	<0.0050	<0.0050	<0.0020	<0.0020	<0.0020
Zinc (Zn)-Total	0.111	0.061	0.0755	0.112	0.0971
Dissolved Metals					
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.32	3.09	2.10	2.05	2.27
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Barium (Ba)-Dissolved	0.0198	0.0182	0.0126	0.0114	0.0118
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010	<0.0010
Boron (B)-Dissolved	<0.050	<0.050	<0.020	<0.020	<0.020
Cadmium (Cd)-Dissolved	0.000089	0.000089	0.000144	0.000112	0.000121
Calcium (Ca)-Dissolved	491	520	388	337	341
Chromium (Cr)-Dissolved	0.00384	0.00477	0.00401	0.00402	0.00422
Cobalt (Co)-Dissolved	<0.00050	<0.00050	0.00034	<0.00020	0.00020
Copper (Cu)-Dissolved	0.0075	0.0022	0.0106	0.00398	0.00412
Iron (Fe)-Dissolved	<0.050	<0.050	0.119	<0.020	0.029
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00010	<0.00010	<0.00010
Lithium (Li)-Dissolved	0.0058	0.0054	0.0057	0.0055	0.0058
Magnesium (Mg)-Dissolved	1.76	3.28	1.23	1.23	1.11
Manganese (Mn)-Dissolved	0.00400	0.00136	0.00672	0.00230	0.00167
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0783	0.0799	0.0670	0.0588	0.0579
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.66	1.71	1.41	1.33	1.36
Selenium (Se)-Dissolved	0.0621	0.0633	0.0503	0.0449	0.0463
Silicon (Si)-Dissolved	0.105	0.095	0.125	0.100	0.112
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020	<0.000020
Sodium (Na)-Dissolved	6.55	5.90	4.91	4.65	4.73
Strontium (Sr)-Dissolved	0.818	0.858	0.658	0.808	0.615
Thallium (Tl)-Dissolved	<0.000050	<0.000050	0.000027	0.000027	0.000027
Tin (Sn)-Dissolved	0.00110	0.00086	0.00112	0.00091	0.00092
Titanium (Ti)-Dissolved	0.015	0.015	0.016	0.013	0.014

Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020	<0.000020
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020	<0.0020
Zinc (Zn)-Dissolved	<0.0050	<0.0050	0.0025	<0.0020	<0.0020

RESULTS OF ANALYSIS

	1298-034 OCT24A	1298-038 OCT24B	1298-042 OCT25A	1298-048 OCT25B	1298-051 OCT26A
Sample ID	- REACTOR2	REACTOR2	- REACTOR2	REACTOR 2	REACTOR 2
Date Sampled	24-OCT-12	24-OCT-12	25-OCT-12	25-OCT-12	26-OCT-12
Time Sampled	02:00	14:00	02:00	14:00	02:00
ALS Sample ID	L1228156-2	L1228980-2	L1228971-2	L1229605-2	L1229604-2
Matrix	Water	Water	Water	Water	Water
Physical Tests					
Hardness (as CaCO3)	1210	1310	995	806	844
pH					
Total Suspended Solids					
Total Dissolved Solids					
Turbidity					
Anions and Nutrients					
Acidity (as CaCO3)					
Alkalinity, Bicarbonate (as CaCO3)					
Alkalinity, Carbonate (as CaCO3)					
Alkalinity, Hydroxide (as CaCO3)					
Alkalinity, Total (as CaCO3)					
Ammonia, Total (as N)					
Bromide (Br)					
Chloride (Cl)					
Fluoride (F)					
Nitrate (as N)					
Nitrite (as N)					
Orthophosphate-Dissolved (as P)					
Phosphorus (P)-Total					
Sulfate (SO4)					
Total Metals					
Aluminum (Al)-Total					
Antimony (Sb)-Total					
Arsenic (As)-Total					
Barium (Ba)-Total					
Beryllium (Be)-Total					
Bismuth (Bi)-Total					
Boron (B)-Total					
Cadmium (Cd)-Total					
Calcium (Ca)-Total					
Chromium (Cr)-Total					
Cobalt (Co)-Total					
Copper (Cu)-Total					
Iron (Fe)-Total					
Lead (Pb)-Total					
Lithium (Li)-Total					
Magnesium (Mg)-Total					
Manganese (Mn)-Total					
Mercury (Hg)-Total					
Molybdenum (Mo)-Total					
Nickel (Ni)-Total					
Phosphorus (P)-Total					
Potassium (K)-Total					
Selenium (Se)-Total					
Silicon (Si)-Total					
Silver (Ag)-Total					
Sodium (Na)-Total					
Strontium (Sr)-Total					
Thallium (Tl)-Total					
Tin (Sn)-Total					
Titanium (Ti)-Total					
Uranium (U)-Total					
Vanadium (V)-Total					
Zinc (Zn)-Total					
Dissolved Metals					
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	2.86	3.12	2.13	2.15	2.46
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Barium (Ba)-Dissolved	0.0188	0.0180	0.0125	0.0113	0.0127
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010	<0.0010
Boron (B)-Dissolved	<0.050	<0.050	<0.020	<0.020	<0.020
Cadmium (Cd)-Dissolved	0.000071	0.000072	<0.00013	0.000100	0.000115
Calcium (Ca)-Dissolved	482	520	396	321	336
Chromium (Cr)-Dissolved	0.00393	0.00429	0.00452	0.00421	0.00463
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	0.00021
Copper (Cu)-Dissolved	0.0046	<0.0010	0.00214	0.00192	0.00271
Iron (Fe)-Dissolved	<0.050	<0.050	0.032	<0.020	0.021
Lead (Pb)-Dissolved	<0.00025	<0.00025	0.00015	<0.00010	<0.00010
Lithium (Li)-Dissolved	0.0064	0.0054	0.0058	0.0054	0.0058
Magnesium (Mg)-Dissolved	2.14	3.55	1.31	1.16	1.09
Manganese (Mn)-Dissolved	0.00277	0.00077	0.00159	0.00082	0.00145
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0786	0.0763	0.175	0.0583	0.0579
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.61	1.68	1.43	1.35	1.51
Selenium (Se)-Dissolved	0.0602	0.0639	0.0504	0.0446	0.0467
Silicon (Si)-Dissolved	0.102	0.098	0.228	0.094	0.098
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000020	0.000043	<0.000020
Sodium (Na)-Dissolved	6.56	5.79	4.94	4.74	5.36
Strontium (Sr)-Dissolved	0.807	0.841	0.667	0.609	0.630
Thallium (Tl)-Dissolved	<0.000050	<0.000050	0.000038	0.000024	0.000029
Tin (Sn)-Dissolved	0.00089	0.00095	0.00087	0.00086	0.00089
Titanium (Ti)-Dissolved	0.014	0.016	0.019	0.013	0.014

Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020	<0.000020
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020	<0.0020
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020	0.0024

RESULTS OF ANALYSIS

Sample ID	1298-035 OCT24A	1298-039 OCT24B	1298-043 OCT25A	1298-049 OCT25B	1298-052 OCT26A
Date Sampled	- REACTOR1 24-OCT-12	REACTOR1 24-OCT-12	- REACTOR1 25-OCT-12	REACTOR1 25-OCT-12	REACTOR 1 26-OCT-12
Time Sampled	02:00	14:00	02:00	14:00	02:00
ALS Sample ID	L1228158-3	L1228980-3	L1228971-3	L1229605-3	L1229604-3
Matrix	Water	Water	Water	Water	Water
Physical Tests					
Hardness (as CaCO3)	1190	1270	1000	801	860
pH	8.1	8.1	8.1	8.1	8.1
Total Suspended Solids	0.0	0.0	0.0	0.0	0.0
Total Dissolved Solids	0.0	0.0	0.0	0.0	0.0
Turbidity	0.0	0.0	0.0	0.0	0.0
Anions and Nutrients					
Acidity (as CaCO3)	0.0	0.0	0.0	0.0	0.0
Alkalinity, Bicarbonate (as CaCO3)	0.0	0.0	0.0	0.0	0.0
Alkalinity, Carbonate (as CaCO3)	0.0	0.0	0.0	0.0	0.0
Alkalinity, Hydroxide (as CaCO3)	0.0	0.0	0.0	0.0	0.0
Alkalinity, Total (as CaCO3)	0.0	0.0	0.0	0.0	0.0
Ammonia, Total (as N)	0.0	0.0	0.0	0.0	0.0
Bromide (Br)	0.0	0.0	0.0	0.0	0.0
Chloride (Cl)	0.0	0.0	0.0	0.0	0.0
Fluoride (F)	0.0	0.0	0.0	0.0	0.0
Nitrate (as N)	0.0	0.0	0.0	0.0	0.0
Nitrite (as N)	0.0	0.0	0.0	0.0	0.0
Orthophosphate-Dissolved (as P)	0.0	0.0	0.0	0.0	0.0
Phosphorus (P)-Total	0.0	0.0	0.0	0.0	0.0
Sulfate (SO4)	0.0	0.0	0.0	0.0	0.0
Total Metals					
Aluminum (Al)-Total	0.0	0.0	0.0	0.0	0.0
Antimony (Sb)-Total	0.0	0.0	0.0	0.0	0.0
Arsenic (As)-Total	0.0	0.0	0.0	0.0	0.0
Barium (Ba)-Total	0.0	0.0	0.0	0.0	0.0
Beryllium (Be)-Total	0.0	0.0	0.0	0.0	0.0
Bismuth (Bi)-Total	0.0	0.0	0.0	0.0	0.0
Boron (B)-Total	0.0	0.0	0.0	0.0	0.0
Cadmium (Cd)-Total	0.0	0.0	0.0	0.0	0.0
Calcium (Ca)-Total	0.0	0.0	0.0	0.0	0.0
Chromium (Cr)-Total	0.0	0.0	0.0	0.0	0.0
Cobalt (Co)-Total	0.0	0.0	0.0	0.0	0.0
Copper (Cu)-Total	0.0	0.0	0.0	0.0	0.0
Iron (Fe)-Total	0.0	0.0	0.0	0.0	0.0
Lead (Pb)-Total	0.0	0.0	0.0	0.0	0.0
Lithium (Li)-Total	0.0	0.0	0.0	0.0	0.0
Magnesium (Mg)-Total	0.0	0.0	0.0	0.0	0.0
Manganese (Mn)-Total	0.0	0.0	0.0	0.0	0.0
Mercury (Hg)-Total	0.0	0.0	0.0	0.0	0.0
Molybdenum (Mo)-Total	0.0	0.0	0.0	0.0	0.0
Nickel (Ni)-Total	0.0	0.0	0.0	0.0	0.0
Phosphorus (P)-Total	0.0	0.0	0.0	0.0	0.0
Potassium (K)-Total	0.0	0.0	0.0	0.0	0.0
Selenium (Se)-Total	0.0	0.0	0.0	0.0	0.0
Silicon (Si)-Total	0.0	0.0	0.0	0.0	0.0
Silver (Ag)-Total	0.0	0.0	0.0	0.0	0.0
Sodium (Na)-Total	0.0	0.0	0.0	0.0	0.0
Strontium (Sr)-Total	0.0	0.0	0.0	0.0	0.0
Thallium (Tl)-Total	0.0	0.0	0.0	0.0	0.0
Tin (Sn)-Total	0.0	0.0	0.0	0.0	0.0
Titanium (Ti)-Total	0.0	0.0	0.0	0.0	0.0
Uranium (U)-Total	0.0	0.0	0.0	0.0	0.0
Vanadium (V)-Total	0.0	0.0	0.0	0.0	0.0
Zinc (Zn)-Total	0.0	0.0	0.0	0.0	0.0
Dissolved Metals					
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.21	3.43	2.38	2.44	2.37
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Barium (Ba)-Dissolved	0.0202	0.0195	0.0132	0.0120	0.0116
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010	<0.0010
Boron (B)-Dissolved	<0.050	<0.050	<0.020	<0.020	<0.020
Cadmium (Cd)-Dissolved	0.000062	0.000084	<0.00017	0.000104	0.000098
Calcium (Ca)-Dissolved	471	502	399	319	342
Chromium (Cr)-Dissolved	0.00372	0.00436	0.00421	0.00395	0.00383
Cobalt (Co)-Dissolved	<0.00050	<0.00050	0.00032	<0.00020	<0.00020
Copper (Cu)-Dissolved	0.0032	0.0019	0.00920	0.00118	0.00322
Iron (Fe)-Dissolved	<0.050	<0.050	0.068	<0.020	0.021
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00010	<0.00010	<0.00010
Lithium (Li)-Dissolved	0.0059	0.0057	0.0055	0.0055	0.0057
Magnesium (Mg)-Dissolved	2.76	4.90	1.38	1.28	1.39
Manganese (Mn)-Dissolved	0.00211	0.00137	0.00663	0.00035	0.00233
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0767	0.0719	0.338	0.0597	0.0583
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.69	1.64	1.42	1.25	1.35
Selenium (Se)-Dissolved	0.0625	0.0615	0.0509	0.0453	0.0470
Silicon (Si)-Dissolved	0.093	0.091	0.129	0.113	0.106
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020	<0.000020
Sodium (Na)-Dissolved	6.24	5.83	5.04	4.66	4.68
Strontium (Sr)-Dissolved	0.814	0.831	0.671	0.609	0.635
Thallium (Tl)-Dissolved	<0.000050	<0.000050	0.000028	0.000025	0.000027
Tin (Sn)-Dissolved	0.00097	0.00092	0.00087	0.00089	0.00092
Titanium (Ti)-Dissolved	0.014	0.015	0.016	0.012	0.013

Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020	<0.000020
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020	<0.0020
Zinc (Zn)-Dissolved	<0.0050	<0.0050	0.0028	<0.0020	<0.0020

RESULTS OF ANALYSIS

	1298-036 OCT24A	1298-040 OCT24B
Sample ID	- FEED	FEED
Date Sampled	24-OCT-12	24-OCT-12
Time Sampled	02:00	14:00
ALS Sample ID	L1228156-4	L1228980-4
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO3)	397	395
pH		
Total Suspended Solids		
Total Dissolved Solids		
Turbidity		
Anions and Nutrients		
Acidity (as CaCO3)		
Alkalinity, Bicarbonate (as CaCO3)		
Alkalinity, Carbonate (as CaCO3)		
Alkalinity, Hydroxide (as CaCO3)		
Alkalinity, Total (as CaCO3)		
Ammonia, Total (as N)		
Bromide (Br)		
Chloride (Cl)		
Fluoride (F)		
Nitrate (as N)		
Nitrite (as N)		
Orthophosphate-Dissolved (as P)		
Phosphorus (P)-Total		
Sulfate (SO4)		
Total Metals		
Aluminum (Al)-Total		
Antimony (Sb)-Total		
Arsenic (As)-Total		
Barium (Ba)-Total		
Beryllium (Be)-Total		
Bismuth (Bi)-Total		
Boron (B)-Total		
Cadmium (Cd)-Total		
Calcium (Ca)-Total		
Chromium (Cr)-Total		
Cobalt (Co)-Total		
Copper (Cu)-Total		
Iron (Fe)-Total		
Lead (Pb)-Total		
Lithium (Li)-Total		
Magnesium (Mg)-Total		
Manganese (Mn)-Total		
Mercury (Hg)-Total		
Molybdenum (Mo)-Total		
Nickel (Ni)-Total		
Phosphorus (P)-Total		
Potassium (K)-Total		
Selenium (Se)-Total		
Silicon (Si)-Total		
Silver (Ag)-Total		
Sodium (Na)-Total		
Strontium (Sr)-Total		
Thallium (Tl)-Total		
Tin (Sn)-Total		
Titanium (Ti)-Total		
Uranium (U)-Total		
Vanadium (V)-Total		
Zinc (Zn)-Total		
Dissolved Metals		
Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	35.3	34.2
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.122	0.120
Barium (Ba)-Dissolved	0.0827	0.0840
Beryllium (Be)-Dissolved	0.00295	0.00289
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.0422	0.0442
Calcium (Ca)-Dissolved	114	116
Chromium (Cr)-Dissolved	0.0227	0.0245
Cobalt (Co)-Dissolved	0.507	0.492
Copper (Cu)-Dissolved	21.7	22.3
Iron (Fe)-Dissolved	231	231
Lead (Pb)-Dissolved	0.0370	0.0389
Lithium (Li)-Dissolved	0.0134	0.0116
Magnesium (Mg)-Dissolved	24.9	25.9
Manganese (Mn)-Dissolved	14.8	14.4
Mercury (Hg)-Dissolved	0.000021	0.000015
Molybdenum (Mo)-Dissolved	0.0829	0.0850
Nickel (Ni)-Dissolved	0.191	0.194
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.77	1.68
Selenium (Se)-Dissolved	0.107	0.108
Silicon (Si)-Dissolved	6.48	6.64
Silver (Ag)-Dissolved	0.00408	0.00363
Sodium (Na)-Dissolved	6.38	5.82
Strontium (Sr)-Dissolved	0.785	0.788
Thallium (Tl)-Dissolved	0.000120	0.000124
Tin (Sn)-Dissolved	0.00118	0.00122
Titanium (Ti)-Dissolved	0.798	0.840
Uranium (U)-Dissolved	0.00208	0.00194

Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	3.64	3.79

RESULTS OF ANALYSIS

	1298-010 OCT21A	1298-014 OCT21B	1298-018 OCT22A	1298-022 OCT22B
Sample ID	- EFFLUENT	- EFFLUENT	- EFFLUENT	- EFFLUENT
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-1	L1227088-1	L1227087-1	L1227710-1
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO ₃)	1250	1260	1340	1150
pH	10.23	9.62	9.25	9.19
Total Suspended Solids	8.0	13.0	6.0	14.0
Total Dissolved Solids	1740	1730	1850	1750
Turbidity	5.12	8.87	3.45	10.1
Anions and Nutrients				
Acidity (as CaCO ₃)	<1.0	<1.0	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO ₃)	<1.0	2.7	5.7	12.3
Alkalinity, Carbonate (as CaCO ₃)	32.4	28.4	22.3	8.9
Alkalinity, Hydroxide (as CaCO ₃)	7.2	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO ₃)	39.6	31.1	28.0	21.2
Ammonia, Total (as N)	0.0349	0.0438	0.0504	0.0408
Bromide (Br)	<1.0	<1.0	<1.0	<1.0
Chloride (Cl)	<10	<10	<10	<10
Fluoride (F)	0.41	0.43	0.44	<0.40
Nitrate (as N)	0.74	0.73	0.75	0.83
Nitrite (as N)	0.024	0.021	<0.020	0.022
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO ₄)	1160	1160	1240	1170
Total Metals				
Aluminum (Al)-Total	3.62	4.48	4.27	3.51
Antimony (Sb)-Total	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total	0.00224	0.00194	0.00069	0.00171
Barium (Ba)-Total	0.0284	0.0264	0.0240	0.0230
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Total	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Total	0.000676	0.000614	0.000285	0.000554
Calcium (Ca)-Total	475	465	482	451
Chromium (Cr)-Total	0.00248	0.00288	0.00360	0.00422
Cobalt (Co)-Total	0.00613	0.00586	0.00229	0.00504
Copper (Cu)-Total	0.267	0.260	0.0954	0.222
Iron (Fe)-Total	3.26	3.01	1.13	2.57
Lead (Pb)-Total	0.00055	0.00049	<0.00025	0.00048
Lithium (Li)-Total	0.0088	0.0057	0.0064	0.0062
Magnesium (Mg)-Total	1.02	1.47	3.62	2.64
Manganese (Mn)-Total	0.178	0.171	0.0618	0.139
Mercury (Hg)-Total	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	0.118	0.0821	0.0726	0.0793
Nickel (Ni)-Total	0.0025	<0.0025	<0.0025	<0.0025

Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	1.76	1.71	1.72	1.73
Selenium (Se)-Total	0.0637	0.0635	0.0656	0.0637
Silicon (Si)-Total	0.240	0.220	0.114	0.181
Silver (Ag)-Total	0.000053	0.000054	0.000057	0.000070
Sodium (Na)-Total	5.87	5.74	5.79	5.78
Strontium (Sr)-Total	0.862	0.833	0.810	0.853
Thallium (Tl)-Total	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)-Total	0.00109	0.00100	0.00095	0.00123
Titanium (Ti)-Total	0.021	0.020	0.012	0.020
Uranium (U)-Total	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Total	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Total	0.052	0.051	0.027	0.046
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.26	4.03	4.36	3.06
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0281	0.0251	0.0240	0.0198
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000090	0.000099	0.000063	0.000074
Calcium (Ca)-Dissolved	499	503	531	457
Chromium (Cr)-Dissolved	0.00194	0.00241	0.00334	0.00374
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0010	<0.0010	<0.0010	0.0013
Iron (Fe)-Dissolved	<0.050	<0.050	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0085	0.0064	0.0065	0.0060
Magnesium (Mg)-Dissolved	0.74	1.33	4.02	2.47
Manganese (Mn)-Dissolved	0.00026	0.00049	0.00083	0.00082
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.117	0.0776	0.0730	0.0749
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.68	1.63	1.78	1.62
Selenium (Se)-Dissolved	0.0647	0.0639	0.0668	0.0587
Silicon (Si)-Dissolved	0.125	0.110	0.077	0.092
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	6.01	5.58	6.07	5.58
Strontium (Sr)-Dissolved	0.840	0.780	0.821	0.815
Thallium (Tl)-Dissolved	<0.000050	0.000071	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00107	0.00097	0.00090	0.00100
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	0.011
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050

1298-026 OCT23A - EFFLUENT 23-OCT-12 02:00 L1227707-1 Water	1298-030 OCT23B - EFFLUENT 23-OCT-12 14:00 L1228195-1 Water	1298-033 OCT24A - EFFLUENT 24-OCT-12 02:00 L1228156-1 Water	1298-037 OCT24B- EFFLUENT 24-OCT-12 14:00 L1228980-1 Water	Average
1180	1210	1230	1310	
9.62	9.49	8.75	9.14	
13.3	5.3	24.0	9.3	11.6
1720	1600	1630	1700	
14.8	7.69	35.4	9.77	
<1.0	<1.0	<1.0	<1.0	
10.8	11.7	15.3	13.9	
14.1	14.4	5.5	8.1	
<1.0	<1.0	<1.0	<1.0	
24.9	26.1	20.8	22.0	
0.0500	0.0606	0.0562	0.0579	
<1.0	<1.0	<1.0	<1.0	
<10	<10	<10	<10	
<0.40	<0.40	<0.40	<0.40	
0.73	0.85	0.90	0.74	
0.026	0.031	0.037	0.036	
<0.0010	<0.0010	<0.0010	<0.0010	
<0.0020	<0.0020	<0.0020	<0.0020	
1140	1130	1150	1190	
3.08	2.92	4.06	3.47	
<0.00050	<0.00050	<0.00050	<0.00050	
0.00177	0.00160	0.00398	0.00204	
0.0216	0.0193	0.0236	0.0193	
<0.00050	<0.00050	<0.00050	<0.00050	
<0.0025	<0.0025	<0.0025	<0.0025	
<0.050	<0.050	<0.050	<0.050	
0.000630	0.000615	0.00137	0.000756	
453	457	493	496	
0.00495	0.00402	0.00553	0.00537	
0.00637	0.00596	0.0145	0.00785	
0.264	0.245	0.607	0.334	
3.10	2.86	7.02	3.76	
0.00054	0.00029	0.00128	0.00064	
0.0062	0.0071	0.0072	0.0054	
2.21	1.61	2.50	3.52	
0.161	0.159	0.401	0.206	
<0.000010	<0.000010	0.000012	0.000013	
0.0807	0.0876	0.0825	0.0779	
0.0026	<0.0025	0.0058	0.0031	

<0.30	<0.30	<0.30	<0.30	
1.69	1.74	1.70	1.69	
0.0629	0.0609	0.0646	0.0635	
0.229	0.211	0.383	0.243	
0.000091	0.000063	0.000162	0.000101	
5.81	6.54	6.52	5.85	
0.859	0.853	0.835	0.853	
<0.000050	<0.000050	<0.000050	<0.000050	
0.00099	0.00086	0.00101	0.00093	
0.022	0.025	0.040	0.029	
<0.000050	<0.000050	0.000112	0.000055	
<0.0050	<0.0050	<0.0050	<0.0050	
0.051	0.046	0.111	0.061	
FIELD	FIELD	FIELD	FIELD	
2.81	2.71	3.32	3.09	3.33
<0.00050	<0.00050	<0.00050	<0.00050	
<0.00050	<0.00050	<0.00050	<0.00050	
0.0201	0.0186	0.0198	0.0182	
<0.00050	<0.00050	<0.00050	<0.00050	
<0.0025	<0.0025	<0.0025	<0.0025	
<0.050	<0.050	<0.050	<0.050	
0.000101	0.000088	0.000089	0.000088	
470	481	491	520	
0.00433	0.00386	0.00384	0.00477	
<0.00050	<0.00050	<0.00050	<0.00050	
0.0044	0.0016	0.0075	0.0022	
<0.050	<0.050	<0.050	<0.050	
<0.00025	<0.00025	<0.00025	<0.00025	
0.0062	0.0073	0.0056	0.0054	
1.99	1.39	1.76	3.28	
0.00211	0.00096	0.00400	0.00136	
<0.000010	<0.000010	<0.000010	<0.000010	
0.0791	0.0885	0.0783	0.0799	0.084
<0.0025	<0.0025	<0.0025	<0.0025	
<0.30	<0.30	<0.30	<0.30	
1.71	1.69	1.66	1.71	
0.0616	0.0617	0.0621	0.0633	
0.114	0.107	0.105	0.095	
<0.000050	<0.000050	<0.000050	<0.000050	
5.71	6.57	6.55	5.90	
0.835	0.852	0.818	0.858	
<0.000050	<0.000050	<0.000050	<0.000050	
0.00098	0.00091	0.00110	0.00086	
0.011	0.016	0.015	0.015	
<0.000050	<0.000050	<0.000050	<0.000050	
<0.0050	<0.0050	<0.0050	<0.0050	
<0.0050	<0.0050	<0.0050	<0.0050	

RESULTS OF ANALYSIS

	1298-012 OCT21A	1298-015 OCT21B	1298-019 OCT22A	1298-023 OCT22B
Sample ID	- REACTOR2	- REACTOR2	- REACTOR2	- REACTOR2
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-3	L1227088-2	L1227087-2	L1227710-2
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO ₃)	1280	1310	1260	1170
pH	-	-	-	-
Total Suspended Solids	-	-	-	-
Total Dissolved Solids	-	-	-	-
Turbidity	-	-	-	-
Anions and Nutrients				
Acidity (as CaCO ₃)	-	-	-	-
Alkalinity, Bicarbonate (as CaCO ₃)	-	-	-	-
Alkalinity, Carbonate (as CaCO ₃)	-	-	-	-
Alkalinity, Hydroxide (as CaCO ₃)	-	-	-	-
Alkalinity, Total (as CaCO ₃)	-	-	-	-
Ammonia, Total (as N)	-	-	-	-
Bromide (Br)	-	-	-	-
Chloride (Cl)	-	-	-	-
Fluoride (F)	-	-	-	-
Nitrate (as N)	-	-	-	-
Nitrite (as N)	-	-	-	-
Orthophosphate-Dissolved (as P)	-	-	-	-
Phosphorus (P)-Total	-	-	-	-
Sulfate (SO ₄)	-	-	-	-
Total Metals				
Aluminum (Al)-Total	-	-	-	-
Antimony (Sb)-Total	-	-	-	-
Arsenic (As)-Total	-	-	-	-
Barium (Ba)-Total	-	-	-	-
Beryllium (Be)-Total	-	-	-	-
Bismuth (Bi)-Total	-	-	-	-
Boron (B)-Total	-	-	-	-
Cadmium (Cd)-Total	-	-	-	-
Calcium (Ca)-Total	-	-	-	-
Chromium (Cr)-Total	-	-	-	-
Cobalt (Co)-Total	-	-	-	-
Copper (Cu)-Total	-	-	-	-
Iron (Fe)-Total	-	-	-	-
Lead (Pb)-Total	-	-	-	-
Lithium (Li)-Total	-	-	-	-
Magnesium (Mg)-Total	-	-	-	-
Manganese (Mn)-Total	-	-	-	-
Mercury (Hg)-Total	-	-	-	-
Molybdenum (Mo)-Total	-	-	-	-
Nickel (Ni)-Total	-	-	-	-

Phosphorus (P)-Total				
Potassium (K)-Total				
Selenium (Se)-Total				
Silicon (Si)-Total				
Silver (Ag)-Total				
Sodium (Na)-Total				
Strontium (Sr)-Total				
Thallium (Tl)-Total				
Tin (Sn)-Total				
Titanium (Ti)-Total				
Uranium (U)-Total				
Vanadium (V)-Total				
Zinc (Zn)-Total				
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.77	5.27	3.74	2.92
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0287	0.0286	0.0222	0.0209
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000069	0.000075	0.000063	0.000088
Calcium (Ca)-Dissolved	510	521	502	464
Chromium (Cr)-Dissolved	0.00202	0.00193	0.00329	0.00387
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0035	0.0122	0.0023	0.0141
Iron (Fe)-Dissolved	<0.050	0.135	<0.050	0.146
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0085	0.0062	0.0067	0.0064
Magnesium (Mg)-Dissolved	0.68	1.72	1.64	2.38
Manganese (Mn)-Dissolved	0.00151	0.00851	0.00132	0.00894
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.102	0.0771	0.0803	0.0772
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.75	1.76	1.77	1.63
Selenium (Se)-Dissolved	0.0669	0.0676	0.0651	0.0599
Silicon (Si)-Dissolved	0.163	0.099	0.093	0.097
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	6.16	5.96	5.90	5.52
Strontium (Sr)-Dissolved	0.870	0.843	0.824	0.844
Thallium (Tl)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00105	0.00098	0.00096	0.00097
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	0.011
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050

FIELD	FIELD	FIELD	FIELD
2.69	2.78	2.86	3.12
<0.00050	<0.00050	<0.00050	<0.00050
<0.00050	<0.00050	<0.00050	<0.00050
0.0221	0.0190	0.0188	0.0180
<0.00050	<0.00050	<0.00050	<0.00050
<0.0025	<0.0025	<0.0025	<0.0025
<0.050	<0.050	<0.050	<0.050
0.000089	0.000080	0.000071	0.000072
491	472	482	520
0.00492	0.00408	0.00393	0.00429
<0.00050	<0.00050	<0.00050	<0.00050
0.0011	<0.0010	0.0046	<0.0010
<0.050	<0.050	<0.050	<0.050
<0.00025	<0.00025	<0.00025	<0.00025
0.0075	0.0073	0.0064	0.0054
1.31	1.44	2.14	3.55
0.00070	0.00064	0.00277	0.00077
<0.000010	<0.000010	<0.000010	<0.000010
0.0826	0.0851	0.0786	0.0763
<0.0025	<0.0025	<0.0025	<0.0025
<0.30	<0.30	<0.30	<0.30
1.83	1.75	1.61	1.68
0.0663	0.0613	0.0602	0.0639
0.109	0.112	0.102	0.088
<0.000050	<0.000050	<0.000050	<0.000050
6.67	6.59	6.56	5.79
0.871	0.850	0.807	0.841
<0.000050	<0.000050	<0.000050	<0.000050
0.00099	0.00098	0.00089	0.00095
0.015	0.015	0.014	0.016
<0.000050	<0.000050	<0.000050	<0.000050
<0.0050	<0.0050	<0.0050	<0.0050
<0.0050	<0.0050	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-013 OCT21A	1298-016 OCT21B	1298-020 OCT22A	1298-024 OCT22B
Sample ID	- REACTOR1	- REACTOR1	- REACTOR1	- REACTOR1
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-4	L1227088-3	L1227087-3	L1227710-3
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	1280	1310	1250	1180
pH	~	~	~	~
Total Suspended Solids	~	~	~	~
Total Dissolved Solids	~	~	~	~
Turbidity	~	~	~	~
Anions and Nutrients				
Acidity (as CaCO3)	~	~	~	~
Alkalinity, Bicarbonate (as CaCO3)	~	~	~	~
Alkalinity, Carbonate (as CaCO3)	~	~	~	~
Alkalinity, Hydroxide (as CaCO3)	~	~	~	~
Alkalinity, Total (as CaCO3)	~	~	~	~
Ammonia, Total (as N)	~	~	~	~
Bromide (Br)	~	~	~	~
Chloride (Cl)	~	~	~	~
Fluoride (F)	~	~	~	~
Nitrate (as N)	~	~	~	~
Nitrite (as N)	~	~	~	~
Orthophosphate-Dissolved (as P)	~	~	~	~
Phosphorus (P)-Total	~	~	~	~
Sulfate (SO4)	~	~	~	~
Total Metals				
Aluminum (Al)-Total	~	~	~	~
Antimony (Sb)-Total	~	~	~	~
Arsenic (As)-Total	~	~	~	~
Barium (Ba)-Total	~	~	~	~
Beryllium (Be)-Total	~	~	~	~
Bismuth (Bi)-Total	~	~	~	~
Boron (B)-Total	~	~	~	~
Cadmium (Cd)-Total	~	~	~	~
Calcium (Ca)-Total	~	~	~	~
Chromium (Cr)-Total	~	~	~	~
Cobalt (Co)-Total	~	~	~	~
Copper (Cu)-Total	~	~	~	~
Iron (Fe)-Total	~	~	~	~
Lead (Pb)-Total	~	~	~	~
Lithium (Li)-Total	~	~	~	~
Magnesium (Mg)-Total	~	~	~	~
Manganese (Mn)-Total	~	~	~	~
Mercury (Hg)-Total	~	~	~	~
Molybdenum (Mo)-Total	~	~	~	~
Nickel (Ni)-Total	~	~	~	~

Phosphorus (P)-Total				
Potassium (K)-Total				
Selenium (Se)-Total				
Silicon (Si)-Total				
Silver (Ag)-Total				
Sodium (Na)-Total				
Strontium (Sr)-Total				
Thallium (Tl)-Total				
Tin (Sn)-Total				
Titanium (Ti)-Total				
Uranium (U)-Total				
Vanadium (V)-Total				
Zinc (Zn)-Total				
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	5.00	5.85	3.74	3.04
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	0.00062	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0303	0.0301	0.0226	0.0205
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000056	<0.000050	0.000070	0.000134
Calcium (Ca)-Dissolved	512	521	497	467
Chromium (Cr)-Dissolved	0.00163	0.00215	0.00331	0.00402
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00050	0.00074
Copper (Cu)-Dissolved	0.0012	0.0016	0.0015	0.0308
Iron (Fe)-Dissolved	<0.050	<0.050	<0.050	0.334
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0079	0.0058	0.0069	0.0061
Magnesium (Mg)-Dissolved	0.85	2.49	1.63	2.26
Manganese (Mn)-Dissolved	0.00095	0.00114	0.00071	0.0198
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0901	0.0717	0.0785	0.0746
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.83	1.74	1.71	1.55
Selenium (Se)-Dissolved	0.0641	0.0675	0.0638	0.0566
Silicon (Si)-Dissolved	0.127	0.107	0.105	0.119
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	6.09	5.90	5.97	5.36
Strontium (Sr)-Dissolved	0.822	0.823	0.821	0.788
Thallium (Tl)-Dissolved	<0.000050	0.000053	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00097	0.00098	0.00093	0.00099
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	0.012
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	0.0072

1298-028 OCT23A	1298-032 OCT23B	1298-035 OCT24A	1298-039 OCT24B-
- REACTOR1	- REACTOR1	- REACTOR1	REACTOR1
23-OCT-12	23-OCT-12	24-OCT-12	24-OCT-12
02:00	14:00	02:00	14:00
L1227707-3	L1228195-3	L1228156-3	L1228980-3
Water	Water	Water	Water

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FIELD	FIELD	FIELD	FIELD
2.98	3.41	3.21	3.43
<0.00050	<0.00050	<0.00050	<0.00050
<0.00050	<0.00050	<0.00050	<0.00050
0.0193	0.0199	0.0202	0.0195
<0.00050	<0.00050	<0.00050	<0.00050
<0.0025	<0.0025	<0.0025	<0.0025
<0.050	<0.050	<0.050	<0.050
0.000059	0.000077	0.000062	0.000084
461	482	471	502
0.00405	0.00380	0.00372	0.00436
<0.00050	<0.00050	<0.00050	<0.00050
<0.0010	<0.0010	0.0032	0.0019
<0.050	<0.050	<0.050	<0.050
<0.00025	<0.00025	<0.00025	<0.00025
0.0060	0.0079	0.0059	0.0057
1.42	1.80	2.76	4.90
0.00034	0.00072	0.00211	0.00137
<0.000010	<0.000010	<0.000010	<0.000010
0.0797	0.0853	0.0767	0.0719
<0.0025	<0.0025	<0.0025	<0.0025
<0.30	<0.30	<0.30	<0.30
1.71	1.71	1.69	1.64
0.0606	0.0630	0.0625	0.0615
0.123	0.112	0.093	0.091
<0.000050	<0.000050	<0.000050	<0.000050
5.83	6.49	6.24	5.83
0.854	0.871	0.814	0.831
<0.000050	<0.000050	<0.000050	<0.000050
0.00111	0.00102	0.00097	0.00092
<0.010	0.015	0.014	0.015
<0.000050	<0.000050	<0.000050	<0.000050
<0.0050	<0.0050	<0.0050	<0.0050
<0.0050	<0.0050	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-011 OCT21A	1298-017 OCT21B	1298-021 OCT22A	1298-025 OCT22B
Sample ID	- FEED	- FEED	- FEED	- FEED
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-2	L1227088-4	L1227087-4	L1227710-4
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	370	374	374	365
pH	2.63	-	-	-
Total Suspended Solids	37.3	-	-	-
Total Dissolved Solids	1950	-	-	-
Turbidity	68.6	-	-	-
Anions and Nutrients				
Acidity (as CaCO3)	984	-	-	-
Alkalinity, Bicarbonate (as CaCO3)	<1.0	-	-	-
Alkalinity, Carbonate (as CaCO3)	<1.0	-	-	-
Alkalinity, Hydroxide (as CaCO3)	<1.0	-	-	-
Alkalinity, Total (as CaCO3)	<1.0	-	-	-
Ammonia, Total (as N)	0.0085	-	-	-
Bromide (Br)	<1.0	-	-	-
Chloride (Cl)	<10	-	-	-
Fluoride (F)	1.38	-	-	-
Nitrate (as N)	0.81	-	-	-
Nitrite (as N)	0.030	-	-	-
Orthophosphate-Dissolved (as P)	0.0340	-	-	-
Phosphorus (P)-Total	<0.20	-	-	-
Sulfate (SO4)	1350	-	-	-
Total Metals				
Aluminum (Al)-Total	33.6	-	-	-
Antimony (Sb)-Total	0.00207	-	-	-
Arsenic (As)-Total	0.138	-	-	-
Barium (Ba)-Total	0.0870	-	-	-
Beryllium (Be)-Total	0.00271	-	-	-
Bismuth (Bi)-Total	<0.0025	-	-	-
Boron (B)-Total	<0.050	-	-	-
Cadmium (Cd)-Total	0.0423	-	-	-
Calcium (Ca)-Total	101	-	-	-
Chromium (Cr)-Total	0.0232	-	-	-
Cobalt (Co)-Total	0.470	-	-	-
Copper (Cu)-Total	20.3	-	-	-
Iron (Fe)-Total	233	-	-	-
Lead (Pb)-Total	0.0378	-	-	-
Lithium (Li)-Total	0.0117	-	-	-
Magnesium (Mg)-Total	22.2	-	-	-
Manganese (Mn)-Total	13.5	-	-	-
Mercury (Hg)-Total	0.000039	-	-	-
Molybdenum (Mo)-Total	0.124	-	-	-
Nickel (Ni)-Total	0.185	-	-	-
Phosphorus (P)-Total	<0.30	-	-	-

Potassium (K)-Total	1.65	-	-	-
Selenium (Se)-Total	0.112	-	-	-
Silicon (Si)-Total	6.37	-	-	-
Silver (Ag)-Total	0.00382	-	-	-
Sodium (Na)-Total	5.66	-	-	-
Strontium (Sr)-Total	0.754	-	-	-
Thallium (Tl)-Total	0.000122	-	-	-
Tin (Sn)-Total	0.00112	-	-	-
Titanium (Ti)-Total	0.832	-	-	-
Uranium (U)-Total	0.00194	-	-	-
Vanadium (V)-Total	0.0064	-	-	-
Zinc (Zn)-Total	3.64	-	-	-
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	34.4	34.5	35.1	31.7
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.129	0.138	0.132	0.118
Barium (Ba)-Dissolved	0.0835	0.0837	0.0870	0.0783
Beryllium (Be)-Dissolved	0.00257	0.00263	0.00255	0.00269
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.0422	0.0453	0.0455	0.0413
Calcium (Ca)-Dissolved	109	110	110	106
Chromium (Cr)-Dissolved	0.0242	0.0251	0.0245	0.0226
Cobalt (Co)-Dissolved	0.481	0.496	0.499	0.450
Copper (Cu)-Dissolved	20.7	21.9	21.7	20.5
Iron (Fe)-Dissolved	232	235	241	219
Lead (Pb)-Dissolved	0.0345	0.0429	0.0362	0.0366
Lithium (Li)-Dissolved	0.0104	0.0107	0.0107	0.0119
Magnesium (Mg)-Dissolved	23.7	24.1	24.0	24.3
Manganese (Mn)-Dissolved	13.8	14.1	14.2	13.4
Mercury (Hg)-Dissolved	<0.000010	0.000015	0.000014	0.000017
Molybdenum (Mo)-Dissolved	0.0758	0.0871	0.0822	0.0809
Nickel (Ni)-Dissolved	0.186	0.194	0.193	0.185
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.75	1.74	1.74	1.60
Selenium (Se)-Dissolved	0.107	0.110	0.113	0.0994
Silicon (Si)-Dissolved	6.43	6.42	6.43	6.53
Silver (Ag)-Dissolved	0.00338	0.00377	0.00373	0.00360
Sodium (Na)-Dissolved	5.78	5.84	6.00	5.46
Strontium (Sr)-Dissolved	0.665	0.762	0.741	0.742
Thallium (Tl)-Dissolved	0.000161	0.000271	0.000109	0.000108
Tin (Sn)-Dissolved	0.00101	0.00101	0.00109	0.00097
Titanium (Ti)-Dissolved	0.797	0.804	0.800	0.792
Uranium (U)-Dissolved	0.00179	0.00201	0.00195	0.00199
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	3.75	3.88	3.90	3.59

FIELD	FIELD	FIELD	
34.7	35.3	34.2	34.3
<0.00050	<0.00050	<0.00050	
0.127	0.122	0.120	
0.0900	0.0827	0.0840	
0.00275	0.00295	0.00269	
<0.0025	<0.0025	<0.0025	
<0.050	<0.050	<0.050	
0.0453	0.0422	0.0442	
109	114	116	
0.0242	0.0227	0.0245	
0.495	0.507	0.492	
22.4	21.7	22.3	
221	231	231	
0.0369	0.0370	0.0389	
0.0123	0.0134	0.0116	
24.0	24.9	25.9	
14.7	14.8	14.4	
0.000020	0.000021	0.000015	
0.0805	0.0829	0.0850	0.082
0.199	0.191	0.194	
<0.30	<0.30	<0.30	
1.81	1.77	1.68	
0.100	0.107	0.108	
6.39	6.48	6.64	
0.00372	0.00408	0.00363	
6.01	6.38	5.82	
0.742	0.785	0.788	
0.000124	0.000120	0.000124	
0.00128	0.00118	0.00122	
0.777	0.798	0.840	
0.00206	0.00208	0.00194	
<0.0050	<0.0050	<0.0050	
3.98	3.64	3.79	

RESULTS OF ANALYSIS

	1298-010 OCT21A	1298-014 OCT21B	1298-018 OCT22A	1298-022 OCT22B
Sample ID	- EFFLUENT	- EFFLUENT	- EFFLUENT	- EFFLUENT
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-1	L1227088-1	L1227087-1	L1227710-1
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	1250	1260	1340	1150
pH	10.23	9.62	9.25	9.19
Total Suspended Solids	8.0	13.0	6.0	14.0
Total Dissolved Solids	1740	1730	1850	1750
Turbidity	5.12	8.87	3.45	10.1
Anions and Nutrients				
Acidity (as CaCO3)	<1.0	<1.0	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO3)	<1.0	2.7	5.7	12.3
Alkalinity, Carbonate (as CaCO3)	32.4	28.4	22.3	8.9
Alkalinity, Hydroxide (as CaCO3)	7.2	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	39.6	31.1	28.0	21.2
Ammonia, Total (as N)	0.0349	0.0438	0.0504	0.0408
Bromide (Br)	<1.0	<1.0	<1.0	<1.0
Chloride (Cl)	<10	<10	<10	<10
Fluoride (F)	0.41	0.43	0.44	<0.40
Nitrate (as N)	0.74	0.73	0.75	0.83
Nitrite (as N)	0.024	0.021	<0.020	0.022
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO4)	1160	1160	1240	1170
Total Metals				
Aluminum (Al)-Total	3.62	4.48	4.27	3.51
Antimony (Sb)-Total	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total	0.00224	0.00194	0.00069	0.00171
Barium (Ba)-Total	0.0284	0.0264	0.0240	0.0230
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Total	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Total	0.000676	0.000614	0.000285	0.000554
Calcium (Ca)-Total	475	465	482	451
Chromium (Cr)-Total	0.00248	0.00288	0.00360	0.00422
Cobalt (Co)-Total	0.00613	0.00586	0.00229	0.00504
Copper (Cu)-Total	0.267	0.260	0.0954	0.222
Iron (Fe)-Total	3.26	3.01	1.13	2.57
Lead (Pb)-Total	0.00055	0.00049	<0.00025	0.00048
Lithium (Li)-Total	0.0088	0.0057	0.0064	0.0062
Magnesium (Mg)-Total	1.02	1.47	3.62	2.64
Manganese (Mn)-Total	0.178	0.171	0.0618	0.139
Mercury (Hg)-Total	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	0.118	0.0821	0.0726	0.0793
Nickel (Ni)-Total	0.0025	<0.0025	<0.0025	<0.0025

Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	1.76	1.71	1.72	1.73
Selenium (Se)-Total	0.0637	0.0635	0.0656	0.0637
Silicon (Si)-Total	0.240	0.220	0.114	0.181
Silver (Ag)-Total	0.000053	0.000054	0.000057	0.000070
Sodium (Na)-Total	5.87	5.74	5.79	5.78
Strontium (Sr)-Total	0.862	0.833	0.810	0.853
Thallium (Tl)-Total	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)-Total	0.00109	0.00100	0.00095	0.00123
Titanium (Ti)-Total	0.021	0.020	0.012	0.020
Uranium (U)-Total	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Total	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Total	0.052	0.051	0.027	0.046
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.26	4.03	4.36	3.06
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0281	0.0251	0.0240	0.0198
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000090	0.000099	0.000063	0.000074
Calcium (Ca)-Dissolved	499	503	531	457
Chromium (Cr)-Dissolved	0.00194	0.00241	0.00334	0.00374
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0010	<0.0010	<0.0010	0.0013
Iron (Fe)-Dissolved	<0.050	<0.050	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0085	0.0064	0.0065	0.0060
Magnesium (Mg)-Dissolved	0.74	1.33	4.02	2.47
Manganese (Mn)-Dissolved	0.00026	0.00049	0.00083	0.00082
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.117	0.0776	0.0730	0.0749
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.68	1.63	1.78	1.62
Selenium (Se)-Dissolved	0.0647	0.0639	0.0668	0.0587
Silicon (Si)-Dissolved	0.125	0.110	0.077	0.092
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	6.01	5.58	6.07	5.58
Strontium (Sr)-Dissolved	0.840	0.780	0.821	0.815
Thallium (Tl)-Dissolved	<0.000050	0.000071	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00107	0.00097	0.00090	0.00100
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	0.011
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050

1298-026 OCT23A - EFFLUENT 23-OCT-12 02:00 L1227707-1 Water	1298-030 OCT23B - EFFLUENT 23-OCT-12 14:00 L1228195-1 Water	1298-033 OCT24A - EFFLUENT 24-OCT-12 02:00 L1228156-1 Water	1298-037 OCT24B EFFLUENT 24-OCT-12 14:00 L1228980-1 Water	Average
1180	1210	1230	1310	
9.62	9.49	8.75	9.14	
13.3	5.3	24.0	9.3	11.6
1720	1600	1630	1700	
14.8	7.69	35.4	9.77	
<1.0	<1.0	<1.0	<1.0	
10.8	11.7	15.3	13.9	
14.1	14.4	5.5	8.1	
<1.0	<1.0	<1.0	<1.0	
24.9	26.1	20.8	22.0	
0.0500	0.0606	0.0562	0.0579	
<1.0	<1.0	<1.0	<1.0	
<10	<10	<10	<10	
<0.40	<0.40	<0.40	<0.40	
0.73	0.85	0.90	0.74	
0.026	0.031	0.037	0.036	
<0.0010	<0.0010	<0.0010	<0.0010	
<0.0020	<0.0020	<0.0020	<0.0020	
1140	1130	1150	1190	
3.08	2.92	4.06	3.47	
<0.00050	<0.00050	<0.00050	<0.00050	
0.00177	0.00160	0.00398	0.00204	
0.0216	0.0193	0.0236	0.0193	
<0.00050	<0.00050	<0.00050	<0.00050	
<0.0025	<0.0025	<0.0025	<0.0025	
<0.050	<0.050	<0.050	<0.050	
0.000630	0.000615	0.00137	0.000756	
453	457	493	496	
0.00495	0.00402	0.00553	0.00537	
0.00637	0.00596	0.0145	0.00785	
0.264	0.245	0.607	0.334	
3.10	2.86	7.02	3.76	
0.00054	0.00029	0.00128	0.00064	
0.0062	0.0071	0.0072	0.0054	
2.21	1.61	2.50	3.52	
0.161	0.159	0.401	0.206	
<0.000010	<0.000010	0.000012	0.000013	
0.0807	0.0876	0.0825	0.0779	
0.0026	<0.0025	0.0058	0.0031	

<0.30	<0.30	<0.30	<0.30
1.69	1.74	1.70	1.69
0.0629	0.0609	0.0646	0.0635
0.229	0.211	0.383	0.243
0.000091	0.000063	0.000162	0.000101
5.81	6.54	6.52	5.85
0.859	0.853	0.835	0.853
<0.000050	<0.000050	<0.000050	<0.000050
0.00099	0.00086	0.00101	0.00093
0.022	0.025	0.040	0.029
<0.000050	<0.000050	0.000112	0.000055
<0.0050	<0.0050	<0.0050	<0.0050
0.051	0.046	0.111	0.061

FIELD	FIELD	FIELD	FIELD	
2.81	2.71	3.32	3.09	3.33
<0.00050	<0.00050	<0.00050	<0.00050	
<0.00050	<0.00050	<0.00050	<0.00050	
0.0201	0.0186	0.0198	0.0182	
<0.00050	<0.00050	<0.00050	<0.00050	
<0.0025	<0.0025	<0.0025	<0.0025	
<0.050	<0.050	<0.050	<0.050	
0.000101	0.000088	0.000089	0.000088	
470	481	491	520	
0.00433	0.00386	0.00384	0.00477	
<0.00050	<0.00050	<0.00050	<0.00050	
0.0044	0.0016	0.0075	0.0022	
<0.050	<0.050	<0.050	<0.050	
<0.00025	<0.00025	<0.00025	<0.00025	
0.0062	0.0073	0.0056	0.0054	
1.99	1.39	1.76	3.28	
0.00211	0.00096	0.00400	0.00136	
<0.000010	<0.000010	<0.000010	<0.000010	
0.0791	0.0885	0.0783	0.0799	0.084
<0.0025	<0.0025	<0.0025	<0.0025	
<0.30	<0.30	<0.30	<0.30	
1.71	1.69	1.66	1.71	
0.0616	0.0617	0.0621	0.0633	
0.114	0.107	0.105	0.095	
<0.000050	<0.000050	<0.000050	<0.000050	
5.71	6.57	6.55	5.90	
0.835	0.852	0.818	0.858	
<0.000050	<0.000050	<0.000050	<0.000050	
0.00098	0.00091	0.00110	0.00086	
0.011	0.016	0.015	0.015	
<0.000050	<0.000050	<0.000050	<0.000050	
<0.0050	<0.0050	<0.0050	<0.0050	
<0.0050	<0.0050	<0.0050	<0.0050	

RESULTS OF ANALYSIS

	1298-012 OCT21A	1298-015 OCT21B	1298-019 OCT22A	1298-023 OCT22B
Sample ID	- REACTOR2	- REACTOR2	- REACTOR2	- REACTOR2
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-3	L1227088-2	L1227087-2	L1227710-2
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	1280	1310	1260	1170
pH	7.8	7.8	7.8	7.8
Total Suspended Solids	1.0	1.0	1.0	1.0
Total Dissolved Solids	1.0	1.0	1.0	1.0
Turbidity	0.1	0.1	0.1	0.1
Anions and Nutrients				
Acidity (as CaCO3)	0.0	0.0	0.0	0.0
Alkalinity, Bicarbonate (as CaCO3)	1.0	1.0	1.0	1.0
Alkalinity, Carbonate (as CaCO3)	0.0	0.0	0.0	0.0
Alkalinity, Hydroxide (as CaCO3)	0.0	0.0	0.0	0.0
Alkalinity, Total (as CaCO3)	1.0	1.0	1.0	1.0
Ammonia, Total (as N)	0.0	0.0	0.0	0.0
Bromide (Br)	0.0	0.0	0.0	0.0
Chloride (Cl)	0.0	0.0	0.0	0.0
Fluoride (F)	0.0	0.0	0.0	0.0
Nitrate (as N)	0.0	0.0	0.0	0.0
Nitrite (as N)	0.0	0.0	0.0	0.0
Orthophosphate-Dissolved (as P)	0.0	0.0	0.0	0.0
Phosphorus (P)-Total	0.0	0.0	0.0	0.0
Sulfate (SO4)	0.0	0.0	0.0	0.0
Total Metals				
Aluminum (Al)-Total	0.0	0.0	0.0	0.0
Antimony (Sb)-Total	0.0	0.0	0.0	0.0
Arsenic (As)-Total	0.0	0.0	0.0	0.0
Barium (Ba)-Total	0.0	0.0	0.0	0.0
Beryllium (Be)-Total	0.0	0.0	0.0	0.0
Bismuth (Bi)-Total	0.0	0.0	0.0	0.0
Boron (B)-Total	0.0	0.0	0.0	0.0
Cadmium (Cd)-Total	0.0	0.0	0.0	0.0
Calcium (Ca)-Total	1.0	1.0	1.0	1.0
Chromium (Cr)-Total	0.0	0.0	0.0	0.0
Cobalt (Co)-Total	0.0	0.0	0.0	0.0
Copper (Cu)-Total	0.0	0.0	0.0	0.0
Iron (Fe)-Total	0.0	0.0	0.0	0.0
Lead (Pb)-Total	0.0	0.0	0.0	0.0
Lithium (Li)-Total	0.0	0.0	0.0	0.0
Magnesium (Mg)-Total	0.0	0.0	0.0	0.0
Manganese (Mn)-Total	0.0	0.0	0.0	0.0
Mercury (Hg)-Total	0.0	0.0	0.0	0.0
Molybdenum (Mo)-Total	0.0	0.0	0.0	0.0
Nickel (Ni)-Total	0.0	0.0	0.0	0.0

Phosphorus (P)-Total				
Potassium (K)-Total				
Selenium (Se)-Total				
Silicon (Si)-Total				
Silver (Ag)-Total				
Sodium (Na)-Total				
Strontium (Sr)-Total				
Thallium (Tl)-Total				
Tin (Sn)-Total				
Titanium (Ti)-Total				
Uranium (U)-Total				
Vanadium (V)-Total				
Zinc (Zn)-Total				
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.77	5.27	3.74	2.92
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0287	0.0286	0.0222	0.0209
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000069	0.000075	0.000063	0.000088
Calcium (Ca)-Dissolved	510	521	502	464
Chromium (Cr)-Dissolved	0.00202	0.00193	0.00329	0.00387
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0035	0.0122	0.0023	0.0141
Iron (Fe)-Dissolved	<0.050	0.135	<0.050	0.146
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0085	0.0062	0.0067	0.0064
Magnesium (Mg)-Dissolved	0.68	1.72	1.64	2.38
Manganese (Mn)-Dissolved	0.00151	0.00851	0.00132	0.00894
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.102	0.0771	0.0803	0.0772
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.75	1.76	1.77	1.63
Selenium (Se)-Dissolved	0.0669	0.0676	0.0651	0.0599
Silicon (Si)-Dissolved	0.163	0.099	0.093	0.097
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	6.16	5.96	5.90	5.52
Strontium (Sr)-Dissolved	0.870	0.843	0.824	0.844
Thallium (Tl)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00105	0.00098	0.00096	0.00097
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	0.011
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050

FIELD	FIELD	FIELD	FIELD
2.69	2.78	2.86	3.12
<0.00050	<0.00050	<0.00050	<0.00050
<0.00050	<0.00050	<0.00050	<0.00050
0.0221	0.0190	0.0188	0.0180
<0.00050	<0.00050	<0.00050	<0.00050
<0.0025	<0.0025	<0.0025	<0.0025
<0.050	<0.050	<0.050	<0.050
0.000089	0.000080	0.000071	0.000072
491	472	482	520
0.00492	0.00408	0.00393	0.00429
<0.00050	<0.00050	<0.00050	<0.00050
0.0011	<0.0010	0.0046	<0.0010
<0.050	<0.050	<0.050	<0.050
<0.00025	<0.00025	<0.00025	<0.00025
0.0075	0.0073	0.0064	0.0054
1.31	1.44	2.14	3.55
0.00070	0.00064	0.00277	0.00077
<0.000010	<0.000010	<0.000010	<0.000010
0.0826	0.0851	0.0786	0.0763
<0.0025	<0.0025	<0.0025	<0.0025
<0.30	<0.30	<0.30	<0.30
1.83	1.75	1.61	1.68
0.0663	0.0613	0.0602	0.0639
0.109	0.112	0.102	0.088
<0.000050	<0.000050	<0.000050	<0.000050
6.67	6.59	6.56	5.79
0.871	0.850	0.807	0.841
<0.000050	<0.000050	<0.000050	<0.000050
0.00099	0.00098	0.00089	0.00095
0.015	0.015	0.014	0.016
<0.000050	<0.000050	<0.000050	<0.000050
<0.0050	<0.0050	<0.0050	<0.0050
<0.0050	<0.0050	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-013 OCT21A	1298-016 OCT21B	1298-020 OCT22A	1298-024 OCT22B
Sample ID	- REACTOR1	- REACTOR1	- REACTOR1	- REACTOR1
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-4	L1227088-3	L1227087-3	L1227710-3
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	1280	1310	1250	1180
pH	-	-	-	-
Total Suspended Solids	-	-	-	-
Total Dissolved Solids	-	-	-	-
Turbidity	-	-	-	-
Anions and Nutrients				
Acidity (as CaCO3)	-	-	-	-
Alkalinity, Bicarbonate (as CaCO3)	-	-	-	-
Alkalinity, Carbonate (as CaCO3)	-	-	-	-
Alkalinity, Hydroxide (as CaCO3)	-	-	-	-
Alkalinity, Total (as CaCO3)	-	-	-	-
Ammonia, Total (as N)	-	-	-	-
Bromide (Br)	-	-	-	-
Chloride (Cl)	-	-	-	-
Fluoride (F)	-	-	-	-
Nitrate (as N)	-	-	-	-
Nitrite (as N)	-	-	-	-
Orthophosphate-Dissolved (as P)	-	-	-	-
Phosphorus (P)-Total	-	-	-	-
Sulfate (SO4)	-	-	-	-
Total Metals				
Aluminum (Al)-Total	-	-	-	-
Antimony (Sb)-Total	-	-	-	-
Arsenic (As)-Total	-	-	-	-
Barium (Ba)-Total	-	-	-	-
Beryllium (Be)-Total	-	-	-	-
Bismuth (Bi)-Total	-	-	-	-
Boron (B)-Total	-	-	-	-
Cadmium (Cd)-Total	-	-	-	-
Calcium (Ca)-Total	-	-	-	-
Chromium (Cr)-Total	-	-	-	-
Cobalt (Co)-Total	-	-	-	-
Copper (Cu)-Total	-	-	-	-
Iron (Fe)-Total	-	-	-	-
Lead (Pb)-Total	-	-	-	-
Lithium (Li)-Total	-	-	-	-
Magnesium (Mg)-Total	-	-	-	-
Manganese (Mn)-Total	-	-	-	-
Mercury (Hg)-Total	-	-	-	-
Molybdenum (Mo)-Total	-	-	-	-
Nickel (Ni)-Total	-	-	-	-

Phosphorus (P)-Total				
Potassium (K)-Total				
Selenium (Se)-Total				
Silicon (Si)-Total				
Silver (Ag)-Total				
Sodium (Na)-Total				
Strontium (Sr)-Total				
Thallium (Tl)-Total				
Tin (Sn)-Total				
Titanium (Ti)-Total				
Uranium (U)-Total				
Vanadium (V)-Total				
Zinc (Zn)-Total				
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	5.00	5.85	3.74	3.04
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	0.00062	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0303	0.0301	0.0226	0.0205
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000056	<0.000050	0.000070	0.000134
Calcium (Ca)-Dissolved	512	521	497	467
Chromium (Cr)-Dissolved	0.00163	0.00215	0.00331	0.00402
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00050	0.00074
Copper (Cu)-Dissolved	0.0012	0.0016	0.0015	0.0308
Iron (Fe)-Dissolved	<0.050	<0.050	<0.050	0.334
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0079	0.0058	0.0069	0.0061
Magnesium (Mg)-Dissolved	0.85	2.49	1.63	2.26
Manganese (Mn)-Dissolved	0.00095	0.00114	0.00071	0.0198
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0901	0.0717	0.0785	0.0746
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.83	1.74	1.71	1.55
Selenium (Se)-Dissolved	0.0641	0.0675	0.0638	0.0566
Silicon (Si)-Dissolved	0.127	0.107	0.105	0.119
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Dissolved	6.09	5.90	5.97	5.36
Strontium (Sr)-Dissolved	0.822	0.823	0.821	0.788
Thallium (Tl)-Dissolved	<0.000050	0.000053	<0.000050	<0.000050
Tin (Sn)-Dissolved	0.00097	0.00098	0.00093	0.00099
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	0.012
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0050	0.0072

1298-028 OCT23A	1298-032 OCT23B	1298-035 OCT24A	1298-039 OCT24B-
- REACTOR1	- REACTOR1	- REACTOR1	REACTOR1
23-OCT-12	23-OCT-12	24-OCT-12	24-OCT-12
02:00	14:00	02:00	14:00
L1227707-3	L1228195-3	L1228156-3	L1228980-3
Water	Water	Water	Water

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FIELD	FIELD	FIELD	FIELD
2.98	3.41	3.21	3.43
<0.00050	<0.00050	<0.00050	<0.00050
<0.00050	<0.00050	<0.00050	<0.00050
0.0193	0.0199	0.0202	0.0195
<0.00050	<0.00050	<0.00050	<0.00050
<0.0025	<0.0025	<0.0025	<0.0025
<0.050	<0.050	<0.050	<0.050
0.000059	0.000077	0.000062	0.000084
461	482	471	502
0.00405	0.00380	0.00372	0.00436
<0.00050	<0.00050	<0.00050	<0.00050
<0.0010	<0.0010	0.0032	0.0019
<0.050	<0.050	<0.050	<0.050
<0.00025	<0.00025	<0.00025	<0.00025
0.0060	0.0079	0.0059	0.0057
1.42	1.80	2.76	4.90
0.00034	0.00072	0.00211	0.00137
<0.000010	<0.000010	<0.000010	<0.000010
0.0797	0.0853	0.0767	0.0719
<0.0025	<0.0025	<0.0025	<0.0025
<0.30	<0.30	<0.30	<0.30
1.71	1.71	1.69	1.64
0.0606	0.0630	0.0625	0.0615
0.123	0.112	0.093	0.091
<0.000050	<0.000050	<0.000050	<0.000050
5.83	6.49	6.24	5.83
0.854	0.871	0.814	0.831
<0.000050	<0.000050	<0.000050	<0.000050
0.00111	0.00102	0.00097	0.00092
<0.010	0.015	0.014	0.015
<0.000050	<0.000050	<0.000050	<0.000050
<0.0050	<0.0050	<0.0050	<0.0050
<0.0050	<0.0050	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-011 OCT21A	1298-017 OCT21B	1298-021 OCT22A	1298-025 OCT22B
Sample ID	- FEED	- FEED	- FEED	- FEED
Date Sampled	21-OCT-12	21-OCT-12	22-OCT-12	22-OCT-12
Time Sampled	14:00	14:00	02:00	14:00
ALS Sample ID	L1227084-2	L1227088-4	L1227087-4	L1227710-4
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	370	374	374	365
pH	2.63	-	-	-
Total Suspended Solids	37.3	-	-	-
Total Dissolved Solids	1950	-	-	-
Turbidity	68.6	-	-	-
Anions and Nutrients				
Acidity (as CaCO3)	984	-	-	-
Alkalinity, Bicarbonate (as CaCO3)	<1.0	-	-	-
Alkalinity, Carbonate (as CaCO3)	<1.0	-	-	-
Alkalinity, Hydroxide (as CaCO3)	<1.0	-	-	-
Alkalinity, Total (as CaCO3)	<1.0	-	-	-
Ammonia, Total (as N)	0.0085	-	-	-
Bromide (Br)	<1.0	-	-	-
Chloride (Cl)	<10	-	-	-
Fluoride (F)	1.38	-	-	-
Nitrate (as N)	0.81	-	-	-
Nitrite (as N)	0.030	-	-	-
Orthophosphate-Dissolved (as P)	0.0340	-	-	-
Phosphorus (P)-Total	<0.20	-	-	-
Sulfate (SO4)	1350	-	-	-
Total Metals				
Aluminum (Al)-Total	33.6	-	-	-
Antimony (Sb)-Total	0.00207	-	-	-
Arsenic (As)-Total	0.138	-	-	-
Barium (Ba)-Total	0.0870	-	-	-
Beryllium (Be)-Total	0.00271	-	-	-
Bismuth (Bi)-Total	<0.0025	-	-	-
Boron (B)-Total	<0.050	-	-	-
Cadmium (Cd)-Total	0.0423	-	-	-
Calcium (Ca)-Total	101	-	-	-
Chromium (Cr)-Total	0.0232	-	-	-
Cobalt (Co)-Total	0.470	-	-	-
Copper (Cu)-Total	20.3	-	-	-
Iron (Fe)-Total	233	-	-	-
Lead (Pb)-Total	0.0378	-	-	-
Lithium (Li)-Total	0.0117	-	-	-
Magnesium (Mg)-Total	22.2	-	-	-
Manganese (Mn)-Total	13.5	-	-	-
Mercury (Hg)-Total	0.000039	-	-	-
Molybdenum (Mo)-Total	0.124	-	-	-
Nickel (Ni)-Total	0.185	-	-	-
Phosphorus (P)-Total	<0.30	-	-	-

Potassium (K)-Total	1.65			
Selenium (Se)-Total	0.112			
Silicon (Si)-Total	6.37			
Silver (Ag)-Total	0.00382			
Sodium (Na)-Total	5.66			
Strontium (Sr)-Total	0.754			
Thallium (Tl)-Total	0.000122			
Tin (Sn)-Total	0.00112			
Titanium (Ti)-Total	0.832			
Uranium (U)-Total	0.00194			
Vanadium (V)-Total	0.0064			
Zinc (Zn)-Total	3.64			
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	34.4	34.5	35.1	31.7
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.129	0.138	0.132	0.118
Barium (Ba)-Dissolved	0.0835	0.0837	0.0870	0.0783
Beryllium (Be)-Dissolved	0.00257	0.00263	0.00255	0.00269
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.0422	0.0453	0.0455	0.0413
Calcium (Ca)-Dissolved	109	110	110	106
Chromium (Cr)-Dissolved	0.0242	0.0251	0.0245	0.0226
Cobalt (Co)-Dissolved	0.481	0.496	0.499	0.450
Copper (Cu)-Dissolved	20.7	21.9	21.7	20.5
Iron (Fe)-Dissolved	232	235	241	219
Lead (Pb)-Dissolved	0.0345	0.0429	0.0362	0.0366
Lithium (Li)-Dissolved	0.0104	0.0107	0.0107	0.0119
Magnesium (Mg)-Dissolved	23.7	24.1	24.0	24.3
Manganese (Mn)-Dissolved	13.8	14.1	14.2	13.4
Mercury (Hg)-Dissolved	<0.000010	0.000015	0.000014	0.000017
Molybdenum (Mo)-Dissolved	0.0758	0.0871	0.0822	0.0809
Nickel (Ni)-Dissolved	0.186	0.194	0.193	0.185
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.75	1.74	1.74	1.60
Selenium (Se)-Dissolved	0.107	0.110	0.113	0.0994
Silicon (Si)-Dissolved	6.43	6.42	6.43	6.53
Silver (Ag)-Dissolved	0.00338	0.00377	0.00373	0.00360
Sodium (Na)-Dissolved	5.78	5.84	6.00	5.46
Strontium (Sr)-Dissolved	0.665	0.762	0.741	0.742
Thallium (Tl)-Dissolved	0.000161	0.000271	0.000109	0.000108
Tin (Sn)-Dissolved	0.00101	0.00101	0.00109	0.00097
Titanium (Ti)-Dissolved	0.797	0.804	0.800	0.792
Uranium (U)-Dissolved	0.00179	0.00201	0.00195	0.00199
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (Zn)-Dissolved	3.75	3.88	3.90	3.59

FIELD	FIELD	FIELD	
34.7	35.3	34.2	34.3
<0.00050	<0.00050	<0.00050	
0.127	0.122	0.120	
0.0900	0.0827	0.0840	
0.00275	0.00295	0.00269	
<0.0025	<0.0025	<0.0025	
<0.050	<0.050	<0.050	
0.0453	0.0422	0.0442	
109	114	116	
0.0242	0.0227	0.0245	
0.495	0.507	0.492	
22.4	21.7	22.3	
221	231	231	
0.0369	0.0370	0.0389	
0.0123	0.0134	0.0116	
24.0	24.9	25.9	
14.7	14.8	14.4	
0.000020	0.000021	0.000015	
0.0805	0.0829	0.0850	0.082
0.199	0.191	0.194	
<0.30	<0.30	<0.30	
1.81	1.77	1.68	
0.100	0.107	0.108	
6.39	6.48	6.64	
0.00372	0.00408	0.00363	
6.01	6.38	5.82	
0.742	0.785	0.788	
0.000124	0.000120	0.000124	
0.00128	0.00118	0.00122	
0.777	0.798	0.840	
0.00206	0.00208	0.00194	
<0.0050	<0.0050	<0.0050	
3.98	3.64	3.79	

RESULTS OF ANALYSIS

Sample ID	1298-033 OCT24A - EFFLUENT	1298-037 OCT24B- EFFLUENT	1298-041 OCT25A - EFFLUENT	1298-047 OCT25B- EFFLUENT
Date Sampled	24-OCT-12	24-OCT-12	25-OCT-12	25-OCT-12
Time Sampled	02:00	14:00	02:00	14:00
ALS Sample ID	L1228156-1	L1228980-1	L1228971-1	L1229605-1
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO ₃)	1230	1310	973	848
pH	8.75	9.14	8.79	9.37
Total Suspended Solids	24.0	9.3	22.0	15.4
Total Dissolved Solids	1630	1700	1250	1260
Turbidity	35.4	9.77	25.7	17.7
Anions and Nutrients				
Acidity (as CaCO ₃)	<1.0	<1.0	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO ₃)	15.3	13.9	10.1	11.8
Alkalinity, Carbonate (as CaCO ₃)	5.5	8.1	3.4	10.4
Alkalinity, Hydroxide (as CaCO ₃)	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO ₃)	20.8	22.0	13.4	22.2
Ammonia, Total (as N)	0.0562	0.0579	0.0815	0.0833
Bromide (Br)	<1.0	<1.0	<0.50	<1.0
Chloride (Cl)	<10	<10	<5.0	<10
Fluoride (F)	<0.40	<0.40	<0.20	<0.40
Nitrate (as N)	0.90	0.74	0.576	0.58
Nitrite (as N)	0.037	0.036	0.020	<0.020
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total	<0.0020	<0.0020	<0.0020	0.0025
Sulfate (SO ₄)	1150	1190	869	848
Total Metals				
Aluminum (Al)-Total	4.06	3.47	2.58	3.03
Antimony (Sb)-Total	<0.00050	<0.00050	<0.00020	<0.00020
Arsenic (As)-Total	0.00398	0.00204	0.00262	0.00364
Barium (Ba)-Total	0.0236	0.0193	0.0131	0.0131
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00020	<0.00020
Bismuth (Bi)-Total	<0.0025	<0.0025	<0.0010	<0.0010
Boron (B)-Total	<0.050	<0.050	<0.020	<0.020
Cadmium (Cd)-Total	0.00137	0.000756	0.000885	0.00128
Calcium (Ca)-Total	493	496	362	331
Chromium (Cr)-Total	0.00553	0.00537	0.00500	0.00512
Cobalt (Co)-Total	0.0145	0.00785	0.0100	0.0146
Copper (Cu)-Total	0.607	0.334	0.403	0.609
Iron (Fe)-Total	7.02	3.76	4.38	6.11
Lead (Pb)-Total	0.00128	0.00064	0.00073	0.00104
Lithium (Li)-Total	0.0072	0.0054	0.0057	0.0057
Magnesium (Mg)-Total	2.50	3.52	1.69	2.15
Manganese (Mn)-Total	0.401	0.206	0.253	0.395
Mercury (Hg)-Total	0.000012	0.000013	<0.000010	<0.000010
Molybdenum (Mo)-Total	0.0825	0.0779	0.0658	0.0604
Nickel (Ni)-Total	0.0058	0.0031	0.0041	0.0061

Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	1.70	1.69	1.36	1.32
Selenium (Se)-Total	0.0646	0.0635	0.0487	0.0465
Silicon (Si)-Total	0.383	0.243	0.274	0.355
Silver (Ag)-Total	0.000162	0.000101	0.000110	0.000153
Sodium (Na)-Total	6.52	5.85	4.81	4.65
Strontium (Sr)-Total	0.835	0.853	0.655	0.622
Thallium (Tl)-Total	<0.000050	<0.000050	0.000028	0.000029
Tin (Sn)-Total	0.00101	0.00093	0.00092	0.00093
Titanium (Ti)-Total	0.040	0.029	0.030	0.036
Uranium (U)-Total	0.000112	0.000055	0.000063	0.000089
Vanadium (V)-Total	<0.0050	<0.0050	<0.0020	<0.0020
Zinc (Zn)-Total	0.111	0.061	0.0755	0.112
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.32	3.09	2.10	2.05
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Barium (Ba)-Dissolved	0.0198	0.0182	0.0126	0.0114
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010
Boron (B)-Dissolved	<0.050	<0.050	<0.020	<0.020
Cadmium (Cd)-Dissolved	0.000089	0.000088	0.000144	0.000112
Calcium (Ca)-Dissolved	491	520	388	337
Chromium (Cr)-Dissolved	0.00384	0.00477	0.00401	0.00402
Cobalt (Co)-Dissolved	<0.00050	<0.00050	0.00034	<0.00020
Copper (Cu)-Dissolved	0.0075	0.0022	0.0106	0.00398
Iron (Fe)-Dissolved	<0.050	<0.050	0.119	<0.020
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00010	<0.00010
Lithium (Li)-Dissolved	0.0056	0.0054	0.0057	0.0055
Magnesium (Mg)-Dissolved	1.76	3.28	1.23	1.23
Manganese (Mn)-Dissolved	0.00400	0.00136	0.00672	0.00230
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0783	0.0799	0.0670	0.0588
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.66	1.71	1.41	1.33
Selenium (Se)-Dissolved	0.0621	0.0633	0.0503	0.0449
Silicon (Si)-Dissolved	0.105	0.095	0.125	0.100
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020
Sodium (Na)-Dissolved	6.55	5.90	4.91	4.65
Strontium (Sr)-Dissolved	0.818	0.858	0.658	0.608
Thallium (Tl)-Dissolved	<0.000050	<0.000050	0.000027	0.000027
Tin (Sn)-Dissolved	0.00110	0.00086	0.00112	0.00091
Titanium (Ti)-Dissolved	0.015	0.015	0.016	0.013
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020
Zinc (Zn)-Dissolved	<0.0050	<0.0050	0.0025	<0.0020

1298-050 OCT26A-
EFFLUENT
26-OCT-12
02:00
L1229604-1
Water

857
8.89
24.5
1250
29.3

<1.0
15.3
5.2
<1.0
20.5
0.0906
<1.0
<10
<0.40
0.61
0.036
<0.0010
0.0020
848

2.96
<0.00020
0.00311
0.0162
<0.00020
<0.0010
<0.020
0.00119
338
0.00505
0.0130
0.506
5.35
0.00095
0.0062
1.90
0.341
0.000010
0.0576
0.0052

<0.30
1.33
0.0476
0.325
0.000135
4.78
0.645
0.000029
0.00093
0.033
0.000073
<0.0020
0.0971

FIELD
2.27
<0.00020
<0.00020
0.0118
<0.00020
<0.0010
<0.020
0.000121
341
0.00422
0.00020
0.00412
0.029
<0.00010
0.0058
1.11
0.00167
<0.000010
0.0579
<0.0010
<0.30
1.36
0.0463
0.112
<0.000020
4.73
0.615
0.000027
0.00092
0.014
<0.000020
<0.0020
<0.0020

RESULTS OF ANALYSIS

Sample ID	1298-034 OCT24A - REACTOR2	1298-038 OCT24B- REACTOR2	1298-042 OCT25A - REACTOR2	1298-048 OCT25B- REACTOR 2
Date Sampled	24-OCT-12	24-OCT-12	25-OCT-12	25-OCT-12
Time Sampled	02:00	14:00	02:00	14:00
ALS Sample ID	L1228156-2	L1228980-2	L1228971-2	L1229605-2
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	1210	1310	995	806
pH	~	~	~	~
Total Suspended Solids	~	~	~	~
Total Dissolved Solids	~	~	~	~
Turbidity	~	~	~	~
Anions and Nutrients				
Acidity (as CaCO3)	~	~	~	~
Alkalinity, Bicarbonate (as CaCO3)	~	~	~	~
Alkalinity, Carbonate (as CaCO3)	~	~	~	~
Alkalinity, Hydroxide (as CaCO3)	~	~	~	~
Alkalinity, Total (as CaCO3)	~	~	~	~
Ammonia, Total (as N)	~	~	~	~
Bromide (Br)	~	~	~	~
Chloride (Cl)	~	~	~	~
Fluoride (F)	~	~	~	~
Nitrate (as N)	~	~	~	~
Nitrite (as N)	~	~	~	~
Orthophosphate-Dissolved (as P)	~	~	~	~
Phosphorus (P)-Total	~	~	~	~
Sulfate (SO4)	~	~	~	~
Total Metals				
Aluminum (Al)-Total	~	~	~	~
Antimony (Sb)-Total	~	~	~	~
Arsenic (As)-Total	~	~	~	~
Barium (Ba)-Total	~	~	~	~
Beryllium (Be)-Total	~	~	~	~
Bismuth (Bi)-Total	~	~	~	~
Boron (B)-Total	~	~	~	~
Cadmium (Cd)-Total	~	~	~	~
Calcium (Ca)-Total	~	~	~	~
Chromium (Cr)-Total	~	~	~	~
Cobalt (Co)-Total	~	~	~	~
Copper (Cu)-Total	~	~	~	~
Iron (Fe)-Total	~	~	~	~
Lead (Pb)-Total	~	~	~	~
Lithium (Li)-Total	~	~	~	~
Magnesium (Mg)-Total	~	~	~	~
Manganese (Mn)-Total	~	~	~	~
Mercury (Hg)-Total	~	~	~	~
Molybdenum (Mo)-Total	~	~	~	~
Nickel (Ni)-Total	~	~	~	~

Phosphorus (P)-Total	-	-	-	-
Potassium (K)-Total	-	-	-	-
Selenium (Se)-Total	-	-	-	-
Silicon (Si)-Total	-	-	-	-
Silver (Ag)-Total	-	-	-	-
Sodium (Na)-Total	-	-	-	-
Strontium (Sr)-Total	-	-	-	-
Thallium (Tl)-Total	-	-	-	-
Tin (Sn)-Total	-	-	-	-
Titanium (Ti)-Total	-	-	-	-
Uranium (U)-Total	-	-	-	-
Vanadium (V)-Total	-	-	-	-
Zinc (Zn)-Total	-	-	-	-
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	2.86	3.12	2.13	2.15
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Barium (Ba)-Dissolved	0.0188	0.0180	0.0125	0.0113
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010
Boron (B)-Dissolved	<0.050	<0.050	<0.020	<0.020
Cadmium (Cd)-Dissolved	0.000071	0.000072	<0.00013	0.000100
Calcium (Ca)-Dissolved	482	520	396	321
Chromium (Cr)-Dissolved	0.00393	0.00429	0.00452	0.00421
Cobalt (Co)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Copper (Cu)-Dissolved	0.0046	<0.0010	0.00214	0.00192
Iron (Fe)-Dissolved	<0.050	<0.050	0.032	<0.020
Lead (Pb)-Dissolved	<0.00025	<0.00025	0.00015	<0.00010
Lithium (Li)-Dissolved	0.0064	0.0054	0.0058	0.0054
Magnesium (Mg)-Dissolved	2.14	3.55	1.31	1.16
Manganese (Mn)-Dissolved	0.00277	0.00077	0.00159	0.00082
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0786	0.0763	0.175	0.0583
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.61	1.68	1.43	1.35
Selenium (Se)-Dissolved	0.0602	0.0639	0.0504	0.0446
Silicon (Si)-Dissolved	0.102	0.088	0.228	0.094
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000020	0.000043
Sodium (Na)-Dissolved	6.56	5.79	4.94	4.74
Strontium (Sr)-Dissolved	0.807	0.841	0.667	0.609
Thallium (Tl)-Dissolved	<0.000050	<0.000050	0.000038	0.000024
Tin (Sn)-Dissolved	0.00089	0.00095	0.00087	0.00086
Titanium (Ti)-Dissolved	0.014	0.016	0.019	0.013
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020
Zinc (Zn)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020

1298-051 OCT26A-
REACTOR 2
26-OCT-12
02:00
L1229604-2
Water

844

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100

FIELD
2.46
<0.00020
<0.00020
0.0127
<0.00020
<0.0010
<0.020
0.000115
336
0.00463
0.00021
0.00271
0.021
<0.00010
0.0058
1.09
0.00145
<0.000010
0.0579
<0.0010
<0.30
1.51
0.0467
0.098
<0.000020
5.36
0.630
0.000029
0.00089
0.014
<0.000020
<0.0020
0.0024

RESULTS OF ANALYSIS

	1298-035 OCT24A	1298-039 OCT24B	1298-043 OCT25A	1298-049 OCT25B
Sample ID	- REACTOR1	REACTOR1	- REACTOR1	REACTOR1
Date Sampled	24-OCT-12	24-OCT-12	25-OCT-12	25-OCT-12
Time Sampled	02:00	14:00	02:00	14:00
ALS Sample ID	L1228156-3	L1228980-3	L1228971-3	L1229605-3
Matrix	Water	Water	Water	Water
Physical Tests				
Hardness (as CaCO3)	1190	1270	1000	801
pH	*	*	*	*
Total Suspended Solids	*	*	*	*
Total Dissolved Solids	*	*	*	*
Turbidity	*	*	*	*
Anions and Nutrients				
Acidity (as CaCO3)	*	*	*	*
Alkalinity, Bicarbonate (as CaCO3)	*	*	*	*
Alkalinity, Carbonate (as CaCO3)	*	*	*	*
Alkalinity, Hydroxide (as CaCO3)	*	*	*	*
Alkalinity, Total (as CaCO3)	*	*	*	*
Ammonia, Total (as N)	*	*	*	*
Bromide (Br)	*	*	*	*
Chloride (Cl)	*	*	*	*
Fluoride (F)	*	*	*	*
Nitrate (as N)	*	*	*	*
Nitrite (as N)	*	*	*	*
Orthophosphate-Dissolved (as P)	*	*	*	*
Phosphorus (P)-Total	*	*	*	*
Sulfate (SO4)	*	*	*	*
Total Metals				
Aluminum (Al)-Total	*	*	*	*
Antimony (Sb)-Total	*	*	*	*
Arsenic (As)-Total	*	*	*	*
Barium (Ba)-Total	*	*	*	*
Beryllium (Be)-Total	*	*	*	*
Bismuth (Bi)-Total	*	*	*	*
Boron (B)-Total	*	*	*	*
Cadmium (Cd)-Total	*	*	*	*
Calcium (Ca)-Total	*	*	*	*
Chromium (Cr)-Total	*	*	*	*
Cobalt (Co)-Total	*	*	*	*
Copper (Cu)-Total	*	*	*	*
Iron (Fe)-Total	*	*	*	*
Lead (Pb)-Total	*	*	*	*
Lithium (Li)-Total	*	*	*	*
Magnesium (Mg)-Total	*	*	*	*
Manganese (Mn)-Total	*	*	*	*
Mercury (Hg)-Total	*	*	*	*
Molybdenum (Mo)-Total	*	*	*	*
Nickel (Ni)-Total	*	*	*	*

Phosphorus (P)-Total				
Potassium (K)-Total				
Selenium (Se)-Total				
Silicon (Si)-Total				
Silver (Ag)-Total				
Sodium (Na)-Total				
Strontium (Sr)-Total				
Thallium (Tl)-Total				
Tin (Sn)-Total				
Titanium (Ti)-Total				
Uranium (U)-Total				
Vanadium (V)-Total				
Zinc (Zn)-Total				
Dissolved Metals				
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	3.21	3.43	2.38	2.44
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Arsenic (As)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Barium (Ba)-Dissolved	0.0202	0.0195	0.0132	0.0120
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010
Boron (B)-Dissolved	<0.050	<0.050	<0.020	<0.020
Cadmium (Cd)-Dissolved	0.000062	0.000084	<0.00017	0.000104
Calcium (Ca)-Dissolved	471	502	399	319
Chromium (Cr)-Dissolved	0.00372	0.00436	0.00421	0.00395
Cobalt (Co)-Dissolved	<0.00050	<0.00050	0.00032	<0.00020
Copper (Cu)-Dissolved	0.0032	0.0019	0.00920	0.00118
Iron (Fe)-Dissolved	<0.050	<0.050	0.068	<0.020
Lead (Pb)-Dissolved	<0.00025	<0.00025	<0.00010	<0.00010
Lithium (Li)-Dissolved	0.0059	0.0057	0.0055	0.0055
Magnesium (Mg)-Dissolved	2.76	4.90	1.38	1.28
Manganese (Mn)-Dissolved	0.00211	0.00137	0.00663	0.00035
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0767	0.0719	0.338	0.0597
Nickel (Ni)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0010
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.69	1.64	1.42	1.25
Selenium (Se)-Dissolved	0.0625	0.0615	0.0509	0.0453
Silicon (Si)-Dissolved	0.093	0.091	0.129	0.113
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020
Sodium (Na)-Dissolved	6.24	5.83	5.04	4.66
Strontium (Sr)-Dissolved	0.814	0.831	0.671	0.609
Thallium (Tl)-Dissolved	<0.000050	<0.000050	0.000028	0.000025
Tin (Sn)-Dissolved	0.00097	0.00092	0.00087	0.00089
Titanium (Ti)-Dissolved	0.014	0.015	0.016	0.012
Uranium (U)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000020
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0020
Zinc (Zn)-Dissolved	<0.0050	<0.0050	0.0026	<0.0020

1298-052 OCT26A-
REACTOR 1
26-OCT-12
02:00
L1229604-3
Water

860



RESULTS OF ANALYSIS

	1298-036 OCT24A	1298-040 OCT24B-
Sample ID	- FEED	FEED
Date Sampled	24-OCT-12	24-OCT-12
Time Sampled	02:00	14:00
ALS Sample ID	L1228156-4	L1228980-4
Matrix	Water	Water

Physical Tests

Hardness (as CaCO ₃)	387	395
pH	-	-
Total Suspended Solids	-	-
Total Dissolved Solids	-	-
Turbidity	-	-

Anions and Nutrients

Acidity (as CaCO ₃)	-	-
Alkalinity, Bicarbonate (as CaCO ₃)	-	-
Alkalinity, Carbonate (as CaCO ₃)	-	-
Alkalinity, Hydroxide (as CaCO ₃)	-	-
Alkalinity, Total (as CaCO ₃)	-	-
Ammonia, Total (as N)	-	-
Bromide (Br)	-	-
Chloride (Cl)	-	-
Fluoride (F)	-	-
Nitrate (as N)	-	-
Nitrite (as N)	-	-
Orthophosphate-Dissolved (as P)	-	-
Phosphorus (P)-Total	-	-
Sulfate (SO ₄)	-	-

Total Metals

Aluminum (Al)-Total	-	-
Antimony (Sb)-Total	-	-
Arsenic (As)-Total	-	-
Barium (Ba)-Total	-	-
Beryllium (Be)-Total	-	-
Bismuth (Bi)-Total	-	-
Boron (B)-Total	-	-
Cadmium (Cd)-Total	-	-
Calcium (Ca)-Total	-	-
Chromium (Cr)-Total	-	-
Cobalt (Co)-Total	-	-
Copper (Cu)-Total	-	-
Iron (Fe)-Total	-	-
Lead (Pb)-Total	-	-
Lithium (Li)-Total	-	-
Magnesium (Mg)-Total	-	-
Manganese (Mn)-Total	-	-
Mercury (Hg)-Total	-	-
Molybdenum (Mo)-Total	-	-
Nickel (Ni)-Total	-	-
Phosphorus (P)-Total	-	-

Potassium (K)-Total	-	-
Selenium (Se)-Total	-	-
Silicon (Si)-Total	-	-
Silver (Ag)-Total	-	-
Sodium (Na)-Total	-	-
Strontium (Sr)-Total	-	-
Thallium (Tl)-Total	-	-
Tin (Sn)-Total	-	-
Titanium (Ti)-Total	-	-
Uranium (U)-Total	-	-
Vanadium (V)-Total	-	-
Zinc (Zn)-Total	-	-
Dissolved Metals		
Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	35.3	34.2
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	0.122	0.120
Barium (Ba)-Dissolved	0.0827	0.0840
Beryllium (Be)-Dissolved	0.00295	0.00269
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.0422	0.0442
Calcium (Ca)-Dissolved	114	116
Chromium (Cr)-Dissolved	0.0227	0.0245
Cobalt (Co)-Dissolved	0.507	0.492
Copper (Cu)-Dissolved	21.7	22.3
Iron (Fe)-Dissolved	231	231
Lead (Pb)-Dissolved	0.0370	0.0389
Lithium (Li)-Dissolved	0.0134	0.0116
Magnesium (Mg)-Dissolved	24.9	25.9
Manganese (Mn)-Dissolved	14.8	14.4
Mercury (Hg)-Dissolved	0.000021	0.000015
Molybdenum (Mo)-Dissolved	0.0829	0.0850
Nickel (Ni)-Dissolved	0.191	0.194
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.77	1.68
Selenium (Se)-Dissolved	0.107	0.108
Silicon (Si)-Dissolved	6.48	6.64
Silver (Ag)-Dissolved	0.00408	0.00363
Sodium (Na)-Dissolved	6.38	5.82
Strontium (Sr)-Dissolved	0.785	0.788
Thallium (Tl)-Dissolved	0.000120	0.000124
Tin (Sn)-Dissolved	0.00118	0.00122
Titanium (Ti)-Dissolved	0.798	0.840
Uranium (U)-Dissolved	0.00208	0.00194
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	3.64	3.79

RESULTS OF ANALYSIS

Sample ID	1298-054 OCT26B- 1298-064 OCT27A-	
	EFFLUENT	EFFLUENT
Date Sampled	26-OCT-12	27-OCT-12
Time Sampled	14:00	02:00
ALS Sample ID	L1229937-1	L1229935-1
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO ₃)	1600	1640
pH	8.03	8.36
Total Suspended Solids	7.1	8.2
Total Dissolved Solids	2290	2250
Turbidity	13.4	14.2
Anions and Nutrients		
Acidity (as CaCO ₃)	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO ₃)	13.3	12.9
Alkalinity, Carbonate (as CaCO ₃)	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO ₃)	<1.0	<1.0
Alkalinity, Total (as CaCO ₃)	13.3	12.9
Ammonia, Total (as N)	0.0602	0.0533
Bromide (Br)	<1.0	<1.0
Chloride (Cl)	<10	<10
Fluoride (F)	0.54	1.25
Nitrate (as N)	0.56	0.57
Nitrite (as N)	<0.020	<0.020
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010
Phosphorus (P)-Total	<0.0020	<0.0020
Sulfate (SO ₄)	1610	1630
Total Metals		
Aluminum (Al)-Total	3.75	2.55
Antimony (Sb)-Total	<0.00050	<0.00050
Arsenic (As)-Total	0.00407	0.00157
Barium (Ba)-Total	0.0249	0.0244
Beryllium (Be)-Total	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.0025	<0.0025
Boron (B)-Total	<0.050	<0.050
Cadmium (Cd)-Total	0.00129	0.000474
Calcium (Ca)-Total	588	626
Chromium (Cr)-Total	0.00578	0.00445
Cobalt (Co)-Total	0.0154	0.00535
Copper (Cu)-Total	0.643	0.221
Iron (Fe)-Total	6.95	2.43
Lead (Pb)-Total	0.00128	0.00042
Lithium (Li)-Total	0.0076	0.0117
Magnesium (Mg)-Total	13.6	18.9
Manganese (Mn)-Total	0.445	0.263
Mercury (Hg)-Total	0.000018	0.000013
Molybdenum (Mo)-Total	0.0374	0.0249
Nickel (Ni)-Total	0.0060	<0.0025

Phosphorus (P)-Total	<0.30	<0.30
Potassium (K)-Total	1.97	1.95
Selenium (Se)-Total	0.0747	0.0660
Silicon (Si)-Total	0.315	0.148
Silver (Ag)-Total	0.000186	0.000094
Sodium (Na)-Total	4.27	4.28
Strontium (Sr)-Total	0.917	0.912
Thallium (Tl)-Total	0.000053	0.000078
Tin (Sn)-Total	<0.00050	<0.00050
Titanium (Ti)-Total	0.033	0.021
Uranium (U)-Total	0.000117	0.000061
Vanadium (V)-Total	<0.0050	<0.0050
Zinc (Zn)-Total	0.114	0.039

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	2.58	2.13
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0198	0.0236
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000053	0.000065
Calcium (Ca)-Dissolved	619	626
Chromium (Cr)-Dissolved	0.00377	0.00418
Cobalt (Co)-Dissolved	<0.00050	0.00064
Copper (Cu)-Dissolved	0.0018	0.0032
Iron (Fe)-Dissolved	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0088	0.0112
Magnesium (Mg)-Dissolved	13.7	18.2
Manganese (Mn)-Dissolved	0.0371	0.116
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0332	0.0241
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.82	1.92
Selenium (Se)-Dissolved	0.0612	0.0628
Silicon (Si)-Dissolved	0.052	0.063
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.03	4.26
Strontium (Sr)-Dissolved	0.877	0.905
Thallium (Tl)-Dissolved	<0.000050	0.000067
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	0.012	0.012
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-055 OCT26B- REACTOR 2	1298-065 OCT27A - REACTOR2
Sample ID	REACTOR 2	- REACTOR2
Date Sampled	26-OCT-12	27-OCT-12
Time Sampled	14:00	02:00
ALS Sample ID	L1229937-2	L1229935-2
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO3)	1590	1680
pH	-	-
Total Suspended Solids	-	-
Total Dissolved Solids	-	-
Turbidity	-	-
Anions and Nutrients		
Acidity (as CaCO3)	-	-
Alkalinity, Bicarbonate (as CaCO3)	-	-
Alkalinity, Carbonate (as CaCO3)	-	-
Alkalinity, Hydroxide (as CaCO3)	-	-
Alkalinity, Total (as CaCO3)	-	-
Ammonia, Total (as N)	-	-
Bromide (Br)	-	-
Chloride (Cl)	-	-
Fluoride (F)	-	-
Nitrate (as N)	-	-
Nitrite (as N)	-	-
Orthophosphate-Dissolved (as P)	-	-
Phosphorus (P)-Total	-	-
Sulfate (SO4)	-	-
Total Metals		
Aluminum (Al)-Total	-	-
Antimony (Sb)-Total	-	-
Arsenic (As)-Total	-	-
Barium (Ba)-Total	-	-
Beryllium (Be)-Total	-	-
Bismuth (Bi)-Total	-	-
Boron (B)-Total	-	-
Cadmium (Cd)-Total	-	-
Calcium (Ca)-Total	-	-
Chromium (Cr)-Total	-	-
Cobalt (Co)-Total	-	-
Copper (Cu)-Total	-	-
Iron (Fe)-Total	-	-
Lead (Pb)-Total	-	-
Lithium (Li)-Total	-	-
Magnesium (Mg)-Total	-	-
Manganese (Mn)-Total	-	-
Mercury (Hg)-Total	-	-
Molybdenum (Mo)-Total	-	-
Nickel (Ni)-Total	-	-

Phosphorus (P)-Total	-	-
Potassium (K)-Total	-	-
Selenium (Se)-Total	-	-
Silicon (Si)-Total	-	-
Silver (Ag)-Total	-	-
Sodium (Na)-Total	-	-
Strontium (Sr)-Total	-	-
Thallium (Tl)-Total	-	-
Tin (Sn)-Total	-	-
Titanium (Ti)-Total	-	-
Uranium (U)-Total	-	-
Vanadium (V)-Total	-	-
Zinc (Zn)-Total	-	-

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	2.69	2.38
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0211	0.0231
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	<0.000050	0.000051
Calcium (Ca)-Dissolved	614	643
Chromium (Cr)-Dissolved	0.00424	0.00431
Cobalt (Co)-Dissolved	<0.00050	0.00063
Copper (Cu)-Dissolved	0.0011	0.0028
Iron (Fe)-Dissolved	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0082	0.0090
Magnesium (Mg)-Dissolved	13.7	18.3
Manganese (Mn)-Dissolved	0.0314	0.101
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0323	0.0258
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.85	1.94
Selenium (Se)-Dissolved	0.0638	0.0633
Silicon (Si)-Dissolved	0.055	0.060
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.22	4.23
Strontium (Sr)-Dissolved	0.847	0.903
Thallium (Tl)-Dissolved	<0.000050	0.000054
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	0.012	0.012
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-056 OCT26B- 1298-066 OCT27A	
	REACTOR 1	- REACTOR1
Sample ID	26-OCT-12	27-OCT-12
Date Sampled	14:00	02:00
Time Sampled	L1229937-3	L1229935-3
ALS Sample ID	Water	Water
Matrix		
Physical Tests		
Hardness (as CaCO3)	1710	1450
pH	-	-
Total Suspended Solids	-	-
Total Dissolved Solids	-	-
Turbidity	-	-
Anions and Nutrients		
Acidity (as CaCO3)	-	-
Alkalinity, Bicarbonate (as CaCO3)	-	-
Alkalinity, Carbonate (as CaCO3)	-	-
Alkalinity, Hydroxide (as CaCO3)	-	-
Alkalinity, Total (as CaCO3)	-	-
Ammonia, Total (as N)	-	-
Bromide (Br)	-	-
Chloride (Cl)	-	-
Fluoride (F)	-	-
Nitrate (as N)	-	-
Nitrite (as N)	-	-
Orthophosphate-Dissolved (as P)	-	-
Phosphorus (P)-Total	-	-
Sulfate (SO4)	-	-
Total Metals		
Aluminum (Al)-Total	-	-
Antimony (Sb)-Total	-	-
Arsenic (As)-Total	-	-
Barium (Ba)-Total	-	-
Beryllium (Be)-Total	-	-
Bismuth (Bi)-Total	-	-
Boron (B)-Total	-	-
Cadmium (Cd)-Total	-	-
Calcium (Ca)-Total	-	-
Chromium (Cr)-Total	-	-
Cobalt (Co)-Total	-	-
Copper (Cu)-Total	-	-
Iron (Fe)-Total	-	-
Lead (Pb)-Total	-	-
Lithium (Li)-Total	-	-
Magnesium (Mg)-Total	-	-
Manganese (Mn)-Total	-	-
Mercury (Hg)-Total	-	-
Molybdenum (Mo)-Total	-	-
Nickel (Ni)-Total	-	-

Phosphorus (P)-Total	-	-
Potassium (K)-Total	-	-
Selenium (Se)-Total	-	-
Silicon (Si)-Total	-	-
Silver (Ag)-Total	-	-
Sodium (Na)-Total	-	-
Strontium (Sr)-Total	-	-
Thallium (Tl)-Total	-	-
Tin (Sn)-Total	-	-
Titanium (Ti)-Total	-	-
Uranium (U)-Total	-	-
Vanadium (V)-Total	-	-
Zinc (Zn)-Total	-	-

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	2.52	2.46
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0236	0.0236
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	<0.000050	0.000066
Calcium (Ca)-Dissolved	656	556
Chromium (Cr)-Dissolved	0.00371	0.00449
Cobalt (Co)-Dissolved	<0.00050	0.00058
Copper (Cu)-Dissolved	0.0015	0.0045
Iron (Fe)-Dissolved	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0087	0.0079
Magnesium (Mg)-Dissolved	17.1	15.5
Manganese (Mn)-Dissolved	0.0736	0.0923
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0270	0.0259
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.91	1.94
Selenium (Se)-Dissolved	0.0711	0.0629
Silicon (Si)-Dissolved	0.055	0.050
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.24	4.23
Strontium (Sr)-Dissolved	0.853	0.891
Thallium (Tl)-Dissolved	<0.000050	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	0.012	0.013
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-057 OCT26B-
Sample ID	FEED
Date Sampled	26-OCT-12
Time Sampled	14:00
ALS Sample ID	L1229937-4
Matrix	Water

Physical Tests

Hardness (as CaCO ₃)	506
pH	2.69
Total Suspended Solids	70.6
Total Dissolved Solids	2000
Turbidity	125

Anions and Nutrients

Acidity (as CaCO ₃)	1020
Alkalinity, Bicarbonate (as CaCO ₃)	<1.0
Alkalinity, Carbonate (as CaCO ₃)	<1.0
Alkalinity, Hydroxide (as CaCO ₃)	<1.0
Alkalinity, Total (as CaCO ₃)	<1.0
Ammonia, Total (as N)	0.0086
Bromide (Br)	<0.50
Chloride (Cl)	<5.0
Fluoride (F)	0.65
Nitrate (as N)	0.267
Nitrite (as N)	<0.010
Orthophosphate-Dissolved (as P)	0.0340
Phosphorus (P)-Total	<0.20
Sulfate (SO ₄)	762

Total Metals

Aluminum (Al)-Total	35.1
Antimony (Sb)-Total	0.00650
Arsenic (As)-Total	0.176
Barium (Ba)-Total	0.137
Beryllium (Be)-Total	0.0193
Bismuth (Bi)-Total	<0.0025
Boron (B)-Total	<0.050
Cadmium (Cd)-Total	0.0432
Calcium (Ca)-Total	164
Chromium (Cr)-Total	0.0242
Cobalt (Co)-Total	0.536
Copper (Cu)-Total	25.9
Iron (Fe)-Total	271
Lead (Pb)-Total	0.0424
Lithium (Li)-Total	0.0136
Magnesium (Mg)-Total	25.7
Manganese (Mn)-Total	17.0
Mercury (Hg)-Total	0.000141
Molybdenum (Mo)-Total	0.0740
Nickel (Ni)-Total	0.205
Phosphorus (P)-Total	<0.30

Potassium (K)-Total	2.28
Selenium (Se)-Total	0.144
Silicon (Si)-Total	10.1
Silver (Ag)-Total	0.00547
Sodium (Na)-Total	4.34
Strontium (Sr)-Total	0.908
Thallium (Tl)-Total	0.000157
Tin (Sn)-Total	<0.00050
Titanium (Ti)-Total	1.22
Uranium (U)-Total	0.00227
Vanadium (V)-Total	0.0155
Zinc (Zn)-Total	3.70

Dissolved Metals

Dissolved Metals Filtration Location	FIELD
Aluminum (Al)-Dissolved	31.3
Antimony (Sb)-Dissolved	0.00077
Arsenic (As)-Dissolved	0.130
Barium (Ba)-Dissolved	0.0910
Beryllium (Be)-Dissolved	0.0193
Bismuth (Bi)-Dissolved	<0.0025
Boron (B)-Dissolved	<0.050
Cadmium (Cd)-Dissolved	0.0402
Calcium (Ca)-Dissolved	162
Chromium (Cr)-Dissolved	0.0209
Cobalt (Co)-Dissolved	0.496
Copper (Cu)-Dissolved	23.6
Iron (Fe)-Dissolved	235
Lead (Pb)-Dissolved	0.0391
Lithium (Li)-Dissolved	0.0133
Magnesium (Mg)-Dissolved	24.9
Manganese (Mn)-Dissolved	15.6
Mercury (Hg)-Dissolved	0.000042
Molybdenum (Mo)-Dissolved	0.0146
Nickel (Ni)-Dissolved	0.189
Phosphorus (P)-Dissolved	<0.30
Potassium (K)-Dissolved	1.88
Selenium (Se)-Dissolved	0.119
Silicon (Si)-Dissolved	6.73
Silver (Ag)-Dissolved	0.00523
Sodium (Na)-Dissolved	3.96
Strontium (Sr)-Dissolved	0.894
Thallium (Tl)-Dissolved	0.000149
Tin (Sn)-Dissolved	<0.00050
Titanium (Ti)-Dissolved	0.964
Uranium (U)-Dissolved	0.00236
Vanadium (V)-Dissolved	0.0072
Zinc (Zn)-Dissolved	3.42

RESULTS OF ANALYSIS

	1298-067 OCT27B- EFFLUENT	1298-070 OCT28A- EFFLUENT
Sample ID	27-OCT-12	28-OCT-12
Date Sampled	14:00	02:00
Time Sampled	L1230279-1	L1230280-1
ALS Sample ID	Water	Water
Matrix		
Physical Tests		
Hardness (as CaCO ₃)	1210	1210
pH	8.74	9.84
Total Suspended Solids	16.5	11.6
Total Dissolved Solids	1740	1690
Turbidity	18.4	16.8
Anions and Nutrients		
Acidity (as CaCO ₃)	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO ₃)	10.9	8.1
Alkalinity, Carbonate (as CaCO ₃)	3.2	16.9
Alkalinity, Hydroxide (as CaCO ₃)	<1.0	<1.0
Alkalinity, Total (as CaCO ₃)	14.2	25.0
Ammonia, Total (as N)	0.0760	0.0793
Bromide (Br)	<1.0	<1.0
Chloride (Cl)	<10	<10
Fluoride (F)	<0.40	<0.40
Nitrate (as N)	0.48	0.44
Nitrite (as N)	<0.020	<0.020
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010
Phosphorus (P)-Total	<0.0020	<0.0020
Sulfate (SO ₄)	1150	1130
Total Metals		
Aluminum (Al)-Total	2.94	2.49
Antimony (Sb)-Total	<0.00050	<0.00050
Arsenic (As)-Total	0.00178	0.00180
Barium (Ba)-Total	0.0194	0.0189
Beryllium (Be)-Total	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.0025	<0.0025
Boron (B)-Total	<0.050	<0.050
Cadmium (Cd)-Total	0.000520	0.000549
Calcium (Ca)-Total	465	463
Chromium (Cr)-Total	0.00651	0.00576
Cobalt (Co)-Total	0.00581	0.00579
Copper (Cu)-Total	0.251	0.255
Iron (Fe)-Total	3.69	2.79
Lead (Pb)-Total	0.00045	0.00047
Lithium (Li)-Total	0.0047	0.0052
Magnesium (Mg)-Total	3.39	1.30
Manganese (Mn)-Total	0.167	0.156
Mercury (Hg)-Total	0.000011	0.000011
Molybdenum (Mo)-Total	0.0321	0.0240
Nickel (Ni)-Total	0.0044	<0.0025

Phosphorus (P)-Total	<0.30	<0.30
Potassium (K)-Total	1.91	1.96
Selenium (Se)-Total	0.0637	0.0654
Silicon (Si)-Total	0.203	0.253
Silver (Ag)-Total	0.000060	0.000081
Sodium (Na)-Total	4.22	4.33
Strontium (Sr)-Total	0.829	0.819
Thallium (Tl)-Total	<0.000050	<0.000050
Tin (Sn)-Total	<0.00050	<0.00050
Titanium (Ti)-Total	0.020	0.020
Uranium (U)-Total	<0.000050	<0.000050
Vanadium (V)-Total	<0.0050	<0.0050
Zinc (Zn)-Total	0.042	0.044

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	2.45	2.13
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0171	0.0173
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000058	0.000085
Calcium (Ca)-Dissolved	478	482
Chromium (Cr)-Dissolved	0.00623	0.00517
Cobalt (Co)-Dissolved	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0016	0.0042
Iron (Fe)-Dissolved	<0.050	0.051
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0043	0.0047
Magnesium (Mg)-Dissolved	3.20	1.11
Manganese (Mn)-Dissolved	0.00150	0.00261
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0294	0.0234
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.62	1.87
Selenium (Se)-Dissolved	0.0578	0.0635
Silicon (Si)-Dissolved	0.100	0.149
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	3.91	4.18
Strontium (Sr)-Dissolved	0.778	0.801
Thallium (Tl)-Dissolved	<0.000050	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	<0.010	<0.010
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-068 OCT27B- 1298-071 OCT28A-	
Sample ID	REACTOR2	REACTOR2
Date Sampled	27-OCT-12	28-OCT-12
Time Sampled	14:00	02:00
ALS Sample ID	L1230279-2	L1230280-2
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO3)	1210	1250
pH	-	-
Total Suspended Solids	-	-
Total Dissolved Solids	-	-
Turbidity	-	-
Anions and Nutrients		
Acidity (as CaCO3)	-	-
Alkalinity, Bicarbonate (as CaCO3)	-	-
Alkalinity, Carbonate (as CaCO3)	-	-
Alkalinity, Hydroxide (as CaCO3)	-	-
Alkalinity, Total (as CaCO3)	-	-
Ammonia, Total (as N)	-	-
Bromide (Br)	-	-
Chloride (Cl)	-	-
Fluoride (F)	-	-
Nitrate (as N)	-	-
Nitrite (as N)	-	-
Orthophosphate-Dissolved (as P)	-	-
Phosphorus (P)-Total	-	-
Sulfate (SO4)	-	-
Total Metals		
Aluminum (Al)-Total	-	-
Antimony (Sb)-Total	-	-
Arsenic (As)-Total	-	-
Barium (Ba)-Total	-	-
Beryllium (Be)-Total	-	-
Bismuth (Bi)-Total	-	-
Boron (B)-Total	-	-
Cadmium (Cd)-Total	-	-
Calcium (Ca)-Total	-	-
Chromium (Cr)-Total	-	-
Cobalt (Co)-Total	-	-
Copper (Cu)-Total	-	-
Iron (Fe)-Total	-	-
Lead (Pb)-Total	-	-
Lithium (Li)-Total	-	-
Magnesium (Mg)-Total	-	-
Manganese (Mn)-Total	-	-
Mercury (Hg)-Total	-	-
Molybdenum (Mo)-Total	-	-
Nickel (Ni)-Total	-	-

Phosphorus (P)-Total	•	•
Potassium (K)-Total	•	•
Selenium (Se)-Total	•	•
Silicon (Si)-Total	•	•
Silver (Ag)-Total	•	•
Sodium (Na)-Total	•	•
Strontium (Sr)-Total	•	•
Thallium (Tl)-Total	•	•
Tin (Sn)-Total	•	•
Titanium (Ti)-Total	•	•
Uranium (U)-Total	•	•
Vanadium (V)-Total	•	•
Zinc (Zn)-Total	•	•

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	2.63	2.47
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	0.00056
Barium (Ba)-Dissolved	0.0182	0.0185
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000061	0.000224
Calcium (Ca)-Dissolved	479	498
Chromium (Cr)-Dissolved	0.00633	0.00524
Cobalt (Co)-Dissolved	<0.00050	0.00179
Copper (Cu)-Dissolved	0.0022	0.0796
Iron (Fe)-Dissolved	<0.050	0.778
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0046	0.0052
Magnesium (Mg)-Dissolved	3.14	1.37
Manganese (Mn)-Dissolved	0.00478	0.0513
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0303	0.0221
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.92	1.90
Selenium (Se)-Dissolved	0.0627	0.0623
Silicon (Si)-Dissolved	0.101	0.162
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.30	4.22
Strontium (Sr)-Dissolved	0.819	0.792
Thallium (Tl)-Dissolved	<0.000050	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	<0.010	0.012
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	0.0126

RESULTS OF ANALYSIS

	1298-069 OCT27B- 1298-072 OCT28A-	
Sample ID	REACTOR1	REACTOR1
Date Sampled	27-OCT-12	28-OCT-12
Time Sampled	14:00	02:00
ALS Sample ID	L1230279-3	L1230280-3
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO3)	1210	1520
pH	-	-
Total Suspended Solids	-	-
Total Dissolved Solids	-	-
Turbidity	-	-
Anions and Nutrients		
Acidity (as CaCO3)	-	-
Alkalinity, Bicarbonate (as CaCO3)	-	-
Alkalinity, Carbonate (as CaCO3)	-	-
Alkalinity, Hydroxide (as CaCO3)	-	-
Alkalinity, Total (as CaCO3)	-	-
Ammonia, Total (as N)	-	-
Bromide (Br)	-	-
Chloride (Cl)	-	-
Fluoride (F)	-	-
Nitrate (as N)	-	-
Nitrite (as N)	-	-
Orthophosphate-Dissolved (as P)	-	-
Phosphorus (P)-Total	-	-
Sulfate (SO4)	-	-
Total Metals		
Aluminum (Al)-Total	-	-
Antimony (Sb)-Total	-	-
Arsenic (As)-Total	-	-
Barium (Ba)-Total	-	-
Beryllium (Be)-Total	-	-
Bismuth (Bi)-Total	-	-
Boron (B)-Total	-	-
Cadmium (Cd)-Total	-	-
Calcium (Ca)-Total	-	-
Chromium (Cr)-Total	-	-
Cobalt (Co)-Total	-	-
Copper (Cu)-Total	-	-
Iron (Fe)-Total	-	-
Lead (Pb)-Total	-	-
Lithium (Li)-Total	-	-
Magnesium (Mg)-Total	-	-
Manganese (Mn)-Total	-	-
Mercury (Hg)-Total	-	-
Molybdenum (Mo)-Total	-	-
Nickel (Ni)-Total	-	-

Phosphorus (P)-Total		
Potassium (K)-Total		
Selenium (Se)-Total		
Silicon (Si)-Total		
Silver (Ag)-Total		
Sodium (Na)-Total		
Strontium (Sr)-Total		
Thallium (Tl)-Total		
Tin (Sn)-Total		
Titanium (Ti)-Total		
Uranium (U)-Total		
Vanadium (V)-Total		
Zinc (Zn)-Total		

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	2.93	0.534
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	0.00061
Barium (Ba)-Dissolved	0.0184	0.0376
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.000051	<0.000050
Calcium (Ca)-Dissolved	478	609
Chromium (Cr)-Dissolved	0.00684	0.00532
Cobalt (Co)-Dissolved	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0017	0.0078
Iron (Fe)-Dissolved	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0048	0.0052
Magnesium (Mg)-Dissolved	2.99	<0.10
Manganese (Mn)-Dissolved	0.00170	0.00163
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0295	0.0163
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.83	1.86
Selenium (Se)-Dissolved	0.0628	0.0665
Silicon (Si)-Dissolved	0.118	0.243
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.34	4.47
Strontium (Sr)-Dissolved	0.809	0.957
Thallium (Tl)-Dissolved	<0.000050	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	<0.010	<0.010
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	0.0082

RESULTS OF ANALYSIS

Sample ID	1298-073 OCT28A- FEED
Date Sampled	28-OCT-12
Time Sampled	02:00
ALS Sample ID	L1230280-4
Matrix	Water

Physical Tests

Hardness (as CaCO ₃)	520
pH	-
Total Suspended Solids	-
Total Dissolved Solids	-
Turbidity	-

Anions and Nutrients

Acidity (as CaCO ₃)	-
Alkalinity, Bicarbonate (as CaCO ₃)	-
Alkalinity, Carbonate (as CaCO ₃)	-
Alkalinity, Hydroxide (as CaCO ₃)	-
Alkalinity, Total (as CaCO ₃)	-
Ammonia, Total (as N)	-
Bromide (Br)	-
Chloride (Cl)	-
Fluoride (F)	-
Nitrate (as N)	-
Nitrite (as N)	-
Orthophosphate-Dissolved (as P)	-
Phosphorus (P)-Total	-
Sulfate (SO ₄)	-

Total Metals

Aluminum (Al)-Total	-
Antimony (Sb)-Total	-
Arsenic (As)-Total	-
Barium (Ba)-Total	-
Beryllium (Be)-Total	-
Bismuth (Bi)-Total	-
Boron (B)-Total	-
Cadmium (Cd)-Total	-
Calcium (Ca)-Total	-
Chromium (Cr)-Total	-
Cobalt (Co)-Total	-
Copper (Cu)-Total	-
Iron (Fe)-Total	-
Lead (Pb)-Total	-
Lithium (Li)-Total	-
Magnesium (Mg)-Total	-
Manganese (Mn)-Total	-
Mercury (Hg)-Total	-
Molybdenum (Mo)-Total	-
Nickel (Ni)-Total	-
Phosphorus (P)-Total	-

Potassium (K)-Total	-
Selenium (Se)-Total	*
Silicon (Si)-Total	-
Silver (Ag)-Total	*
Sodium (Na)-Total	*
Strontium (Sr)-Total	*
Thallium (Tl)-Total	*
Tin (Sn)-Total	-
Titanium (Ti)-Total	*
Uranium (U)-Total	*
Vanadium (V)-Total	*
Zinc (Zn)-Total	-

Dissolved Metals

Dissolved Metals Filtration Location	FIELD
Aluminum (Al)-Dissolved	35.2
Antimony (Sb)-Dissolved	0.00051
Arsenic (As)-Dissolved	0.135
Barium (Ba)-Dissolved	0.0935
Beryllium (Be)-Dissolved	0.0186
Bismuth (Bi)-Dissolved	<0.0025
Boron (B)-Dissolved	<0.050
Cadmium (Cd)-Dissolved	0.0430
Calcium (Ca)-Dissolved	167
Chromium (Cr)-Dissolved	0.0242
Cobalt (Co)-Dissolved	0.525
Copper (Cu)-Dissolved	24.2
Iron (Fe)-Dissolved	247
Lead (Pb)-Dissolved	0.0336
Lithium (Li)-Dissolved	0.0128
Magnesium (Mg)-Dissolved	25.1
Manganese (Mn)-Dissolved	15.5
Mercury (Hg)-Dissolved	0.000030
Molybdenum (Mo)-Dissolved	0.0116
Nickel (Ni)-Dissolved	0.203
Phosphorus (P)-Dissolved	<0.30
Potassium (K)-Dissolved	1.97
Selenium (Se)-Dissolved	0.131
Silicon (Si)-Dissolved	6.68
Silver (Ag)-Dissolved	0.00457
Sodium (Na)-Dissolved	4.42
Strontium (Sr)-Dissolved	0.792
Thallium (Tl)-Dissolved	0.000120
Tin (Sn)-Dissolved	0.00182
Titanium (Ti)-Dissolved	0.954
Uranium (U)-Dissolved	0.00199
Vanadium (V)-Dissolved	0.0070
Zinc (Zn)-Dissolved	3.62

RESULTS OF ANALYSIS

	1298-074 OCT28B	1298-079 OCT29A-
Sample ID	- EFFLUENT	EFFLUENT
Date Sampled	28-OCT-12	29-OCT-12
Time Sampled	14:00	02:00
ALS Sample ID	L1230283-1	L1230285-1
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO ₃)	1240	1320
pH	9.88	10.64
Total Suspended Solids	11.2	21.9
Total Dissolved Solids	1850	1930
Turbidity	11.4	20.4
Anions and Nutrients		
Acidity (as CaCO ₃)	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO ₃)	10.1	<1.0
Alkalinity, Carbonate (as CaCO ₃)	18.5	44.6
Alkalinity, Hydroxide (as CaCO ₃)	<1.0	10.8
Alkalinity, Total (as CaCO ₃)	28.6	55.3
Ammonia, Total (as N)	0.0663	0.0653
Bromide (Br)	<1.0	<1.0
Chloride (Cl)	<10	<10
Fluoride (F)	<0.40	0.45
Nitrate (as N)	0.47	0.49
Nitrite (as N)	<0.020	0.023
Orthophosphate-Dissolved (as P)	<0.0010	<0.0010
Phosphorus (P)-Total	<0.0020	<0.0020
Sulfate (SO ₄)	1200	1260
Total Metals		
Aluminum (Al)-Total	3.93	3.72
Antimony (Sb)-Total	<0.00050	<0.00050
Arsenic (As)-Total	0.00396	0.00155
Barium (Ba)-Total	0.0234	0.0242
Beryllium (Be)-Total	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.0025	<0.0025
Boron (B)-Total	<0.050	<0.050
Cadmium (Cd)-Total	0.00126	0.000487
Calcium (Ca)-Total	498	522
Chromium (Cr)-Total	0.00551	0.00457
Cobalt (Co)-Total	0.0141	0.00517
Copper (Cu)-Total	0.609	0.229
Iron (Fe)-Total	6.82	2.48
Lead (Pb)-Total	0.00110	0.00040
Lithium (Li)-Total	0.0048	0.0059
Magnesium (Mg)-Total	2.48	1.76
Manganese (Mn)-Total	0.380	0.146
Mercury (Hg)-Total	0.000012	0.000021
Molybdenum (Mo)-Total	0.0163	0.0185
Nickel (Ni)-Total	0.0059	<0.0025

Phosphorus (P)-Total	<0.30	<0.30
Potassium (K)-Total	1.88	1.94
Selenium (Se)-Total	0.0655	0.0707
Silicon (Si)-Total	0.375	0.244
Silver (Ag)-Total	0.000193	0.000088
Sodium (Na)-Total	4.11	4.35
Strontium (Sr)-Total	0.813	0.880
Thallium (Tl)-Total	<0.000050	<0.000050
Tin (Sn)-Total	<0.00050	<0.00050
Titanium (Ti)-Total	0.037	0.019
Uranium (U)-Total	0.000107	<0.000050
Vanadium (V)-Total	<0.0050	<0.0050
Zinc (Zn)-Total	0.100	0.040

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	3.32	3.22
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0201	0.0225
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	<0.000050	0.000054
Calcium (Ca)-Dissolved	494	526
Chromium (Cr)-Dissolved	0.00391	0.00417
Cobalt (Co)-Dissolved	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0015	0.0082
Iron (Fe)-Dissolved	<0.050	0.074
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0047	0.0054
Magnesium (Mg)-Dissolved	1.78	1.30
Manganese (Mn)-Dissolved	0.00047	0.00461
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0166	0.0178
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.89	1.90
Selenium (Se)-Dissolved	0.0651	0.0660
Silicon (Si)-Dissolved	0.107	0.152
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.09	4.26
Strontium (Sr)-Dissolved	0.815	0.839
Thallium (Tl)-Dissolved	<0.000050	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	<0.010	<0.010
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-075 OCT28B- 1298-080 OCT29A-	
	REACTOR2	REACTOR2
Sample ID		
Date Sampled	28-OCT-12	29-OCT-12
Time Sampled	14:00	02:00
ALS Sample ID	L1230283-2	L1230285-2
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO3)	1240	1420
pH	~	~
Total Suspended Solids	~	~
Total Dissolved Solids	~	~
Turbidity	~	~
Anions and Nutrients		
Acidity (as CaCO3)	~	~
Alkalinity, Bicarbonate (as CaCO3)	~	~
Alkalinity, Carbonate (as CaCO3)	~	~
Alkalinity, Hydroxide (as CaCO3)	~	~
Alkalinity, Total (as CaCO3)	~	~
Ammonia, Total (as N)	~	~
Bromide (Br)	~	~
Chloride (Cl)	~	~
Fluoride (F)	~	~
Nitrate (as N)	~	~
Nitrite (as N)	~	~
Orthophosphate-Dissolved (as P)	~	~
Phosphorus (P)-Total	~	~
Sulfate (SO4)	~	~
Total Metals		
Aluminum (Al)-Total	~	~
Antimony (Sb)-Total	~	~
Arsenic (As)-Total	~	~
Barium (Ba)-Total	~	~
Beryllium (Be)-Total	~	~
Bismuth (Bi)-Total	~	~
Boron (B)-Total	~	~
Cadmium (Cd)-Total	~	~
Calcium (Ca)-Total	~	~
Chromium (Cr)-Total	~	~
Cobalt (Co)-Total	~	~
Copper (Cu)-Total	~	~
Iron (Fe)-Total	~	~
Lead (Pb)-Total	~	~
Lithium (Li)-Total	~	~
Magnesium (Mg)-Total	~	~
Manganese (Mn)-Total	~	~
Mercury (Hg)-Total	~	~
Molybdenum (Mo)-Total	~	~
Nickel (Ni)-Total	~	~

Phosphorus (P)-Total		
Potassium (K)-Total		
Selenium (Se)-Total		
Silicon (Si)-Total		
Silver (Ag)-Total		
Sodium (Na)-Total		
Strontium (Sr)-Total		
Thallium (Tl)-Total		
Tin (Sn)-Total		
Titanium (Ti)-Total		
Uranium (U)-Total		
Vanadium (V)-Total		
Zinc (Zn)-Total		

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	3.11	3.35
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0194	0.0274
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	<0.000050	0.000083
Calcium (Ca)-Dissolved	493	559
Chromium (Cr)-Dissolved	0.00542	0.00492
Cobalt (Co)-Dissolved	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0016	0.0077
Iron (Fe)-Dissolved	<0.050	<0.050
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0046	0.0066
Magnesium (Mg)-Dissolved	1.42	5.63
Manganese (Mn)-Dissolved	0.00065	0.00573
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0164	0.0141
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.79	2.16
Selenium (Se)-Dissolved	0.0636	0.0666
Silicon (Si)-Dissolved	0.119	0.081
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.09	4.88
Strontium (Sr)-Dissolved	0.817	0.870
Thallium (Tl)-Dissolved	<0.000050	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	<0.010	<0.010
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050

RESULTS OF ANALYSIS

	1298-076 OCT28B-	1298-081 OCT29A-
Sample ID	REACTOR1	REACTOR1
Date Sampled	28-OCT-12	29-OCT-12
Time Sampled	14:00	02:00
ALS Sample ID	L1230283-3	L1230285-3
Matrix	Water	Water
Physical Tests		
Hardness (as CaCO3)	1210	1370
pH	-	-
Total Suspended Solids	-	-
Total Dissolved Solids	-	-
Turbidity	-	-
Anions and Nutrients		
Acidity (as CaCO3)	-	-
Alkalinity, Bicarbonate (as CaCO3)	-	-
Alkalinity, Carbonate (as CaCO3)	-	-
Alkalinity, Hydroxide (as CaCO3)	-	-
Alkalinity, Total (as CaCO3)	-	-
Ammonia, Total (as N)	-	-
Bromide (Br)	-	-
Chloride (Cl)	-	-
Fluoride (F)	-	-
Nitrate (as N)	-	-
Nitrite (as N)	-	-
Orthophosphate-Dissolved (as P)	-	-
Phosphorus (P)-Total	-	-
Sulfate (SO4)	-	-
Total Metals		
Aluminum (Al)-Total	-	-
Antimony (Sb)-Total	-	-
Arsenic (As)-Total	-	-
Barium (Ba)-Total	-	-
Beryllium (Be)-Total	-	-
Bismuth (Bi)-Total	-	-
Boron (B)-Total	-	-
Cadmium (Cd)-Total	-	-
Calcium (Ca)-Total	-	-
Chromium (Cr)-Total	-	-
Cobalt (Co)-Total	-	-
Copper (Cu)-Total	-	-
Iron (Fe)-Total	-	-
Lead (Pb)-Total	-	-
Lithium (Li)-Total	-	-
Magnesium (Mg)-Total	-	-
Manganese (Mn)-Total	-	-
Mercury (Hg)-Total	-	-
Molybdenum (Mo)-Total	-	-
Nickel (Ni)-Total	-	-

Phosphorus (P)-Total	-	-
Potassium (K)-Total	-	-
Selenium (Se)-Total	-	-
Silicon (Si)-Total	-	-
Silver (Ag)-Total	-	-
Sodium (Na)-Total	-	-
Strontium (Sr)-Total	-	-
Thallium (Tl)-Total	-	-
Tin (Sn)-Total	-	-
Titanium (Ti)-Total	-	-
Uranium (U)-Total	-	-
Vanadium (V)-Total	-	-
Zinc (Zn)-Total	-	-

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD
Aluminum (Al)-Dissolved	3.17	3.96
Antimony (Sb)-Dissolved	<0.00050	<0.00050
Arsenic (As)-Dissolved	<0.00050	<0.00050
Barium (Ba)-Dissolved	0.0220	0.0277
Beryllium (Be)-Dissolved	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050
Cadmium (Cd)-Dissolved	<0.000050	0.000058
Calcium (Ca)-Dissolved	481	541
Chromium (Cr)-Dissolved	0.00401	0.00380
Cobalt (Co)-Dissolved	<0.00050	<0.00050
Copper (Cu)-Dissolved	0.0026	0.0109
Iron (Fe)-Dissolved	<0.050	0.107
Lead (Pb)-Dissolved	<0.00025	<0.00025
Lithium (Li)-Dissolved	0.0048	0.0067
Magnesium (Mg)-Dissolved	2.61	4.85
Manganese (Mn)-Dissolved	0.00168	0.00689
Mercury (Hg)-Dissolved	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.0147	0.0139
Nickel (Ni)-Dissolved	<0.0025	<0.0025
Phosphorus (P)-Dissolved	<0.30	<0.30
Potassium (K)-Dissolved	1.83	1.98
Selenium (Se)-Dissolved	0.0626	0.0660
Silicon (Si)-Dissolved	0.095	0.092
Silver (Ag)-Dissolved	<0.000050	<0.000050
Sodium (Na)-Dissolved	4.13	4.56
Strontium (Sr)-Dissolved	0.792	0.884
Thallium (Tl)-Dissolved	<0.000050	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050
Titanium (Ti)-Dissolved	<0.010	<0.010
Uranium (U)-Dissolved	<0.000050	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050
Zinc (Zn)-Dissolved	<0.0050	<0.0050

RESULTS OF ANALYSIS

Sample ID	1298-082 OCT29A- FEED
Date Sampled	29-OCT-12
Time Sampled	02:00
ALS Sample ID	L1230285-4
Matrix	Water

Physical Tests

Hardness (as CaCO ₃)	518
pH	~
Total Suspended Solids	~
Total Dissolved Solids	~
Turbidity	~

Anions and Nutrients

Acidity (as CaCO ₃)	~
Alkalinity, Bicarbonate (as CaCO ₃)	~
Alkalinity, Carbonate (as CaCO ₃)	~
Alkalinity, Hydroxide (as CaCO ₃)	~
Alkalinity, Total (as CaCO ₃)	~
Ammonia, Total (as N)	~
Bromide (Br)	~
Chloride (Cl)	~
Fluoride (F)	~
Nitrate (as N)	~
Nitrite (as N)	~
Orthophosphate-Dissolved (as P)	~
Phosphorus (P)-Total	~
Sulfate (SO ₄)	~

Total Metals

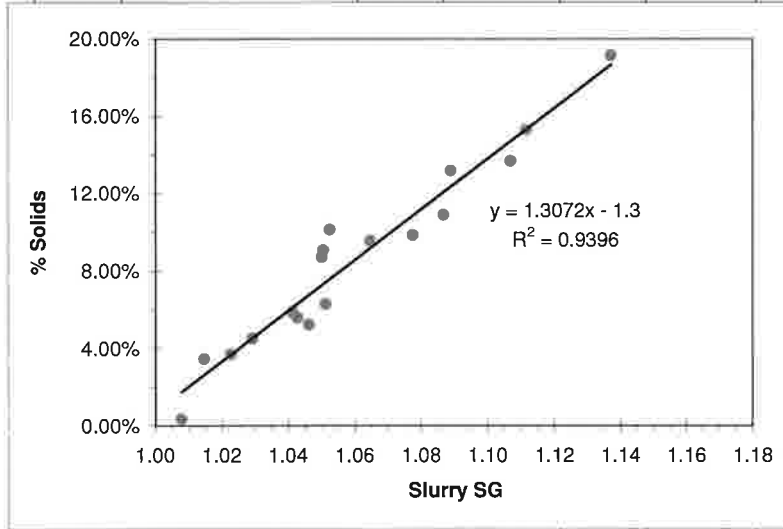
Aluminum (Al)-Total	~
Antimony (Sb)-Total	~
Arsenic (As)-Total	~
Barium (Ba)-Total	~
Beryllium (Be)-Total	~
Bismuth (Bi)-Total	~
Boron (B)-Total	~
Cadmium (Cd)-Total	~
Calcium (Ca)-Total	~
Chromium (Cr)-Total	~
Cobalt (Co)-Total	~
Copper (Cu)-Total	~
Iron (Fe)-Total	~
Lead (Pb)-Total	~
Lithium (Li)-Total	~
Magnesium (Mg)-Total	~
Manganese (Mn)-Total	~
Mercury (Hg)-Total	~
Molybdenum (Mo)-Total	~
Nickel (Ni)-Total	~
Phosphorus (P)-Total	~

Potassium (K)-Total	-
Selenium (Se)-Total	-
Silicon (Si)-Total	-
Silver (Ag)-Total	-
Sodium (Na)-Total	-
Strontium (Sr)-Total	-
Thallium (Tl)-Total	-
Tin (Sn)-Total	-
Titanium (Ti)-Total	-
Uranium (U)-Total	-
Vanadium (V)-Total	-
Zinc (Zn)-Total	-
Dissolved Metals	
Dissolved Metals Filtration Location	FIELD
Aluminum (Al)-Dissolved	34.8
Antimony (Sb)-Dissolved	<0.00050
Arsenic (As)-Dissolved	0.129
Barium (Ba)-Dissolved	0.0935
Beryllium (Be)-Dissolved	0.0187
Bismuth (Bi)-Dissolved	<0.0025
Boron (B)-Dissolved	<0.050
Cadmium (Cd)-Dissolved	0.0425
Calcium (Ca)-Dissolved	166
Chromium (Cr)-Dissolved	0.0242
Cobalt (Co)-Dissolved	0.522
Copper (Cu)-Dissolved	24.2
Iron (Fe)-Dissolved	249
Lead (Pb)-Dissolved	0.0333
Lithium (Li)-Dissolved	0.0128
Magnesium (Mg)-Dissolved	25.1
Manganese (Mn)-Dissolved	15.7
Mercury (Hg)-Dissolved	0.000050
Molybdenum (Mo)-Dissolved	0.0117
Nickel (Ni)-Dissolved	0.201
Phosphorus (P)-Dissolved	<0.30
Potassium (K)-Dissolved	1.96
Selenium (Se)-Dissolved	0.130
Silicon (Si)-Dissolved	6.68
Silver (Ag)-Dissolved	0.00468
Sodium (Na)-Dissolved	4.43
Strontium (Sr)-Dissolved	0.812
Thallium (Tl)-Dissolved	0.000121
Tin (Sn)-Dissolved	<0.00050
Titanium (Ti)-Dissolved	0.944
Uranium (U)-Dissolved	0.00196
Vanadium (V)-Dissolved	0.0067
Zinc (Zn)-Dissolved	3.53

Appendix C – Sludge Generation Data & Percent Solids

Appendix C

Date (2012)	Time	Sample Description	Vol.	Slurry Wt. (g)	S.G.	Dry Cake Wt. (g)	% Solids
21-Oct	18:00	Clarifier U/F	250	251.98	1.008	0.86	0.34%
21-Oct	22:00	Clarifier U/F	250	253.70	1.015	8.87	3.50%
22-Oct	2:00	Clarifier U/F	250	255.65	1.023	9.45	3.70%
22-Oct	6:00	Clarifier U/F	250	257.31	1.029	11.59	4.50%
22-Oct	10:00	Clarifier U/F	250	261.57	1.046	13.70	5.24%
22-Oct	16:00	Clarifier U/F	250	260.33	1.041	15.32	5.88%
22-Oct	18:00	Clarifier U/F	250	260.69	1.043	14.56	5.59%
22-Oct	22:00	Clarifier U/F	250	262.57	1.050	22.95	8.74%
23-Oct	2:00	Clarifier U/F	250	262.67	1.051	23.90	9.10%
23-Oct	6:00	Clarifier U/F	250	263.16	1.053	26.70	10.15%
23-Oct	16:00	Clarifier U/F	250	262.83	1.051	16.53	6.29%
23-Oct	18:00	Clarifier U/F	250	266.19	1.065	25.47	9.57%
23-Oct	22:00	Clarifier U/F	250	269.41	1.078	26.57	9.86%
24-Oct	2:00	Clarifier U/F	250	271.71	1.087	29.65	10.91%
24-Oct	6:00	Clarifier U/F	250	272.27	1.089	35.88	13.18%
27-Oct	8:00	Clarifier U/F	106	117.34	1.107	16.06	13.69%
28-Oct	14:00	Clarifier U/F	100	111.16	1.112	17.00	15.29%
31-Oct	3:30	Clarifier U/F	250	284.30	1.137	54.41	19.14%



Appendix D – Settling Test Results

Appendix D

SETTLING TEST DATA AND CALCULATIONS**CLIENT**

Seabridge KSM
HDS Process

Test Date: 23-Oct-12
Tested By: PS
Test I.D.: 1298-S1A-23

1. INITIAL CONDITIONS

SAMPLE Reactor #2 O/F

2. TEST CONDITIONS

<p>FLOCCULANT Type: Magnafloc 10 Concentration: 0.25 g/L Addition (mL): 3.0</p>	<p>Settling vessel size (mL/cm): 29 Undecanted slurry vol. (mL): 1000.0 Slurry weight (g): 1003 Dry Solids weight (g): 14.5 Final interface Height (mL): 100</p>
---	---

3. COMMENTS

Clear interface seen after 2 minutes

4. SETTLING DATA AND CALCULATIONS

<i>Time (min)</i>	<i>Volume (mL)</i>	<i>Height (mm)</i>	<i>Pulp Density</i>
0	1000	345	1.4
0.2	980	338	1.5
0.5	870	300	1.7
1	630	217	2.3
2	320	110	4.5
5	215	74	6.7
10	165	57	8.6
15	140	48	10.1
20	130	45	10.9
30	120	41	11.8
40	110	38	12.8
50	100	34	14.1
60	100	34	14.1
65	100	34	14.1
70	100	34	14.1

SETTLING TEST DATA AND CALCULATIONS**CLIENT**

*Seabridge KSM
HDS Process*

*Test Date: 27-Oct-12
Tested By: PS
Test I.D.: 1298-S2A-27*

1. INITIAL CONDITIONS

SAMPLE
Reactor #2 O/F

2. TEST CONDITIONS

FLOCCULANT	<i>Settling vessel size (mL/cm): 29</i>
<i>Type: Magnafloc 10</i>	<i>Undecanted slurry vol. (mL): 1000.0</i>
<i>Concentration: 0.25 g/L</i>	<i>Slurry weight (g): 1010.72</i>
<i>Addition (mL): 2</i>	<i>Dry Solids weight (g): 18.7</i>
	<i>Final interface Height (mL): 90</i>

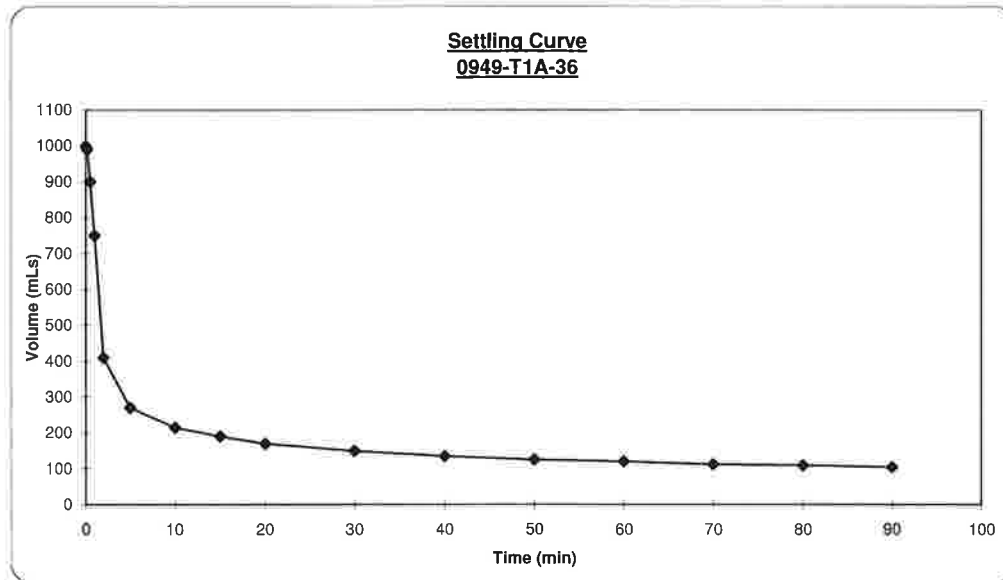
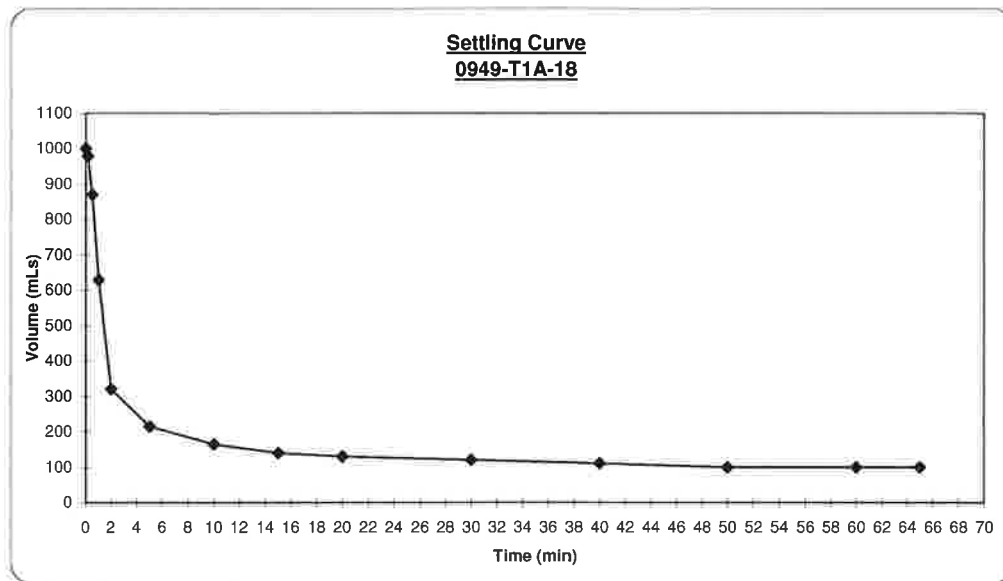
3. COMMENTS

Very clear overflow

4. SETTLING DATA AND CALCULATIONS

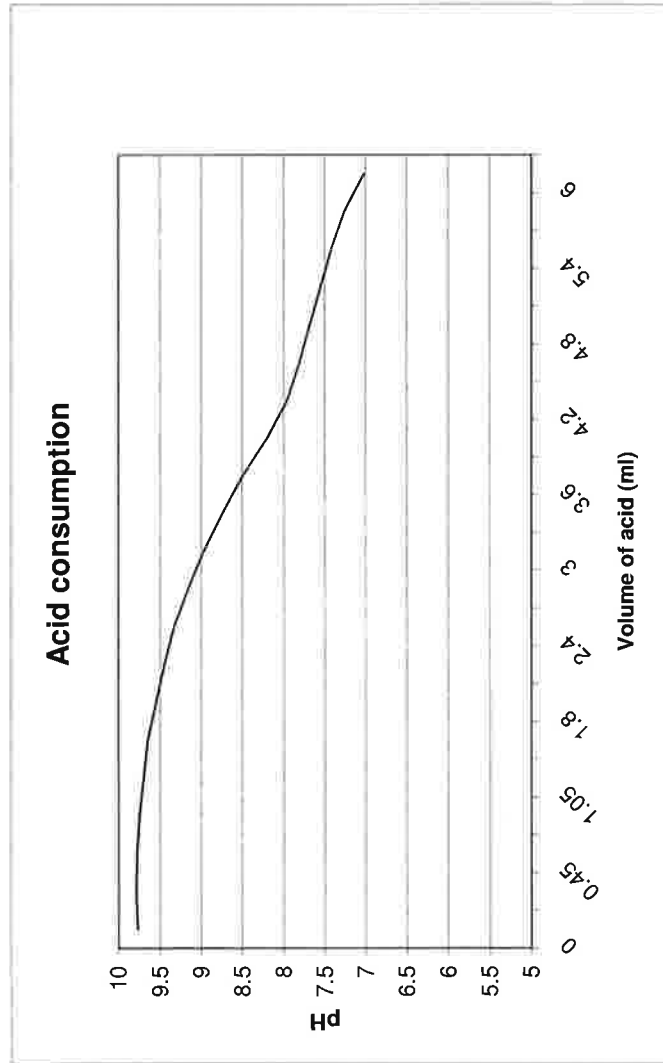
<i>Time (min)</i>	<i>Volume (mL)</i>	<i>Height (mm)</i>	<i>Pulp Density</i>
0	1000	345	1.9
0.2	990	341	1.9
0.5	900	310	2.1
1	750	259	2.5
2	410	141	4.4
5	270	93	6.7
10	215	74	8.3
15	190	66	9.3
20	170	59	10.3
30	150	52	11.6
40	135	47	12.8
50	125	43	13.8
60	120	41	14.3
70	112	39	15.2
80	110	38	15.5
90	105	36	16.2
100	100	34	16.9
120	100	34	16.9
130	99	34	17.0
145	90	31	18.6

Appendix D



Appendix E – Acid Consumption Results

Sulphuric acid	
Total volume of treated water (ml)	1500
Volume of 0.1 N H_2SO_4 (ml)	pH
0	9.77
0.15	9.79
0.45	9.78
0.75	9.75
1.05	9.7
1.35	9.65
1.8	9.55
2.1	9.45
2.4	9.33
2.7	9.16
3	8.97
3.3	8.74
3.6	8.49
3.9	8.2
4.2	7.96
4.5	7.81
4.8	7.68
5.1	7.55
5.4	7.42
5.7	7.26
6	7.02

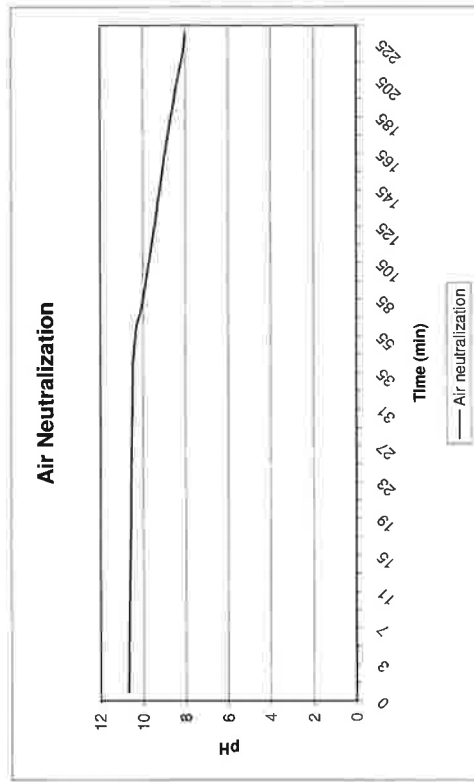


Air neutralization

Volume of treated water (ml)	4000
Diameter of column (cm)	10
Hight of water (cm)	50

Air flow rate (LPM)	0.5	Air consumption (L/L of treated water)	28.1250
---------------------	-----	--	---------

Time (min)	pH
0	10.7
2	10.69
3	10.68
5	10.67
7	10.66
9	10.64
11	10.63
13	10.62
15	10.6
17	10.59
19	10.58
21	10.57
23	10.56
25	10.54
27	10.53
29	10.52
31	10.5
33	10.49
35	10.48
45	10.4
55	10.31
75	10.08
85	9.92
95	9.78
105	9.65
115	9.52
125	9.39
135	9.27
145	9.14
155	9.02
165	8.89
175	8.75
185	8.6
195	8.45
205	8.27
215	8.1
225	8

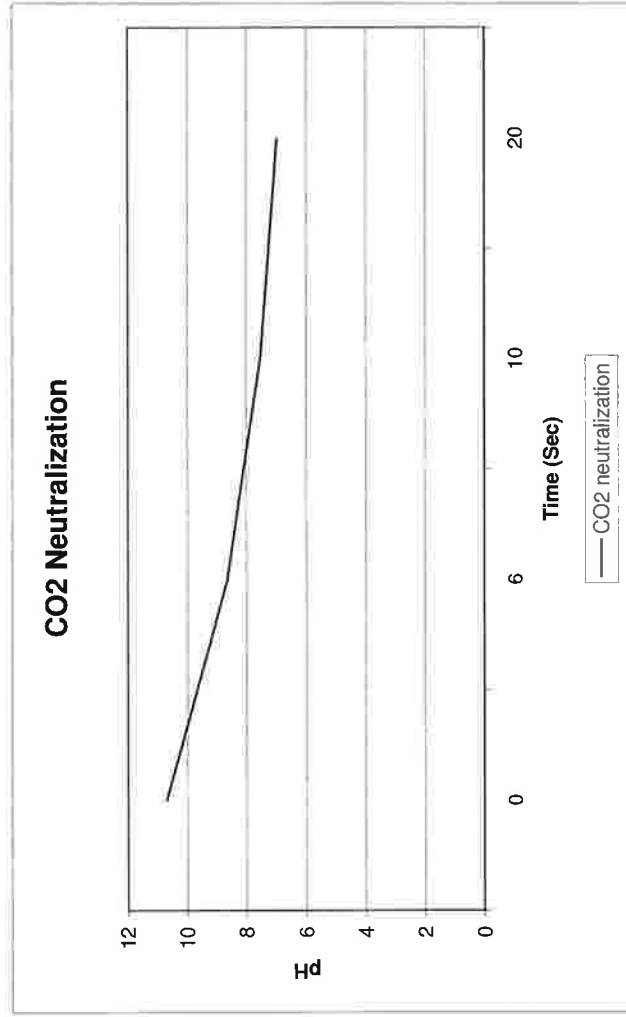


CO2 neutralization

Volume of treated water (ml)	4000	
Diameter of column (cm)	10	Height of water (cm)
		50

CO2 flow rate (LPM)	0.5	CO2 consumption (L/L of treated water)
		0.0417

Time (sec)	pH
0	10.7
6	8.65
10	7.55
20	6.99



Appendix F – Sulphidization and High Iron Testing

Sulphide Tests Results

	Test #1	Test #2	Test #3	Test #4
Test Condition				
Initial pH (adjusted)	4	4	5.5	-----
Sulphide concentration (mg/l)	100	100	100	-----
Reaction time after adding sulphide (min)	20	20	20	-----
Adjusted pH by lime	-----	10.5	10.5	10.5
Retention time after lime neutralization	-----	40	40	40
Test Results				
Dissolved Metals (in mg/L)				
Aluminum (Al)-Dissolved	29.4	3.92	2.59	2.39
Antimony (Sb)-Dissolved	<0.00050	<0.00050	<0.00020	<0.00050
Arsenic (As)-Dissolved	0.0785	<0.00050	0.00034	<0.00050
Barium (Ba)-Dissolved	0.0822	0.0355	0.0397	0.0237
Beryllium (Be)-Dissolved	0.0170	<0.00050	<0.00020	<0.00050
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0010	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.020	<0.050
Cadmium (Cd)-Dissolved	0.0364	<0.000050	0.000116	0.000054
Calcium (Ca)-Dissolved	144	473	402	516
Chromium (Cr)-Dissolved	0.0196	0.00100	<0.00020	0.00649
Cobalt (Co)-Dissolved	0.434	<0.00050	0.00024	<0.00050
Copper (Cu)-Dissolved	16.3	0.0034	0.00681	0.0041
Iron (Fe)-Dissolved	203	<0.050	0.060	<0.050
Lead (Pb)-Dissolved	0.0354	<0.00025	0.00058	<0.00025
Lithium (Li)-Dissolved	0.0095	0.0114	0.0091	0.0066
Magnesium (Mg)-Dissolved	21.4	2.26	3.52	11.6
Manganese (Mn)-Dissolved	14.2	0.00767	0.0576	0.0182
Mercury (Hg)-Dissolved	0.000037	<0.000010	<0.000010	0.000012
Molybdenum (Mo)-Dissolved	0.00505	0.00483	0.00292	0.0104
Nickel (Ni)-Dissolved	0.170	<0.0025	<0.0010	<0.0025
Phosphorus (P)-Dissolved	0.66	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	2.76	2.76	3.74	1.92
Selenium (Se)-Dissolved	0.0979	0.0663	0.0565	0.0615
Silicon (Si)-Dissolved	6.00	0.105	0.229	0.067
Silver (Ag)-Dissolved	<0.000050	<0.000050	<0.000020	<0.000050
Sodium (Na)-Dissolved	66.1	70.9	163	4.45
Strontium (Sr)-Dissolved	0.702	0.802	0.803	0.822
Thallium (Tl)-Dissolved	0.000080	<0.000050	<0.000020	<0.000050
Tin (Sn)-Dissolved	<0.00050	<0.00050	0.00038	<0.00050
Titanium (Ti)-Dissolved	0.641	<0.010	<0.010	0.021
Uranium (U)-Dissolved	0.00181	<0.000050	0.000047	<0.000050
Vanadium (V)-Dissolved	<0.0050	<0.0050	<0.0020	<0.0050
Zinc (Zn)-Dissolved	3.14	<0.0050	0.0042	<0.0050

Appendix G – Delkor Filtration Test



The Delkor Filter Press is a robust and reliable pressure filter designed for optimum solution recovery and maximum solids dryness. The filters are available from 1m² to 350m² filtration area at operating pressures up to 25 bar.

The Delkor Manual Filter press is a low cost filtration option suitable for small tonnages and long filtration cycle times where manual labour is available to open the press and discharge the solids.

The Delkor Automatic Filter press is specified for larger tonnages or hazardous applications where the full operating cycle is automated, including press opening and solids discharge.

Delkor Filter presses are designed for:

- 98% availability
- Simple operation
- Low maintenance requirements due to:
 - Minimum number of moving parts
 - Conservative sizing parameters
 - Low internal velocities

Options include

- Simple dewatering
- Process Washing
- Membrane Compression
- Standard, Recessed and Membrane Press Plates in PP, PVDF, Cast Iron
- Automatic Discharge



Method of Operation

The Delkor Filter press comprises a steel framework with a hydraulic closing cylinder that locks a pack of filter plates in place. The filter plates have an internal recess with a feed inlet and a filtrate drainage grid.

A filter cloth overlays the drainage grid and forms a chamber into which feed slurry is introduced under pressure.

As the chamber fills under pressure, filtrate moves through the filter cloth and exits via the plate drainage grid. The solids are trapped in the chamber and formed into a solid cake.

At this point the feed is stopped and the cake may be washed by forcing water from one side of the cake to the other. The cake can also be air-dried after this stage in a similar fashion.

When solids discharge is required, the closing cylinder is retracted and each filter plate is moved to allow gravity discharge of the cake.



Applications

- Solution Recovery
 - Metals in solution
 - Sodium from lime mud and dregs
 - Any duty requiring cake washing
- Solids Drying
- Mineral concentrates
 - Cu, Zn, Pb, Fe, Ti, Zr and PGMs
- Fine Coal
- Underground Mud
- Clays and Kaolin
- Precipitates incl. Gypsum
- Hydroxides, Cement Copper
- Lime Mud
- Phosphate Rock
- Effluent Treatment

Safety devices (Optional)

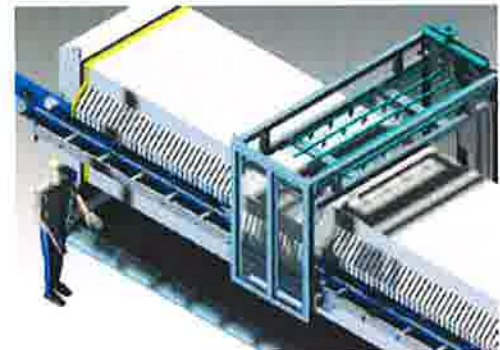
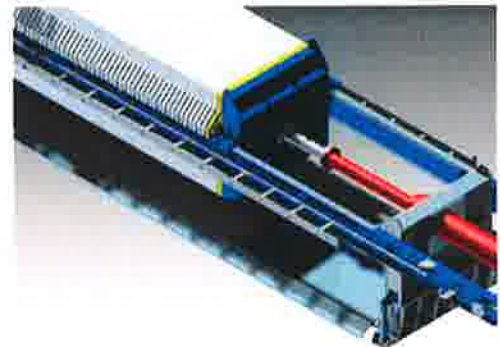
- Trip/pull-wire switches
- Light curtain
- Guarding
- Bomb-bay doors

Test Apparatus

- Laboratory test work
- Pilot plants

Research & Development

- Ongoing process to improve current and future installations
- Develop more efficient control philosophies
- Provide superior performance of each item of equipment.





BOND INDEXING FILTERS



www.delkorglobal.com

Filtration Equipment

Developed to meet the needs of today's modern process industries, the Delkor Bond Indexing Filter incorporates features derived from Delkor's wealth of industrial experience in the field of solid / liquid separation.

The Delkor Bond Indexing Filter offers a reliable, cost effective and versatile solution for solids extraction and cake washing applications.

Using the principles of horizontal vacuum filtration, the microprocessor controlled Bond Indexing Filter allows true process optimisation under all conditions to ensure filtration and washing parameters are achieved. The microprocessor sequence controls not only provide flexibility to quickly adjust the filtration parameters, they also allow process integration within the site operating system.

Filtration takes place through a filter cloth supported on a stationary vacuum tray. The filter cloth is moved in increments along the vacuum tray by an electric drive.

When the filter cloth is stationary, vacuum is applied for a set time interval and then released. The process of cloth movement and vacuum application is repeated a number of times along the length of the vacuum filter to give an incremental movement of the filter cloth. During the cycle of movement the filter feed and required wash are applied to specific zones of the filter. Being microprocessor controlled, precise synchronisation of all movement, vacuum times, feed times and wash times is simply and quickly achieved.

Benefits

- Low capital cost
- Low maintenance requirements
- Low power consumption
- Easy to adjust microprocessor controls which can be linked to the main process computer
- Controlled cloth acceleration to prolong cloth life
- Variable stroke operation to eliminate filtrate carry over
- Accurate separation of primary and wash filtrates
- Single or multistage cake washing
- Co-Current or Counter Current washing
- Filter cloth washed on both sides
- Feed is applied above the filter cloth so that's sedimentation aids filtration
- Filter can be partially or completely hooded
- Cake compression modules available to produce drier cakes

Applications

- Pigment dewatering and washing
- Fine Chemical production
- Pharmaceuticals
- Gypsum Dewatering
- Fluorosilic acid
- Uranium – Yellow Cake
- General Chemical Process
- Process effluent dewatering
- Chemical Intermediates
- Salt dewatering and washing
- General solid / liquid separation

DELKOR

IT PAYS TO TALK TO A SPECIALIST



For further information, contact your regional Delkor office.

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- centralasia.nthafrika@delkorglobal.com
- subsahara.africa@delkorglobal.com
- asia.pacific@delkorglobal.com

- Delkor Belt Filters
- Ceramic Disc Filters (CDF)
- Automated Filter Presses
- Bond Indexing Filters
- Tipping Pan Filters
- Gravity Sand Filters
- Polishing Ceramic Filters

Filter Press Testwork Results Summary

Handled by	Christian Kyle	Date	November 2nd, 2012
Customer	SGS	Project	
Attention	Prab Bhatia	Test N ^o	

Sample Data	
Slurry R.D.	1.15
Solids S.G.	3.30 assumed
Liquid S.G.	1.00
% Solids	18.7%
Slurry Temp.	Amb.
Slurry pH	10.50
Wash pH	
Wash Temp	
Wash Solution	

Test 1	
N ^o of Plates	4
Thickness of Plates	20 mm
Surface Area (1)	0.007854 m ²
Filter Area	0.015708 m ²
Drying Area	0.007854 m ²
Operating Pressure	7.0 Bar
Cloth Type	Needlefelt AMP412202G1 (15-25cfm)
Comments	Very clear filtrate, very firm cake.

Sample Data	
Slurry R.D.	1.15
Solids S.G.	3.30 assumed
Liquid S.G.	1.00
% Solids	18.7%
Slurry Temp.	Amb.
Slurry pH	10.50
Wash pH	
Wash Temp	
Wash Solution	

Test 2	
N ^o of Plates	1
Thickness of Plates	40 mm
Surface Area (1)	0.007854 m ²
Filter Area	0.015708 m ²
Drying Area	0.007854 m ²
Operating Pressure	7.0 Bar
Cloth Type	Needlefelt AMP412202G1 (15-25cfm)
Comments	Very clear filtrate, very firm cake. During test breaker tripped multiple times during form (once/min) and dry (once).

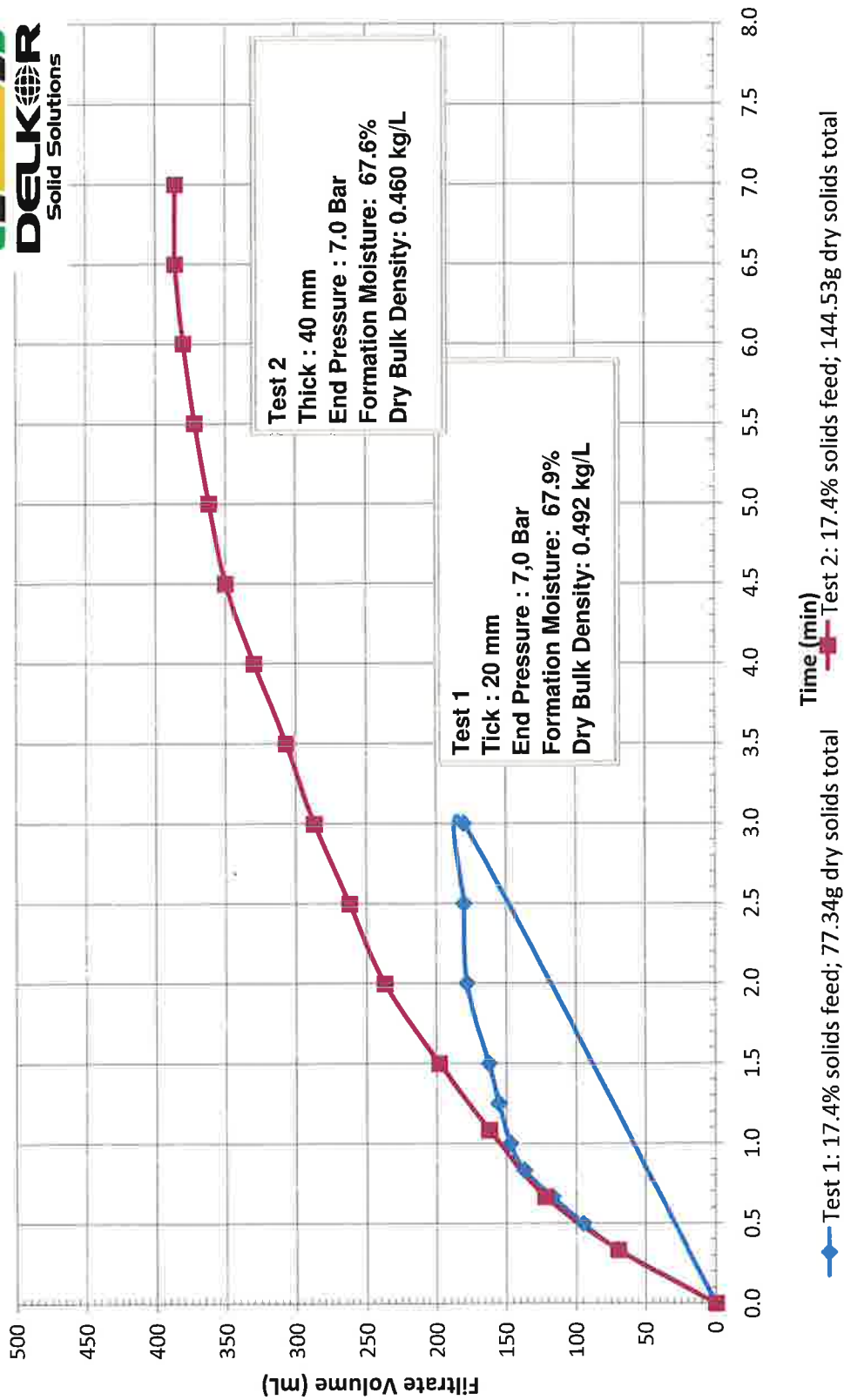


Test No	Test Data										Calculated					
	Form Pressure [kPa]	Dry (Air Blow) Pressure [kPa]	Pressure Time [min]	Plate Thickness [mm]	Cake Wet Weight [gr]	Cake Dry Weight [gr]	Blowing time [min]	Moisture [%]	Dry Time Factor [min/(kg/m ²)]	Dry Cake Weight [kg/m ²]	Slurry Density Before Blowing [kg/lt]	Slurry Density Before Blowing [kg/lt]	% Solid Before Blowing [%]	Dry Bulk Density [kg/lt]	(B)/(A)	
1	700	700	2.5	20	220.95	77.34	1 0.5 0.33 0.165 0	64.997 65.311 66.072 66.942 67.902	0.102 0.051 0.034 0.017 0.000	9.847	1.534	0.492	32.098	1.317	0.423	85.9

Test No	Test Data										Calculated					
	Form Pressure [kPa]	Dry (Air Blow) Pressure [kPa]	Pressure Time [min]	Plate Thickness [mm]	Cake Wet Weight [gr]	Cake Dry Weight [gr]	Blowing time [min]	Moisture [%]	Dry Time Factor [min/(kg/m ²)]	Dry Cake Weight [kg/m ²]	Slurry Density Before Blowing [kg/lt]	Slurry Density Before Blowing [kg/lt]	% Solid Before Blowing [%]	Dry Bulk Density [kg/lt]	(B)/(A)	
2	700	700	7	40	423.69	144.53	1 0.5 0.33 0.165 0	65.888 66.048 66.364 66.827 67.572	0.054 0.027 0.018 0.009 0.000	18.402	1.419	0.460	32.428	1.321	0.429	95.1

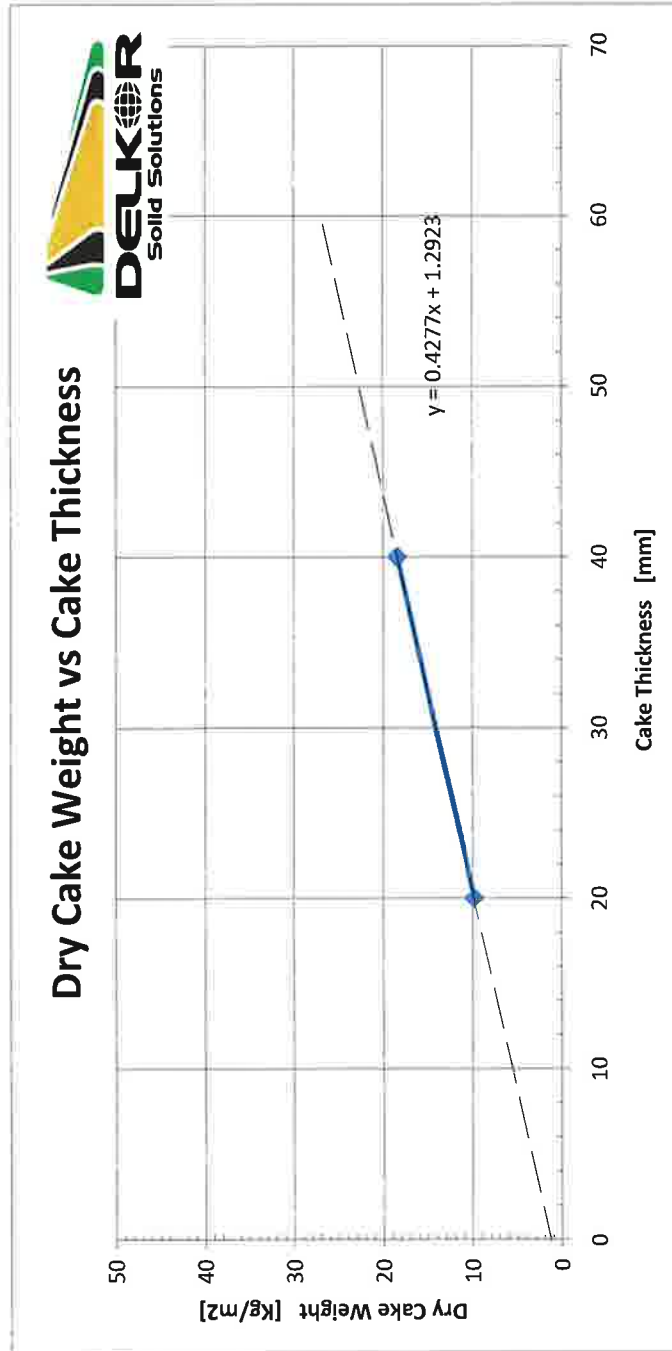


Pressure Filtration Cake Formation

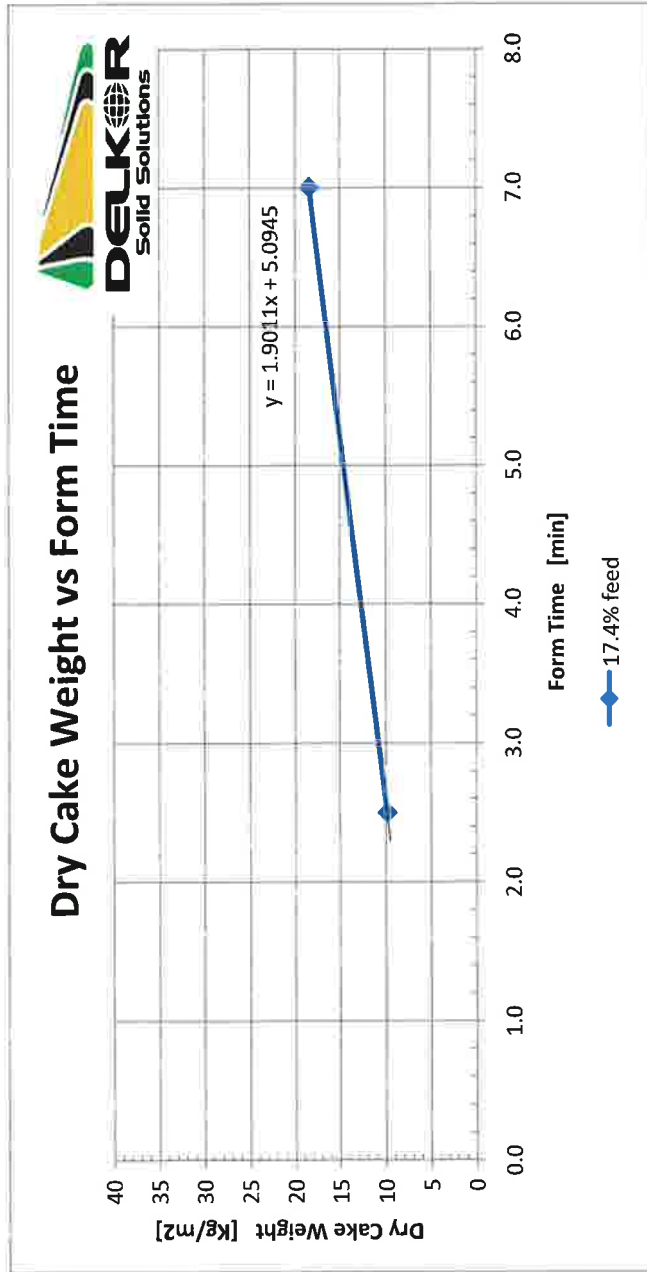


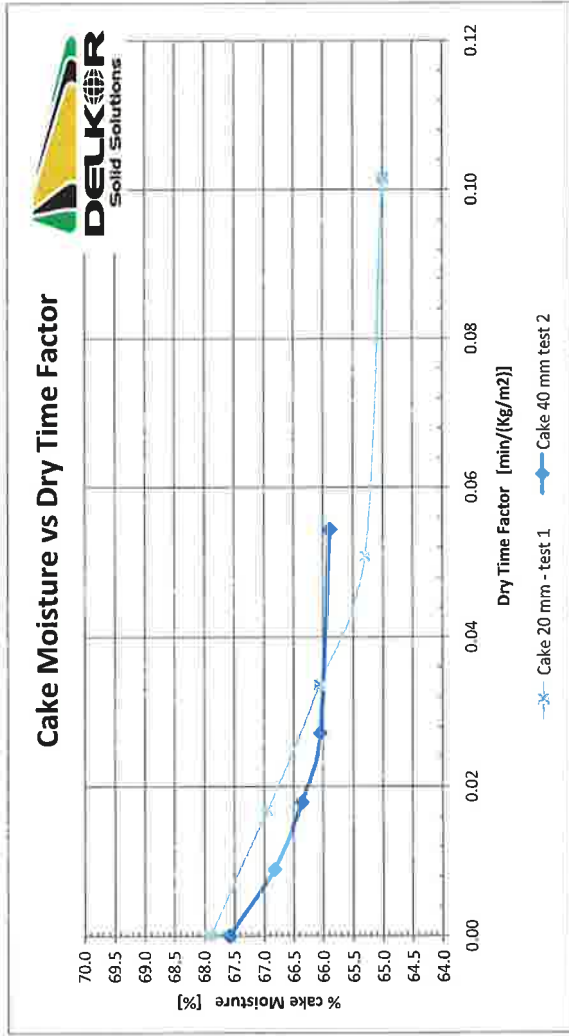
◆ Test 1: 17.4% solids feed; 77.34g dry solids total
 ■ Test 2: 17.4% solids feed; 144.53g dry solids total

Cake Thickness [mm]	Dry Cake Weight [Kg/m ²]
20	9.85
40	18.40



Form Time [min]	Dry Cake Weight [Kg/m ²]
2.5	9.85
7.0	18.40





20mm (1 min total dry time)	
Moisture [%]	Dry Time Factor [min/(kg/m ²)]
67.902	0.000
66.942	0.017
66.072	0.034
65.311	0.051
62.997	0.102

40mm (1 min total dry time)	
Moisture [%]	Dry Time Factor [min/(kg/m ²)]
67.572	0.000
66.827	0.009
66.364	0.018
66.048	0.027
63.888	0.054

Project	868-021-01
Report To	Rebecca Burton, RESCAN ENVIRONMENTAL SERVICES
ALS File No.	L1233267
Date Received	05-Nov-12 11:15
Date	06-Nov-12

RESULTS OF ANALYSIS	
Sample ID	SOLIDS
Date Sampled	05-NOV-12
Time Sampled	10:00
ALS Sample ID	L1233267-1
Matrix	Soil
Physical Tests	
Moisture	8.50
pH (1:2 soil:water)	9.48
Metals	
Aluminum (Al)	24900
Antimony (Sb)	1.80
Arsenic (As)	112
Barium (Ba)	68.4
Beryllium (Be)	9.81
Bismuth (Bi)	<0.20
Cadmium (Cd)	34.2
Calcium (Ca)	127000
Chromium (Cr)	30.7
Cobalt (Co)	380
Copper (Cu)	17500
Iron (Fe)	195000
Lead (Pb)	29.9
Lithium (Li)	5.5
Magnesium (Mg)	17300
Manganese (Mn)	12000
Mercury (Hg)	0.0365
Molybdenum (Mo)	13.3
Nickel (Ni)	154
Phosphorus (P)	<50
Potassium (K)	<100
Selenium (Se)	43.8
Silver (Ag)	3.77
Sodium (Na)	<100
Strontium (Sr)	117
Thallium (Tl)	0.065
Tin (Sn)	<2.0
Titanium (Ti)	683
Uranium (U)	2.83
Vanadium (V)	51.9
Zinc (Zn)	2830
TCLP Metals	
1st Preliminary PH	9.46
2nd Preliminary PH	5.71
Final pH	7.12
Extraction Solution Initial pH	2.89
Antimony (Sb)-Leachable	<1.0
Arsenic (As)-Leachable	<1.0
Barium (Ba)-Leachable	<2.5
Beryllium (Be)-Leachable	<0.025

Boron (B)-Leachable	<0.50
Cadmium (Cd)-Leachable	<0.050
Calcium (Ca)-Leachable	2260
Chromium (Cr)-Leachable	<0.25
Cobalt (Co)-Leachable	0.068
Copper (Cu)-Leachable	0.124
Iron (Fe)-Leachable	<0.15
Lead (Pb)-Leachable	<0.25
Magnesium (Mg)-Leachable	179
Mercury (Hg)-Leachable	<0.0010
Nickel (Ni)-Leachable	<0.25
Selenium (Se)-Leachable	<1.0
Silver (Ag)-Leachable	<0.25
Thallium (Tl)-Leachable	<1.0
Vanadium (V)-Leachable	<0.15
Zinc (Zn)-Leachable	<0.50
BC MLEP Extractables	
Final pH	8.75
BC MLEP Metals	
Arsenic (As)-Leachable	<0.20
Barium (Ba)-Leachable	<0.050
Boron (B)-Leachable	<0.10
Cadmium (Cd)-Leachable	<0.010
Chromium (Cr)-Leachable	0.029
Copper (Cu)-Leachable	<0.010
Lead (Pb)-Leachable	<0.050
Mercury (Hg)-Leachable	<0.0010
Selenium (Se)-Leachable	<0.20
Silver (Ag)-Leachable	<0.010
Uranium (U)-Leachable	<2.0
Zinc (Zn)-Leachable	<0.050

Appendix H – Synthetic Feed Analysis

Project	868-021-01
Report To	Rebecca Burton, RESCAN ENVIRONMENTAL SERVICES
ALS File No.	L1225725
Date Received	18-Oct-12 11:15
Date	19-Oct-12

RESULTS OF ANALYSIS

Sample ID	FEED-BOTTOM	FEED-MID	FEED-TOP
Date Sampled	18-OCT-12	18-OCT-12	18-OCT-12
Time Sampled	09:00	09:00	09:00
ALS Sample ID	L1225725-1	L1225725-2	L1225725-3
Matrix	Water	Water	Water

Physical Tests

Hardness (as CaCO ₃)	235	234	234
pH	2.78	2.81	2.79
Total Suspended Solids	58.1	59.9	52.5
Total Dissolved Solids	1930	1990	1890
Turbidity	86.2	84.1	80.2

Anions and Nutrients

Acidity (as CaCO ₃)	915	937	935
Alkalinity, Bicarbonate (as CaCO ₃)	<1.0	<1.0	<1.0
Alkalinity, Carbonate (as CaCO ₃)	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO ₃)	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO ₃)	<1.0	<1.0	<1.0
Ammonia, Total (as N)	0.0051	0.0055	0.0070
Bromide (Br)	<1.0	<1.0	<1.0
Chloride (Cl)	<1.0	<1.0	<1.0
Fluoride (F)	1.35	1.35	1.37
Nitrate (as N)	0.68	0.71	0.70
Nitrite (as N)	0.047	0.045	0.045
Orthophosphate-Dissolved (as P)	0.0122	0.0101	0.0123
Phosphorus (P)-Total	<0.020	<0.020	<0.020
Sulfate (SO ₄)	1170	1160	1170

Total Metals

Aluminum (Al)-Total	23.0	20.8	21.3
Antimony (Sb)-Total	0.00574	0.00698	0.00638
Arsenic (As)-Total	0.0225	0.0220	0.0212
Barium (Ba)-Total	0.124	0.118	0.114
Beryllium (Be)-Total	0.00280	0.00279	0.00273
Bismuth (Bi)-Total	<0.0010	<0.0010	<0.0010
Boron (B)-Total	<0.020	<0.020	<0.020
Cadmium (Cd)-Total	0.0484	0.0438	0.0433
Calcium (Ca)-Total	53.4	52.2	51.0
Chromium (Cr)-Total	0.0262	0.0236	0.0238
Cobalt (Co)-Total	0.528	0.482	0.475
Copper (Cu)-Total	23.1	21.0	20.5
Iron (Fe)-Total	258	244	246
Lead (Pb)-Total	0.0407	0.0404	0.0403
Lithium (Li)-Total	0.0125	0.0120	0.0123
Magnesium (Mg)-Total	24.0	23.6	23.1
Manganese (Mn)-Total	15.2	13.7	13.7
Mercury (Hg)-Total	0.000052	0.000054	0.000057
Molybdenum (Mo)-Total	0.200	0.200	0.186
Nickel (Ni)-Total	0.211	0.191	0.185
Phosphorus (P)-Total	<0.30	<0.30	<0.30
Potassium (K)-Total	2.22	1.99	1.95

Selenium (Se)-Total	0.139	0.138	0.137
Silicon (Si)-Total	8.15	8.14	7.74
Silver (Ag)-Total	0.00483	0.00481	0.00461
Sodium (Na)-Total	6.46	5.86	5.83
Strontium (Sr)-Total	0.744	0.735	0.710
Thallium (Tl)-Total	0.000136	0.000134	0.000137
Tin (Sn)-Total	0.00150	0.00103	0.00097
Titanium (Ti)-Total	1.03	1.04	1.01
Uranium (U)-Total	0.00201	0.00193	0.00196
Vanadium (V)-Total	0.0127	0.0127	0.0121
Zinc (Zn)-Total	3.98	3.63	3.57

Dissolved Metals

Dissolved Metals Filtration Location	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	20.3	20.4	20.8
Antimony (Sb)-Dissolved	0.00094	0.00094	0.00091
Arsenic (As)-Dissolved	0.0155	0.0157	0.0160
Barium (Ba)-Dissolved	0.0883	0.0889	0.0910
Beryllium (Be)-Dissolved	0.00282	0.00273	0.00277
Bismuth (Bi)-Dissolved	<0.0010	<0.0010	<0.0010
Boron (B)-Dissolved	<0.020	<0.020	<0.020
Cadmium (Cd)-Dissolved	0.0450	0.0452	0.0446
Calcium (Ca)-Dissolved	54.7	54.3	54.3
Chromium (Cr)-Dissolved	0.0241	0.0241	0.0242
Cobalt (Co)-Dissolved	0.489	0.487	0.487
Copper (Cu)-Dissolved	21.2	21.0	20.6
Iron (Fe)-Dissolved	235	235	234
Lead (Pb)-Dissolved	0.0396	0.0389	0.0380
Lithium (Li)-Dissolved	0.0122	0.0120	0.0120
Magnesium (Mg)-Dissolved	23.9	23.8	24.0
Manganese (Mn)-Dissolved	13.7	13.9	13.8
Mercury (Hg)-Dissolved	0.000021	0.000021	0.000025
Molybdenum (Mo)-Dissolved	0.152	0.150	0.151
Nickel (Ni)-Dissolved	0.195	0.194	0.188
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.80	1.77	1.76
Selenium (Se)-Dissolved	0.127	0.128	0.132
Silicon (Si)-Dissolved	6.38	6.35	6.35
Silver (Ag)-Dissolved	0.00438	0.00408	0.00441
Sodium (Na)-Dissolved	5.78	5.75	5.84
Strontium (Sr)-Dissolved	0.754	0.742	0.737
Thallium (Tl)-Dissolved	0.000119	0.000124	0.000118
Tin (Sn)-Dissolved	0.00098	0.00090	0.00096
Titanium (Ti)-Dissolved	0.916	0.912	0.918
Uranium (U)-Dissolved	0.00200	0.00198	0.00191
Vanadium (V)-Dissolved	0.0069	0.0069	0.0070
Zinc (Zn)-Dissolved	3.62	3.79	3.64

Project	868-021-01
Report To	Rebecca Burton, RESCAN ENVIRONMENTAL SERVICES
ALS File No.	L1228961
Date Received	25-Oct-12 10:45
Date	26-Oct-12

RESULTS OF ANALYSIS

	1298-044 BATCH- 2 FEED:BOTTOM	1298-045 BATCH- 2 FEED: MID	1298-046 BATCH- 2 FEED:TOP
Sample ID			
Date Sampled	25-OCT-12	25-OCT-12	25-OCT-12
Time Sampled	08:30	08:30	08:30
ALS Sample ID	L1228961-1	L1228961-2	L1228961-3
Matrix	Water	Water	Water

Physical Tests

Hardness (as CaCO ₃)	503	512	513
pH	2.73	2.72	2.73
Total Suspended Solids	76.0	78.7	76.0
Total Dissolved Solids	2170	2140	2060
Turbidity	113	112	111

Anions and Nutrients

Acidity (as CaCO ₃)	1030	1050	1050
Alkalinity, Bicarbonate (as CaCO ₃)	<1.0	<1.0	<1.0
Alkalinity, Carbonate (as CaCO ₃)	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO ₃)	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO ₃)	<1.0	<1.0	<1.0
Ammonia, Total (as N)	0.0090	0.0090	0.0097
Bromide (Br)	<1.0	<1.0	<1.0
Chloride (Cl)	<10	<10	<10
Fluoride (F)	1.39	1.33	1.34
Nitrate (as N)	0.53	0.52	0.53
Nitrite (as N)	<0.020	<0.020	<0.020
Orthophosphate-Dissolved (as P)	0.041	0.0422	0.0428
Phosphorus (P)-Total	0.0628	0.0643	0.0687
Sulfate (SO ₄)	1540	1540	1540

Total Metals

Aluminum (Al)-Total	36.1	34.6	33.8
Antimony (Sb)-Total	0.00970	0.00986	0.00921
Arsenic (As)-Total	0.200	0.193	0.191
Barium (Ba)-Total	0.143	0.145	0.138
Beryllium (Be)-Total	0.0177	0.0163	0.0159
Bismuth (Bi)-Total	<0.0025	<0.0025	<0.0025
Boron (B)-Total	<0.050	<0.050	<0.050
Cadmium (Cd)-Total	0.0443	0.0420	0.0409
Calcium (Ca)-Total	153	153	151
Chromium (Cr)-Total	0.0246	0.0242	0.0235
Cobalt (Co)-Total	0.541	0.520	0.516
Copper (Cu)-Total	26.8	25.8	25.5
Iron (Fe)-Total	285	263	271
Lead (Pb)-Total	0.0399	0.0396	0.0379
Lithium (Li)-Total	0.0133	0.0117	0.0112
Magnesium (Mg)-Total	24.8	25.0	24.6
Manganese (Mn)-Total	17.3	16.5	16.3
Mercury (Hg)-Total	0.000076	0.000075	0.000077
Molybdenum (Mo)-Total	0.112	0.112	0.105
Nickel (Ni)-Total	0.211	0.202	0.200

Phosphorus (P)-Total	<0.30	<0.30	<0.30
Potassium (K)-Total	2.26	2.20	2.11
Selenium (Se)-Total	0.160	0.146	0.149
Silicon (Si)-Total	8.97	9.60	8.96
Silver (Ag)-Total	0.00548	0.00533	0.00516
Sodium (Na)-Total	4.33	4.16	4.09
Strontium (Sr)-Total	0.847	0.818	0.794
Thallium (Tl)-Total	0.000163	0.000151	0.000140
Tin (Sn)-Total	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total	1.35	1.38	1.33
Uranium (U)-Total	0.00196	0.00195	0.00187
Vanadium (V)-Total	0.0197	0.0197	0.0185
Zinc (Zn)-Total	3.81	3.67	3.62
Dissolved Metals			
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	34.4	34.9	34.1
Antimony (Sb)-Dissolved	0.00125	0.00112	0.00118
Arsenic (As)-Dissolved	0.154	0.153	0.153
Barium (Ba)-Dissolved	0.0967	0.0984	0.0975
Beryllium (Be)-Dissolved	0.0198	0.0187	0.0187
Bismuth (Bi)-Dissolved	<0.0025	<0.0025	<0.0025
Boron (B)-Dissolved	<0.050	<0.050	<0.050
Cadmium (Cd)-Dissolved	0.0422	0.0416	0.0418
Calcium (Ca)-Dissolved	161	164	165
Chromium (Cr)-Dissolved	0.0233	0.0224	0.0224
Cobalt (Co)-Dissolved	0.540	0.535	0.518
Copper (Cu)-Dissolved	25.4	24.9	24.9
Iron (Fe)-Dissolved	258	256	257
Lead (Pb)-Dissolved	0.0355	0.0343	0.0340
Lithium (Li)-Dissolved	0.0140	0.0126	0.0126
Magnesium (Mg)-Dissolved	24.4	24.8	24.8
Manganese (Mn)-Dissolved	16.4	16.3	16.6
Mercury (Hg)-Dissolved	0.000032	0.000031	0.000033
Molybdenum (Mo)-Dissolved	0.0137	0.0136	0.0135
Nickel (Ni)-Dissolved	0.201	0.197	0.196
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30
Potassium (K)-Dissolved	1.91	1.94	1.94
Selenium (Se)-Dissolved	0.132	0.130	0.129
Silicon (Si)-Dissolved	6.41	6.50	6.54
Silver (Ag)-Dissolved	0.00490	0.00473	0.00485
Sodium (Na)-Dissolved	4.36	4.26	4.17
Strontium (Sr)-Dissolved	0.839	0.800	0.804
Thallium (Tl)-Dissolved	0.000118	0.000115	0.000120
Tin (Sn)-Dissolved	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Dissolved	1.05	1.07	1.07
Uranium (U)-Dissolved	0.00194	0.00183	0.00184
Vanadium (V)-Dissolved	0.0098	0.0098	0.0098
Zinc (Zn)-Dissolved	3.64	3.44	3.52

Appendix I – Burnaby Tap Water Report



Physical and Chemical Analysis of Water Supply
Greater Vancouver Water District

2011- Capilano Water System

<u>Parameter</u>	<u>Untreated</u>		<u>Treated</u>		<u>Days Guideline Exceeded</u>	<u>Canadian</u>	<u>Reason</u>
	<u>Average</u>	<u>Average</u>	<u>Range</u>	<u>Range</u>		<u>Guideline Limit</u>	<u>Guideline Established</u>
Alkalinity as CaCO ₃ (mg/L)	2.4	2.9	2.6-3.2			none	
Aluminium Dissolved (mg/L)	0.073	0.067	0.067			none	
Aluminium Total (mg/L)	0.115	0.090	0.090			none	
Antimony Total (µg/L)	<0.5	<0.5	<0.5		0	6	health
Arsenic Total (µg/L)	<0.5	<0.5	<0.5		0	10	health
Barium Total (µg/L)	2.8	2.2	2.2		0	1000	health
Boron Total (mg/L)	<0.01	<0.01	<0.01		0	5.0	health
Bromate (mg/L)		<0.01	<0.01		0	0.01	health
Bromide (mg/L)		<0.01	<0.01		0	none	
Cadmium Total (µg/L)	<0.2	<0.2	<0.2		0	5	health
Calcium Total (mg/L)	1.18	1.15	1.07-1.32			none	
Carbon Organic Dissolved (mg/L)	1.5	1.3	1.2-1.4			none	
Carbon Organic Total (mg/L)	1.55	1.35	1.13-1.42			none	
Chlorate (mg/L)		0.05	0.04-0.06		0	1.0	health
Chloride Total (mg/L)	0.42	2.1	1.7-3.1		0	≤ 250	aesthetic
Chromium Total (µg/L)	0.07	0.07	0.05-0.08		0	50	health
Color Apparent (ACU)	13	4	2-5			none	
Color True (TCU)	11	2	1-4		0	≤ 15	aesthetic
Conductivity (µmhos/cm)	10	15	14-16			none	
Copper Total (µg/L)	3.2	1.1	1-1.1			≤ 1000	aesthetic
Cyanide Total (mg/L)	<0.02	<0.02	<0.02		0	0.2	health
Fluoride (mg/L)	<0.05	<0.05	<0.05		0	1.5	health
Hardness as CaCO ₃ (mg/L)	3.62	3.48	3.25-4.04			none	
Iron Dissolved (µg/L)	27	22	12-40			none	
Iron Total (µg/L)	60	47	28-79		0	≤ 300	aesthetic
Lead Total (µg/L)	<0.5	<0.5	<0.5			10	health
Magnesium Total (mg/L)	0.163	0.150	0.138-0.182			none	
Manganese Dissolved (µg/L)	2.8	1.5	1.0-2.0			none	
Manganese Total (µg/L)	3.4	1.8	1.2-2.7		0	≤ 50	aesthetic
Mercury Total (µg/L)	<0.05	<0.05	<0.05		0	1	health
Nickel Total (µg/L)	<0.05	<0.05	<0.05			none	
Nitrogen - Ammonia as N (mg/L)	<0.02	<0.02	<0.02			none	
Nitrogen - Nitrate as N (mg/L)	0.05	0.07	0.06-0.10		0	10	health
Nitrogen - Nitrite as N (mg/L)	<0.01	<0.01	<0.01		0	1.0	health
pH	6.4	6.5	6.3-6.7		5	6.5 to 8.5	aesthetic
Phenols (µg/L)	<5	<5	<5			none	
Phosphorus Total (µg/L)	<5	<5	<5			none	
Potassium Total (mg/L)	0.149	0.134	0.133-0.134			none	
Residue Total (mg/L)	17	17	17			none	
Residue Total Dissolved (mg/L)	14	12	12		0	≤ 500	aesthetic
Residue Total Fixed (mg/L)	10	11	11			none	
Residue Total Volatile (mg/L)	6	6	6			none	
Selenium Total (µg/L)	<0.5	<0.5	<0.5		0	10	health
Silica as SiO ₂ (mg/L)	3.1	2.9	2.9			none	
Silver Total (µg/L)	<0.5	<0.5	<0.5			none	
Sodium Total (mg/L)	0.598	1.81	1.81		0	≤ 200	aesthetic
Sulphate (mg/L)	0.83	0.82	0.7-1.0		0	≤ 500	aesthetic
Turbidity (NTU)	0.57	0.36	0.21-0.68				
Uranium Total (µg/L)	0.027				0	< 20	health
UV254 (Abs/cm)	0.067	0.043	0.036-0.047			none	
Zinc Total (µg/L)	<3	<3	<3		0	≤ 5000	aesthetic

These figures are average values from a number of laboratory analyses done throughout the year. Where the range is a single value no variation was measured for the samples analysed. Methods and terms are based on those of "Standard Methods of Water and Waste Water" 21st Edition 2005. Less than (<) denotes not detectable with the technique used for determination. Untreated water is from the intake prior to chlorination, treated water is from a sample line after 10 minutes chlorine contact time. Guidelines are taken from "Guidelines for Canadian Drinking Water Quality - Sixth Edition" Health and Welfare Canada 1996, updated to Dec 2010. Capilano source water is treated with sodium hypochlorite for disinfection. Capilano Primary Disinfection Plant was out of service from January 1st to April 29th, Aug 22nd to Aug 26th, and Sept 26th to Dec 31st due to high turbidity. It was operational for only 146 days in 2011.



Physical and Chemical Analysis of Water Supply
Greater Vancouver Water District

2011 - Seymour Water System

Parameter	Untreated		Treated		Days Guideline Exceeded	Canadian Guideline Limit	Reason Guideline Established
	Average		Average	Range			
Alkalinity as CaCO ₃ (mg/L)	3.0		6.7	4.9-9.6		none	
Aluminium Dissolved (mg/L)	0.068		0.047	0.025-0.086		none	
Aluminium Total (mg/L)	0.156		0.037	0.017-0.101	0	0.2	aesthetic
Antimony Total (µg/L)	<0.5		<0.5	<0.5	0	6	health
Arsenic Total (µg/L)	<0.5		<0.5	<0.5	0	10	health
Barium Total (µg/L)	3.9		3.2	2.9-3.8	0	1000	health
Boron Total (mg/L)	<0.01		<0.01	<0.01	0	5.0	health
Bromate (mg/L)			<0.01	<0.01	0	0.01	health
Bromide (mg/L)			<0.01	<0.01		none	
Cadmium Total (µg/L)	<0.2		<0.2	<0.2	0	5	health
Calcium Total (mg/L)	1.56		3.26	2.59-3.86		none	
Carbon Organic Dissolved (mg/L)	1.4		0.58	0.4-0.8		none	
Carbon Organic Total (mg/L)	1.43		0.56	0.42-0.88		none	
Chlorate (mg/L)			0.025	0.01-0.05	0	1.0	health
Chloride Total (mg/L)	0.18		1.43	1.10-1.70	0	≤ 250	aesthetic
Chromium Total (µg/L)	0.09		0.07	<0.05-0.09	0	50	health
Color Apparent (ACU)	13		1.1	<1-2		none	
Color True (TCU)	11		<1	<1	0	≤ 15	aesthetic
Conductivity (µmhos/cm)	12		25	22-30		none	
Copper Total (µg/L)	3.6		<0.5	<0.5	0	≤ 1000	aesthetic
Cyanide Total (mg/L)	<0.02		<0.02	<0.02	0	0.2	health
Fluoride (mg/L)	<0.05		<0.05	<0.05	0	1.5	health
Hardness as CaCO ₃ (mg/L)	4.55		8.79	7.06-10.3		none	
Iron Dissolved (µg/L)	61		6	5-8		none	
Iron Total (µg/L)	143		8	<5-19	0	≤ 300	aesthetic
Lead Total (µg/L)	<0.5		<0.5	<0.5	0	10	health
Magnesium Total (mg/L)	0.158		0.157	0.137-0.179		none	
Manganese Dissolved (µg/L)	4.7		4.4	2-8		none	
Manganese Total (µg/L)	5.9		4.9	2-9	0	≤ 50	aesthetic
Mercury Total (µg/L)	<0.05		<0.05	<0.05	0	1	health
Nickel Total (µg/L)	<0.5		<0.5	<0.5		none	
Nitrogen - Ammonia as N (mg/L)	<0.02		<0.02	<0.02		none	
Nitrogen - Nitrate as N (mg/L)	0.07		0.07	0.02-0.11	0	10	health
Nitrogen - Nitrite as N (mg/L)	<0.01		<0.01	<0.01	0	1.0	health
pH	6.5		7.2	6.9-7.5	0	6.5 to 8.5	aesthetic
Phenols (µg/L)	<5		<5	<5		none	
Phosphorus Total (µg/L)	<5		<5	<5-6		none	
Potassium Total (mg/L)	0.163		0.163	0.138-0.184		none	
Residue Total (mg/L)	17		24	21-32		none	
Residue Total Dissolved (mg/L)	14		20	16-22	0	≤ 500	aesthetic
Residue Total Fixed (mg/L)	11		20	16-24		none	
Residue Total Volatile (mg/L)	6		5	3-8		none	
Selenium Total (µg/L)	<0.5		<0.5	<0.5	0	10	health
Silica as SiO ₂ (mg/L)	3.0		3.0	2.90-3.20		none	
Silver Total (µg/L)	<0.5		<0.5	<0.5		none	
Sodium Total (mg/L)	0.54		1.41	1.22-1.53	0	≤ 200	aesthetic
Sulphate (mg/L)	1.2		2.8	2.4-3.3	0	≤ 500	aesthetic
Turbidity* (NTU)	0.72		0.06	0.05-0.09			
Uranium Total (µg/L)	0.018					<20	health
UV254 (Abs/cm)	0.064		0.009	0.005-0.014		none	
Zinc Total (µg/L)	<3		<3	<3	0	≤ 5000	aesthetic

These figures are average values from a number of laboratory analyses done throughout the year. Where the range is a single value no variation was measured for the samples analysed. Methods and terms are based on those of "Standard Methods of Water and Waste Water" 21st Edition 2005. Less than (<) denotes not detectable with the technique used for determination. Untreated water is from the intake or a sample site prior to coagulation, treated water is from a sample site downstream of SCFP clearwell. Guidelines are taken from "Guidelines for Canadian Drinking Water Quality - Sixth Edition" Health and Welfare Canada 1996, updated to Dec 2010. Seymour source water is filtered, treated with UV light for primary disinfection, sodium hypochlorite for secondary disinfection, lime to increase pH and alkalinity and CO₂ to adjust pH. * Turbidities for raw and treated waters of Seymour source were taken from the data generated by SCFP on-line turbidity analyzers.



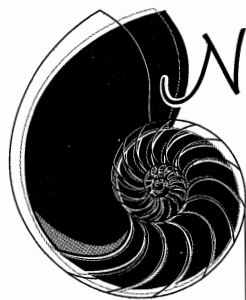
Physical and Chemical Analysis of Water Supply
Greater Vancouver Water District

2011 - Coquitlam Water System

Parameter	Untreated	Treated			Canadian Guideline Limit	Reason Guideline Established
	Average	Average	Range	Days Guideline Exceeded		
Alkalinity as CaCO ₃ (mg/L)	1.38	8.58	5.2-10.3		none	
Aluminium Dissolved (mg/L)	0.064	0.063	0.051-0.068		none	
Aluminium Total (mg/L)	0.095	0.084	0.074-0.089		none	
Antimony Total (µg/L)	<0.5	<0.5	<0.5	0	6	health
Arsenic Total (µg/L)	<0.5	<0.5	<0.5	0	10	health
Barium Total (µg/L)	2.5	2.3	2.2-2.5	0	1000	health
Boron Total (mg/L)	<0.01	<0.01	<0.01	0	5.0	health
Bromate (mg/L)		<0.01	<0.01	0	0.01	health
Bromide (mg/L)		<0.01	<0.01		none	
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	0	5	health
Calcium Total (mg/L)	0.873	0.877	0.784-0.900		none	
Carbon Organic Dissolved (mg/L)	1.45	1.39	1.20-1.80		none	
Carbon Organic Total (mg/L)	1.47	1.39	1.19-1.84		none	
Chlorate (mg/L)		<0.01	<0.01	0	1.0	health
Chloride Total (mg/L)	0.39	1.87	1.5-2.9	0	≤ 250	aesthetic
Chromium Total (µg/L)	0.04	<0.05	<0.05	0	50	health
Color Apparent (ACU)	13	1.5	<1-2		none	
Color True (TCU)	11	<1	<1	0	≤ 15	aesthetic
Conductivity (umhos/cm)	8	27	16-38		none	
Copper Total (µg/L)	20	0.63	<0.5-0.7	0	≤ 1000	aesthetic
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	0	0.2	health
Fluoride (mg/L)	<0.05	<0.05	<0.05	0	1.5	health
Hardness as CaCO ₃ (mg/L)	2.60	2.62	2.31-2.89		none	
Iron Dissolved (µg/L)	24	25	15-38		none	
Iron Total (µg/L)	55	53	39-73	0	≤ 300	aesthetic
Lead Total (µg/L)	0.7	<0.5	<0.5	0	10	health
Magnesium Total (mg/L)	0.103	0.104	0.085-0.120		none	
Manganese Dissolved (µg/L)	4.0	3.0	1.6-5.0		none	
Manganese Total (µg/L)	4.6	3.4	2.1-5.0	0	≤ 50	aesthetic
Mercury Total (µg/L)	<0.05	<0.05	<0.05	0	1	health
Nickel Total (µg/L)	<0.5	<0.5	<0.5		none	
Nitrogen - Ammonia as N (mg/L)	<0.02	<0.02	<0.02		none	
Nitrogen - Nitrate as N (mg/L)	0.10	0.10	0.07-0.13	0	10	health
Nitrogen - Nitrite as N (mg/L)	<0.01	<0.01	<0.01	0	1.0	health
pH	6.1	7.0	6.6-7.3	0	6.5 to 8.5	aesthetic
Phenols (µg/L)	<5	<5	<5		none	
Phosphorus Total (µg/L)	<5	<5	<5		none	
Potassium Total (mg/L)	0.115	0.114	0.110-0.119		none	
Residue Total (mg/L)	14	27	26-28		none	
Residue Total Dissolved (mg/L)	11	24	21-27	0	≤ 500	aesthetic
Residue Total Fixed (mg/L)	9	20	18-23		none	
Residue Total Volatile (mg/L)	6	7	4-10		none	
Selenium Total (µg/L)	<0.5	<0.5	<0.5	0	10	health
Silica as SiO ₂ (mg/L)	2.5	2.5	2.1-2.7		none	
Silver Total (µg/L)	<0.5	<0.5	<0.5		none	
Sodium Total (mg/L)	0.49	5.36	5.01-5.86	0	≤ 200	aesthetic
Sulphate (mg/L)	0.69	0.70	0.60-0.80	0	≤ 500	aesthetic
Turbidity (NTU)	0.39	0.34	0.21-1.05			
Uranium Total (µg/L)	0.043			0	<20	health
UV254 (Abs/cm)	0.063	0.017	0.012-0.028		none	
UV254 App. (Abs/cm)	0.070	0.021	0.015-0.032		none	
Zinc Total (µg/L)	<3	<3	<3	0	≤ 5000	aesthetic

These figures are average values from a number of laboratory analyses done throughout the year. Where the range is a single value no variation was measured for the samples analysed. Methods and terms are based on those of "Standard Methods of Water and Waste Water" 21st Edition 2005. Less than (<) denotes not detectable with the technique used for determination. Untreated water is from the intake prior to chlorination, treated water is from a single site in the GWD distribution system downstream of chlorination. Guidelines are taken from "Guidelines for Canadian Drinking Water Quality - Sixth Edition" Health and Welfare Canada 1996, updated to Dec 2010. Guidelines are taken from "Guidelines for Canadian Drinking Water Quality - Sixth Edition" Health and Welfare Canada 1996, updated to Dec 2010. Coquitlam water is treated with ozone for primary disinfection, chlorine for secondary disinfection, sodium carbonate to increase pH and alkalinity.

Appendix J – Toxicity Testing



Nautilus Environmental

8664 Commerce Court, Burnaby, BC V5A 4N7

WO#: 12539-540

Ms. Lesley Shelley
 Rescan Environmental Services Ltd.
 1111 W. Hastings Street, 6th floor
 Vancouver, BC
 V6E 2J3

December 17, 2012

Dear Ms. Shelley:

**Re: Toxicity testing on the sample identified as PP Effluent Tox test 1
 (Collected on October 28, 2012)**

Nautilus Environmental is pleased to provide you the results of the 96-h LC50 rainbow trout and the 48-h LC50 *Daphnia magna* toxicity tests on the above sample, received on October 29, 2012. Testing was conducted according to Environment Canada 1/RM/13, (Second Edition, 2000, with May 2007 amendments) and 1/RM/14, (Second Edition, 2000) protocols. By the client's request, the sample's initial pH of 9.0 was adjusted to 7.3 and 8.5 for rainbow trout and *D. magna*, respectively. The results of these tests are provided in the tables below and are based on the appended data. All other acceptability criteria outlined in the Environment Canada protocols were met.

Table A. Results for the 96-h rainbow trout test.

Sample ID	Collection Date and Time	96-h LC50 (%v/v) ¹
PP Effluent Tox test 1	October 28, 2012 @ 0200h	>100

Table B. Results for the 48-h *D. magna* tests.

Sample ID	Collection Date and Time	48-h LC50 (%v/v) [with 95% confidence limits] ¹
PP Effluent Tox test 1	October 28, 2012 @ 0200h	16.5 (14.5 – 18.8)

¹ Results relate only to the samples tested.

Please feel free to contact the undersigned at 604-420-8773 should you have any questions or require any additional information.

Yours truly,

Nautilus Environmental

Jacob Frank, B.Sc.
 Laboratory Biologist

Rainbow Trout Summary Sheet

Client: Rescan Environmental Start Date/Time: October 31/12 @ 1545
 Work Order No.: 12539 Test Species: Oncorhynchus mykiss

Sample Information:

Sample ID: PP Effluent Tox Test 1
 Sample Date: October 28/12 @ 0200
 Date Received: October 29/12 @ 1300
 Sample Volume: 2 x 20L
 Other: N/A

Test Validity Criteria:

≥ 90% control survival

WQ Ranges:

T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

Dilution Water:

Type: Dechlorinated Municipal Tap Water
 Hardness (mg/L CaCO₃): 11
 Alkalinity (mg/L CaCO₃): 11

Test Organism Information:

Batch No.: 092512
 Source: Miracle Spings
 No. Fish/Volume (L): 10/15L
 Loading Density: 0.49
 Mean Length ± SD (mm): 41 ± 4 Range: 35 - 48
 Mean Weight ± SD (g): 0.73 ± 0.21 Range: 0.42 - 1.19

NaNO₂ Reference Toxicant Results:

Reference Toxicant ID: RTNt27
 Stock Solution ID: 12Nt01
 Date Initiated: October 10/12
 96-h LC₅₀ (95% CL): 8.1 (6.1 - 10.7) mg/L NaNO₂

Reference Toxicant Mean and Historical Range: 5.0 (3.0 - 8.4) mg/L NaNO₂
 Reference Toxicant CV (%): 30

Test Results: The 96-h LC₅₀ is >100% (v/v)

Reviewed by: Joh

Date reviewed: Nov. 30/12

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#: Rescan Environmental
 Sample I.D. PP Effluent Tox test 1
 W.O. # 12639
 RBT Batch #: 092612
 Date Collected/Time: October 28 12 @ 0200
 Date Setup/Time: October 31 12 @ 1545
 Sample Setup By: SBF

Number Fish/Volume: 10/15
 7-d % Mortality: 0.15
 Total Pre-aeration Time (mins): 30
 Aeration rate adjusted to 6.5 ± 1 mL/min/L? (Y/N): Y

D.O. meter: DO-1
 pH meter: pH-1
 Cond. Meter: C-1

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	15.0	1M HCL	14.5
pH	9.0	Used to adjust	7.3
D.O. (mg/L)	9.9	pH to 7.5±1.	9.9
Cond. (µS/cm)	1814	then aerated	1839

Concentration (% v/v)	# Survivors							Temperature (°C)					Dissolved Oxygen (mg/L)					pH					Conductivity (µS/cm)	
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
CONT				10	10	10	10	14.0	14.5	14.5	14.5	14.5	10.1	10.0	9.8	9.8	9.8	7.1	7.0	6.9	6.8	6.8	40	42
6.25				10	10	10	10	14.0	14.5	14.5	14.5	14.5	10.0	9.9	9.9	9.9	9.9	7.1	6.9	6.8	6.8	6.9	225	238
12.5				10	10	10	10	14.0	14.5	14.5	14.5	14.5	9.9	9.7	9.8	9.8	9.9	7.1	7.0	6.9	6.9	6.9	491	469
25				10	10	10	10	14.5	14.5	14.5	14.5	14.5	9.9	9.7	9.9	9.8	9.8	7.4	6.9	6.9	6.8	7.0	626	611
50				10	10	10	10	14.5	14.5	14.5	14.5	14.5	9.9	9.7	9.9	9.8	9.8	7.2	6.9	6.9	6.9	6.9	1103	1086
100				10	10	10	10	14.5	14.5	14.5	14.5	14.5	9.9	9.8	9.9	9.9	9.8	7.3	6.7	6.8	6.9	6.9	1839	1802
Initials				SBF				SBF	SBF				SBF	SBF				SBF	SBF				SBF	

WQ Ranges: T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

Sample Description/Comments: Clear

Fish Description at 96? all fish ok

Other Observations: _____

Reviewed by: JGh

Date Reviewed: Nov. 30/12

Daphnia magna Summary Sheet

Client: Rescan
 Work Order No.: 12540

Start Date/Time: NOV 1/12 @ 1045h
 Test Species: Daphnia magna
 Set up by: KLB

Sample Information:

Sample ID: PP Effluent Tox test 1.
 Sample Date: Oct 28/12
 Date Received: Oct 29/12
 Sample Volume: 2 x 20L.

Test Validity Criteria:

≥ 90% mean control survival (no more than 2 mortalities in any control replicate)

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 101012 A
 Age of young (Day 0): < 24 hours
 Avg No. young per brood in previous 7 d: 22
 Mortality (%) in previous 7 d: 0
 Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: DM 90
 Stock Solution ID: 12 NA 02
 Date Initiated: JW ~~Nov~~ Oct 22/12
 48-h LC50 (95% CL): 3.9 (3.2 - 4.9) g/L NaCl

Reference Toxicant Mean and Historical Range: 4.0 (3.6 - 4.4) g/L NaCl
 Reference Toxicant CV (%): 5

Test Results: The 48h LC50 is estimated at 16.5 % (v/v) w/ 95 % confidence limits at 14.5 % & 18.8 % (v/v).

Reviewed by: JGh

Date reviewed: Nov 30/12

Freshwater Acute 48 Hour Toxicity Test Data Sheet

Client: Rescan
 Sample ID: PPEffluent
 Work Order No.: 12540

Start Date/Time: Nov 11/12 @ 1045h
 No. Organisms/volume: 10/200mL
 Test Organism: D. magna
 Set up by: KUB

DO meter: DO-1 pH meter: pH-1 Conductivity meter: C-1

Concentration % (v/v)	Number of Live Organisms Rep	Number of Live Organisms		No. Immobilized	Temperature (°C)			Dissolved oxygen (mg/L)			pH			Conductivity (µS/cm)	
		24	48		48	0	24	48	0	24	48	0	24	48	0
Control	A	10	10	0	19.0	20.0	20.0	9.0		8.4	8.1		8.0	355	361
	B														
	C														
	D														
6.25	A	10	10	0	19.0	20.0	20.0	9.0		8.3	8.0		8.1	478	472
	B														
	C														
	D														
12.5	A	10	9	0	19.0	20.0	20.0	9.0		8.3	8.0		8.1	599	591
	B														
	C														
	D														
25	A	10	0	-	19.5	20.0	20.0	9.0		8.3	8.1		8.3	808	800
	B														
	C														
	D														
50	A	10	0	-	19.5	20.0	20.0	9.0		8.4	8.1		8.4	1199	1199
	B														
	C														
	D														
100	A	0	—	—	19.5	20.0	—	9.0		—	8.5		—	1816	—
	B														
	C														
	D														
Technician Initials		KUB X~		~	KUB	KUB	-	KUB	~	KUB	~	KUB	~	KUB	~

WQ Ranges: T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5
 Day 100% (un)adjusted: Temp (°C) = 19.5 pH = 9.2 DO (mg/L) = 9.0 Cond (µS/cm) = 1799
 100% Unadjusted @ 4-h: 0 live organisms, 20.0°C

	Hardness*	Alkalinity*
Conc.	*(mg/L as CaCO3)	
Control (MHW)	100	70
Highest conc.	1060	24

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	19.5	—	19.5
DO (mg/L)	9.1	—	9.0
pH	9.2	pH adjusted w/ 0.1M HCl	8.5
Cond (µS/cm)	1799	—	1816

Sample Description: clear pH adjusted 100% (w) prior to dilutions according to client request

Comments: Batch# 10012A 7-d previous # young/brood: 22 Day of 1st Brood: 9 Previous 7-d % Mortality: 0

Reviewed by: JGU Date reviewed: Dec. 6/12

CETIS Analytical Report

Report Date: 14 Nov-12 15:35 (p 1 of 1)
 Test Code: 12540 | 12-2953-4277

Daphnia magna 48-h Acute Survival Test

Nautilus Environmental

Analysis ID: 11-2283-3661	Endpoint: 48h Survival Rate	CETIS Version: CETISv1.8.4
Analyzed: 14 Nov-12 15:34	Analysis: Untrimmed Spearman-Kärber	Official Results: Yes
Batch ID: 19-0860-3573	Test Type: Survival (48h)	Analyst: Jeslin Wijaya
Start Date: 01 Nov-12 10:45	Protocol: EC/EPS 1/RM/14	Diluent: Mod-Hard Synthetic Water
Ending Date: 03 Nov-12 11:30	Species: Daphnia magna	Brine:
Duration: 49h	Source: In-House Culture	Age: <24h
Sample ID: 09-2962-7616	Code: 3768FDE0	Client: Rescan
Sample Date: 28 Oct-12 02:00	Material: Water Sample	Project:
Receive Date: 29 Oct-12 13:00	Source: Rescan	
Sample Age: 4d 9h (11.2 °C)	Station: PP Effluent	

Spearman-Kärber Estimates

Threshold Option	Threshold	Trim	Mu	Sigma	EC50	95% LCL	95% UCL
Control Threshold	0	0.00%	1.217	0.02856	16.49	14.46	18.81

48h Survival Rate Summary

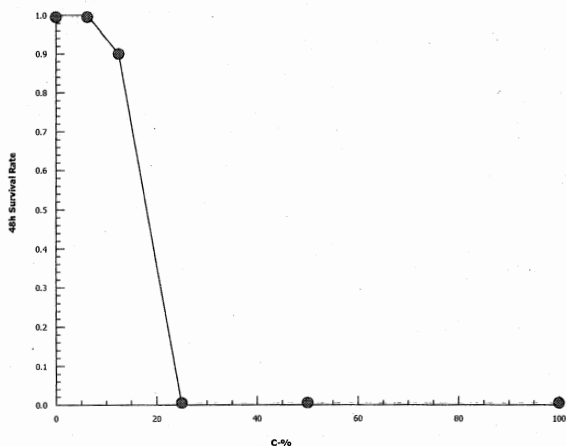
Calculated Variate(A/B)

C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	Negative Control	1	1	1	1	0	0	0.0%	0.0%	10	10
6.25		1	1	1	1	0	0	0.0%	0.0%	10	10
12.5		1	0.9	0.9	0.9	0	0	0.0%	10.0%	9	10
25		1	0	0	0	0	0		100.0%	0	10
50		1	0	0	0	0	0		100.0%	0	10
100		1	0	0	0	0	0		100.0%	0	10

48h Survival Rate Detail

C-%	Control Type	Rep 1
0	Negative Control	1
6.25		1
12.5		0.9
25		0
50		0
100		0

Graphics



Hardness and Alkalinity Datasheet

Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H ₂ SO ₄ used to pH 4.5	(mL) of 0.02N HCL/H ₂ SO ₄ used to pH 4.2	Total Alkalinity (mg/L CaCO ₃)	Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness (mg/L CaCO ₃)	Technician
PP Effluent	Nov 11/12 Nov 20/12	50	1.3	1.4	24	100 [Ⓢ]	10.6	1060	Emm
MHW	Nov 1/12	50	3.6	3.7	70	50	5.0	100	KUB

Notes: Ⓢ diluted to 100ml w/ D.I. water

Reviewed by: JGH

Date Reviewed: Nov. 30/12

British Columbia: 8664 Commerce Court, Burnaby, BC, V5A 4N7

Date _____ Page ___ of ___

Sample Collection By:			ANALYSES REQUIRED										Receipt Temperature (°C)	
Report to:	Invoice to:		96 hr Acute Rainbow Trout Toxic	48 hr Acute Daphnia magna toxic										
Company	Rescan Environmental	Rescan Environmental												
Address	1111 West Hasting Street	1111 West Hasting Street												
City/Prov/Postal Code	Vancouver, BC, V6E 2J3	Vancouver, BC, V6E 2J3												
Contact	Lesley Shelley or Kelsey Norlund	Lesley Shelley or Kelsey Norlund												
Phone	604-689-9460	604-689-9460												
Email	lshelley@rescan.com; knorlund@rescan.com													

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	# OF CONTAINERS	COMMENTS	96 hr Acute Rainbow Trout Toxic	48 hr Acute Daphnia magna toxic										
1 PP Effluent Tox Test 1	Oct 28/12	0200h	Water	20L	2		X	X										11.2
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

PROJECT INFORMATION		SAMPLE RECEIPT		RELIQUISHED BY (CLIENT)		RELIQUISHED BY (COURIER)	
Client:		Total # Containers:		Signature:		Signature:	
P.O. No.:		Good Condition?		Print:		Print:	
Shipped Via:		Matches Schedule?		Company:		Company:	
				Time/Date:		Time/Date:	
SPECIAL INSTRUCTIONS/COMMENTS: Identify sample as Rescan Project # 868-021-01 on invoices				RECEIVED BY (COURIER)		RECEIVED BY (LABORATORY)	
				Signature:		Signature: <i>Jacob Frank</i>	
				Print:		Print: <i>Jacob Frank</i>	
				Company:		Company: <i>Nautilus</i>	
				Time/Date:		Time/Date: <i>Oct 29/12 @ 1300</i>	

Additional costs may be required for sample disposal or storage. Net 30 unless otherwise contracted.